



THE PHILIPPINE BAMBOO INDUSTRY DEVELOPMENT ROADMAP



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FOREWORD

Bamboo has always been an under-rated and under-valued resource. Despite its many uses it has been categorized as a minor forest product and until recently, has not been given the importance it deserves. One reason for this is that wood was plentiful and has been the favoured material for construction, furniture, handicrafts and other uses. With the decline in wood resources and new methods of processing, bamboo can now be engineered into products once thought to be suitable only for wood. As a more fitting substitute for wood, bamboo is gaining the recognition it deserves.

Bamboo provides livelihood to many people especially in the rural areas. Farmers with a few clumps of bamboo in their backyards can convert these to cash by harvesting a few culms and selling these to bamboo processors who in turn, make a living by producing articles such as “sawali”, furniture and handicrafts.

The Philippines has been dubbed the “Milan of Asia” because of the innovative high quality furniture that the country exports to Europe, the US, the Middle East and other countries. Handicrafts are also a major export product of the country. Producers of traditional furniture and handicraft items and those for export have been providing employment to an unnumbered Filipinos.

Despite all these, the bamboo industry is saddled with many problems. Foremost is the insufficiency of culms, as experienced by many enterprises that have ventured into the manufacture of bamboo products only to close shop because they have ran out of raw materials. Policies are not supportive of the industry. Incentives for those who invest are lacking and promotional support in the local and foreign markets is inadequate. There is no single agency dedicated to oversee its development.

Recently however, Executive Order No. 879 creating the Philippine Bamboo Industry Development Council and mandating it to establish a bamboo industry development program was issued. Under the Philippine Development Plan (PDP) 2011-2016, the Government is mandated to “formulate a Comprehensive National Industrial Strategy (CNIS) that will spell out opportunities, coordinate and promote the growth of forward and backward linkages in priority areas and high potential growth sectors, and prepare other industries to attract investments and generate jobs”.

A major strategy of the PDP is the development and promotion of industry clusters to help achieve its vision. Towards this end, DTI is developing roadmaps for industries with large potentials to boost the economy and that will generate more jobs in the countryside. One of these is the bamboo industry.

This Roadmap embodies strategies and implementation plan identified as a result of consultations with industry players. When properly carried out the goals of the industry can hopefully be realized.

ACKNOWLEDGEMENTS

This Roadmap is not the work of one or two persons. It is the result of the collaborative efforts of individuals, institutions, organizations and associations who unselfishly contributed to the formulation of the roadmap with the hope that they will be contributing to the advancement of the bamboo industry in the country and to the improvement of the lives of many people who are dependent on the industry. They are too many to individually list here, so to them our unending gratitude.



[file:///D:/Bamboo Road Map/Rosario Encarnacion Tan Architect/
We build a bahay kubo bamboo guest house_.html](file:///D:/Bamboo Road Map/Rosario Encarnacion Tan Architect/We build a bahay kubo bamboo guest house_.html)

The Bahay kubo is the DNA of Philippine architecture and bamboo is its spiritual material – Ning Encarnacion Tan Architect (Nov 26, 2015)

EXECUTIVE SUMMARY

This roadmap is the result of reviews of previous roadmaps on bamboo, business and technical reports, and information accessed from the internet.

Primary data were collected through interviews with stakeholders such as farmers, micro scale entrepreneurs producing traditional bamboo products, producers of high quality bamboo products for exports, and investors of large scale bamboo projects. Round Table Discussions and fora were conducted to identify key issues affecting the industry and strategies to address these. Discussions with a few Local Government Executives (LGUs) on bamboo development programs were also conducted. Out of these reviews, interviews and discussions, the Roadmap was formulated.

A few facts about the bamboo industry were revealed:

1. There is a dearth of data and information about the industry;
2. There is insufficient supply of raw materials across the industry sectors;
3. There is no one agency or institution responsible and dedicated to oversee the growth and development of the bamboo industry;
4. Current government policies are not supportive of the bamboo industry;
5. There are investors who are investing in big ticket projects;
6. Government has started to recognize the social, economic and environmental contributions of bamboo and the bamboo industry.

The bamboo industry is made up of several sectors. On the supply side are propagators of bamboo planting materials and plantation developers. The technologies currently in place in the propagation of bamboo planting materials are the one- and two-node cuttings and branch cuttings for species with large diameter culms. Planting material propagation is seldom done alone by nurseries. Many nurseries produce planting materials of bamboo in conjunction with planting materials of other plants such as fruit trees or with ornamental bamboos. Many propagators come to existence only when there are government projects such as the National Greening Program (NGP) and close after the termination of the project.

There are very few bamboo plantations. At present, bamboos are gathered from public or privately owned areas with naturally growing clumps.

On the demand side are the furniture and handicrafts sectors. Sub-sectors are the informal and formal enterprises. The informal sub-sector is composed of micro and small scale enterprises producing traditional products. They are characterized by low capitalization, use of simple hand-held tools, low level technologies, few workers - often family members, makeshift workplaces under or adjacent to their houses, product designs that are usually copied from neighboring producers, and open display areas along the roadside. They also market their products through itinerant vendors who go from province to province carrying the products on modified tricycles. This sub-sector makes up, in terms of numbers, the bulk of furniture and handicrafts sector.

The formal sub-sector is composed of furniture and handicrafts producers characterized by their high-end products developed by company designers, their use of high capacity and precise machines, high operating capital, and their capability to mount local and foreign trade missions. Their workers are well trained and highly skilled. This sub-sector uses bamboo of the highest quality - straight, thick

walled, and visibly free from attack of destroying organisms such as beetles, termites, and stain and decay fungi.

A relatively new bamboo product is engineered bamboo (engineered bamboo). This product has many applications in furniture, handicrafts and in construction. At least 10 enterprises have ventured into engineered bamboo manufacture to produce school desks and chairs required by the DepEd and other engineered bamboo products such as panels and floor tiles. Lack of raw materials has forced most of them to close shop. Other constraints to the growth of this sector are lack of high production capacity machines, low-cost but effective glues and new gluing technologies. Standards on engineered bamboo still have to be formulated, design specifications established and adopted into the National Structural Code of the Philippines.

A major user of bamboo culms/poles is the in-land fisheries and the agricultural sectors. Bamboo poles are used for fencing fish pens and cages. Laguna Lake has large scale in-land fisheries and an equally high demand for bamboo poles which are used for fencing. Requirement of Taal Lake is lesser because there are fewer cages. Bamboo poles are also used to prop fruit-laden bananas. There are close to 42,000 ha of banana plantations in Mindanao with an estimated demand of more than 10M culms a year. Bamboo poles are also used as outriggers of motorized and non-motorized bancas used mostly by municipal fishermen who fish within the 15 km municipal water limit.

The construction industry is a major market of bamboo. Engineered bamboo has found applications in construction such as for panelling and floor tiles. It can also be used for columns, beams and rafters and other load-bearing uses. However, it still has not found applications in the local construction scene because it is not yet included in the National Structural Code of the Philippines. Once accepted as a construction material under the Code the demand for culms for engineered bamboo production is expected to increase.

Bamboo can be a good raw material for producing charcoal. Charcoaling studies of bamboo at FPRDI showed that *kawayan tinik* and *botong* had yields of about 44%. The heating value of bamboo is about 4,600 cal/g. This is comparable to wood which has a heating value of 4,700 to 4,900 cal/g. It can thus replace wood charcoal for barbecuing and in the cooking of "lechon". Bamboo charcoal is also a good material in the production of activated carbon. As activated carbon it can be used as water purifier, deodorizer, air freshener, and when mixed with the soil it can increase soil alkalinity.

During the carbonization process chemicals from bamboo are emitted as part of the smoke. When condensed they form what is called light distillate or pyroligneous liquid (PLL). The Japanese call it bamboo vinegar because of its smell. It contains more than 30% acetic acid. The PLL has found many uses in Japan: deodorizer, air freshener and disinfectant against fungal infection. Along with the charcoal, PLL could be a good base for a community enterprise in areas with rich bamboo resources.

Bamboo shoots are another product that comes from the cultivation of bamboo. It is a delicacy in all places where bamboo grows. A survey of 26 provinces showed that 6 species of bamboo shoots are harvested and sold in local markets throughout the country. The predominant species in the survey was found to be *kawayan tinik* but any bamboo species growing in the area is also harvested for its shoots. Bamboo shoots are high in fiber content and contain healthful chemicals such as vitamins, minerals, carbohydrates, and protein. Bamboo shoots can aid in weight loss, reduce risk of cancer, strengthen the immune system, help improve cardio-vascular health, provide relief from stomach aches, and effective against respiratory diseases. It also helps control cholesterol levels. The other claimed medicinal properties of bamboo shoots include: aid in digestion; keep blood pressure at normal levels; anti-bacterial, anti-fungal, anti-oxidants (flavones, phenols, steroids), anti-viral; aid in cell activation; curative for respiratory diseases, wounds, infections, ulcers, diarrhea, measles; and have no harmful effects (e.g. diabetes, heart problems, cancer).

There is no cannery for bamboo shoots in the country but a private organization, the FILBAMBO, Inc. is producing recipes in the preparation of menus and in the preparation of delicacies and sweets from bamboo shoots.

Other high potential uses of bamboo are in pulp and paper and bio-fuels. In the 1960s a paper factory in Bataan had to close because its bamboo plantation flowered and eventually died. A large international pulp and paper company is establishing bamboo plantations for its pulp and paper mills. India and other south Asian countries have long been using bamboo for pulp and paper production. An extension of paper production is in the production of textiles. China has been exporting high quality textile products from bamboo fiber.

Bamboo can also be used as bio-mass fuel for boilers to run machineries in factories or generators to produce electricity. One company is contemplating the use of bamboo chips to co-fire with its rice hull fuel or to replace rice hull entirely. Bamboo chips could also be used to replace fossil fuel such as coal and bunker oil in heating boilers for energy generation. This would have tremendous environmental benefits as bamboo would emit less CO₂ in the atmosphere in addition to the fact that the bamboo plantation would be sequestering and storing carbon.

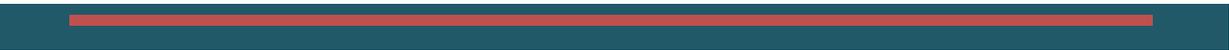
The Roadmap has identified doable goals. By 2040 the Philippine Bamboo Industry would:

1. have a stable institution shepherding its growth and development;
2. have stable and supportive policies;
3. be self-sufficient in sustainable raw material resources;
4. have cost-effective technologies and production processes;
5. have well trained manpower;
6. have established bamboo-based enterprises in rural areas;
7. have high capacity but affordable machineries and equipment; and
8. have a stable and reliable local and foreign markets.

To achieve these goals several strategies have been identified which include the following:

1. Establishment of a reliable institution to shepherd the industry;
2. Establishment of supportive policies;
3. Conduct of inventory of raw material supply, survey of enterprises engaged in bamboo processing including employment in these enterprises and their contribution to the economy and establishment of a system of managing data and information
4. Development of a sustainable supply of quality raw materials;;
5. Steady input of relevant and cost effective production technologies and new products;
6. Development of high capacity machines and equipment;
7. Training of highly skilled manpower;
8. Establishment of rural based enterprises; and
9. Development of reliable local and international markets.

Although EO 879 established the PBIDC and provided it with a Secretariat and initial funding of Php 20 million, it did not provide sufficient manpower or sources of appropriations to carry out its mandate. Currently, personnel of the Secretariat (otherwise called Technical Working Group) are merely part of a working group assigned from member-agencies of the Council. Since their primary duties are in their mother agencies, time allotted to the Secretariat is limited. The Php 20 million initial budget of the Council has been exhausted and without any funding the Council cannot exercise its functions. There is therefore a need to strengthen the Council by expanding its mandate, provide additional manpower and allot a sufficient budget for the Secretariat.



The industry needs policies that support it. The requirement of obtaining transport permits or certificates of verification hinders the movement of raw materials from the farm to the processing plant. These are cost items that the farmers could hardly afford. The industry could also use incentives to encourage investors in plantation development and bamboo processing plants.

There is a dearth of information and data on the industry particularly on the raw material supply (volume and distribution), the enterprises comprising the industry, employment, domestic trade of bamboo and bamboo products and contributions to the economy. An inventory of the supply as well as the bamboo enterprises, including employment and contributions to the economy should be undertaken. A system should also be put in place to manage and update the data periodically. The information gathered should be fed to the industry and government agencies for decision-making.

To overcome insufficiency of raw materials, plantations should be developed and existing culms in public and private lands should be managed. The Roadmap study has estimated that the area needed to be developed over a period of 30 years is about 69,000 ha. To be able to meet the requirements of all the sectors while waiting for the culms from plantations to mature, existing clumps in farmers' fields should be properly managed to produce higher quality culms.

The supply of new technologies and products is essential, even critical for the industry to be able to compete locally and internationally. It is incumbent upon government to support research institutions for the generation of needed technologies and new products.

Machines and equipment used in most of the factories processing bamboo are wood processing equipment that were modified. As such they often are not suitable for bamboo. In general the machines have low outputs and the cost of production is high. Products thus have difficulty competing. What the industry needs are high production capacity machines. A program on the design and fabrication of these kinds of machines is needed by the industry.

One of the greatest assets of the export furniture and handicrafts industries of the country is skilled labor. However, many of these workers have been lured into accepting higher paying jobs in foreign countries. The new sectors of the industry would need workers equipped with new skills. A program of manpower development is in order for the industry. Manpower development would also give attention to training and capacity building for women and persons with disabilities.

The take-home income of bamboo farmers is small compared to processors. It was estimated that the value of a product for export is 10-15 times the value of the raw material. A Php 50.00 culm from a farmer would have an export value of Php 500 to Php 750. There are of course processing and marketing expenses but the benefit retained by the processor would be much higher than the farmer's. A program is needed to achieve inclusive growth, one that would increase the benefits accruing to the farmers. A program of establishing community-based bamboo enterprises would be in order. The farmers would be provided with technologies and the skills to produce marketable products such as charcoal, briquettes and products from pyroligneous liquid.

A critical link in the supply chain of the bamboo industry is market. Without sustainable and reliable markets processors will not be able to sell their products at a profit. It is important to develop new products and new markets. Thus, activities to promote these products should be given due attention. In the local scene, trade fairs are familiar ways of making customers aware of products and of getting orders from prospective buyers. Government agencies such as the Department of Science and Technology (DOST), the Department of Trade and Industry (DTI) conduct trade fairs and trade missions in foreign countries are mounted by the private sector. In the rural areas the establishment of "bagsakan centers" as marketing initiatives could be useful if handled properly.



Industry organizations or associations can be effective in promoting the industry. Where possible these organizations should be organized. There is also a need to promote the industry with the local government units (LGUs). The LGUs should establish local industry councils, create their own industry development programs and provide the needed funding for these programs.

The cost of implementing the strategies outlined in the Roadmap is estimated at Php26.23 billion pesos. Planned investments are estimated at Php 34.026 billion. An implementation plan has also been prepared.

Chapter 1

INTRODUCTION

Perspectives on the Roadmap

Worldwide, bamboo has become a US \$ 11.21 billion industry as of 2009. The total value of exports of the 15 top exporters was US\$ 2.252 billion (INBAR, 2015). The top exporters were China, Indonesia, EU, Vietnam, the Philippines, USA, United Arab Emirates and Malaysia. The value of China exports was US\$ 1.398 billion; Indonesia ranked second with a reported export value of US\$ 354 million while the Philippines ranked 5th world wide with an export value of US \$ 54 million (INBAR, 2015). The major importers of bamboo products are the EU, USA, Japan, Malaysia, Canada, United Arab Emirate, China, Singapore, South Korea and Indonesia. The value of imports of the top 15 importers of bamboo furniture amounted to US\$ 1.628 billion (INBAR, 2015). The international trade of bamboo and rattan was estimated at US\$ 2.557 billion in 2008. In 2012 the value of domestic trade in major bamboo and rattan producing countries was estimated at US\$ 34.2 billion.

In the local scene, the Exports Marketing Bureau (EMB) of the Department of Trade and Industry (DTI) reported that in 2014 the value of exported bamboo products was US\$ 10.49 million, which is much less than the value reported by INBAR (2015). There is no estimate of the value of locally traded bamboo products.

The growth of the local bamboo industry is hampered by a number of factors. Among these are the absence of reliable data and information on various aspects of the industry such as amount of available raw materials, number of enterprises using bamboo as raw materials, demand for bamboo culms, number of employment in the industry, contributions to the Gross Domestic Product (GDP) and other information. The main reason for this dearth of information and data is the fact that many of the transactions in bamboo especially in the rural areas do not enter into official records. When a farmer cuts and sells a few culms there are no receipts, neither are there receipts of transactions when bamboo products are sold. Exports and imports of bamboo products go through official transactions and are therefore recorded and reflected in the Philippine Statistics Authority's official accounts.

In addition to insufficient information, there is a growing shortage in the supply of bamboo raw materials. Many enterprises that have ventured into the manufacture of engineered-bamboo have closed operations because of this. And although research and development programs on bamboo continue, infusion of new technologies and products to the industry is inadequate and slow. Many enterprises still utilize wood working machines which are not appropriate tools for processing bamboo. This results to increased processing time and consequently to low productivity which is reflected in the high cost of production.

Presently there is no one institution that is dedicated to oversee the development of the bamboo industry. Programs on bamboo are dispersed. Policies are not supportive to the industry and there are no incentives for investing in the industry. Above all, there is no bamboo industry development program.

The Roadmap aims to identify strategies to develop the bamboo industry, determine the raw material requirements of the various industry sectors and identify shortfalls in supply, and determine the number and size of plantations needed to provide a sustainable supply of raw materials to the industry. The Roadmap also endeavors to come up with a bamboo industry development program that will be a vehicle for inclusive growth, prepare an implementation plan and estimate the cost of implementing the program.

There are already positive developments in the industry. Premier among these is Executive Order (EO) No. 879 issued in 2010 creating the Philippine Bamboo Industry Development Council (PBIDC) under the leadership of the Department of Trade and Industry (DTI) (EO 879, 2010). It directs the use bamboo for at least 25% of school desks, chairs and other furniture requirements of public elementary and secondary schools and prioritizing the use of bamboo in furniture, fixtures and other construction requirements of government facilities thus opening a market for bamboo products.

The Department of Science and Technology (DOST) is also directed to conduct, through the Forest Products Research and Development Institute (FPRDI) and the Philippine Nutrition Research Institute, researches that can increase efficiency, reduce production costs and increase saleability of bamboo products. In addition, DOST is mandated to allocate 20% of its assistance funds such as the Small and Medium Enterprise Technology Upgrading Program (SET-UP) and the Venture Capital funds of the Technology Application and Promotion Institute (TAPI) to bamboo-based enterprises.

The Department of Environment and Natural Resources is also directed to use bamboo as planting materials for 20% of its reforestation projects. The League of Municipalities of the Philippines (LMP) is mandated to provide coordinative support and partnership with LGUs for the development of the bamboo industry.

There are also initiatives in the private sector to develop bamboo plantations and establish processing plants. The CS 1st Agro-industrial Development Corporation is in the process of establishing nurseries to produce planting materials for its initial 250 ha plantation and a 25,000 ha plantation in 8 municipalities in Pangasinan. It has acquired bamboo processing machineries worth US\$1 million from China¹. The budget for its entire operation is Php 6 billion.

Another big ticket project is the Bamboo Technology and Development Park, Inc. in Ilo-ilo which is in the process of establishing a 15,000 ha bamboo plantation. It will put up a pulp and paper mill, a textile mill using bamboo as raw material and an engineered bamboo processing mill. The company will invest Php 15 billion² in the project.

There are other smaller initiatives such as the Guevara Investment and Development Corporation Inc. (GIDCI) in Taytay, Palawan which has already established 14 ha of *kawayan tinik* (*Bambusa blumeana*, J. A. Schultes and J. H. Schultes) and *Giant bamboo* [*Dendrocalamus asper*, (Schultes f.) Backer ex Heyne] plantations and is in the course of putting up a bamboo processing plant.

On the government side, the Land Bank of the Philippines (LBP) has set aside Php 11 billion to finance bamboo plantation development and bamboo processing mills³. Likewise, the Development Bank of the Philippines (DBP) has allocated Php 2 billion for a program called DBP Forest⁴ to finance plantations of forest tree species as well as bamboo.

¹ Uy, L. 2015. Personal communication, November 6, 2015.

² Caranza, E. 2015. Personal communication, November 10, 2015.

³ Domingo, D. 2015. Land Bank of the Philippines, Manager KAWAYAN Program, Personal communication, October 2015.

⁴ Pagkanlungan, E. 2015. Manager, Financing Inclusive Development (FIND) Department, DBP, Personal communication, May 12, 2015.

Many Local Government Units (LGUs) such as Ilocos Sur⁵ and Tarlac⁶ have established their respective Bamboo Industry Development Councils. The City of Cauayan (Isabela) is contemplating to follow suit.⁷

This heightened awareness and interest of the private sector and the LGUs bodes well for the bamboo industry in the Philippines.

Methodology

One task in the enhancement of the roadmap is to determine the gaps in data and information, considering new developments in the region such as the implementation of the ASEAN Foreign Trade Agreement and the Department of Environment and Natural Resources' (DENR) National Greening Program (NGP) which targets 54,416 ha in bamboo plantation development (DENR, 2015).

The enhancement of the Roadmap entails the following activities.

1. Review of data in the previous roadmap and validating these, particularly those with respect to bamboo resources, raw material requirements of the bamboo industries, and domestic and foreign trade.
2. Identification of government and non-government organizations involved in the development of the bamboo industry and their roles in enhancing the industry.
3. Determine and assess the effectiveness of institutional arrangements in promoting the bamboo industry; discuss with the local government units their plans in promoting the bamboo industry as well as pursuing the social agenda of President Aquino and in promoting climate change adaptation and mitigation of government through the use bamboo plantation development;
4. Identification of financial institutions that can assist the bamboo industry in the establishment of plantations and in providing assistance to manufacturers.
5. Address the concerns and observations made during the meeting among the PIDS, BOI, DTI and SPAI on October 24, 2013.
6. Collection of secondary and/or primary data to cover gaps in information and update existing data. Primary data and information were collected through interviews and dialogues with local executives, government officials, and non-government organization officials, industry leaders and the academe. Table 1.1 lists agencies, organizations and local government units that were consulted.

Table 1.1 – List of agencies, organizations and local government units consulted

⁵ Rabena, K. 2015. Administrative Assistant, Sanguinang Panlalawigan of Ilocos Sur, Personal communication September 4, 2015.

⁶ Ramirez, A. 2015. Secretariat, Provincial Bamboo Council, Tarlac, Personal communication. October 28, 2015.

⁷ Tesoro, F. 2015. Meeting with the Vice Mayor of Cauayan City and the EA of Mayor Dy of Cauayan City, November 10, 2015.

Sectors	Agencies/organizations/institutions
Government	Department of Environment and Natural Resources Department of Agriculture Department of Trade and Industry Department of Science and Technology Board of Investments Philippine Institute of Development Studies Philippine Bamboo Industries Development Council
Local Government Units	Selected provincial, municipal and barangay officials
Academe	Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development Ecosystems Research and Development Bureau UPLB College of Forestry and Natural Resources Forest Products Research and Development Institute State colleges and universities
Non-government organization	Philippine Bamboo Foundation, Inc.
Business/Industry organizations	Chamber of Furniture Industry of the Philippines Philippine Chamber of Handicraft Industries Philippine Federation of Furnishings Association (PhilFFA) Philippine Exporters Confederation, Inc. (PHILEXPORT)
Financial institutions	Land Bank of the Philippines Development Bank of the Philippines
Other Stakeholders	Bamboo clumps owners and farmers

Chapter 2

VISION, GOALS AND OBJECTIVES

Vision

A progressive, dynamic, productive, and globally competitive bamboo industry with a sustainable resource base

Goals

The short (2016 – 2020), medium (2021 – 2030) and long term (2031 – 2040) goals are shown in the following Tables 2.1 to 2.3. The Goal is that by 2040 the Philippine Bamboo Industry would:

1. have stable institutions shepherding its growth and development;
2. have stable and supportive polices;
3. be self-sufficient in raw material resources;
4. have cost-effective technologies and production processes;
5. have well trained manpower;
6. have established bamboo-based enterprises in rural areas;
7. have high capacity but affordable machineries and equipment; and
8. have stable and reliable local and foreign markets.

The short, medium and long term development goals are shown respectively in Table 2.1 to 2.3. They include targets for strengthening the PBIDC, establishment of bamboo industry development programs, inventory of resources and enterprises, growth rates for furniture, handicrafts, engineered bamboo and the establishment of community bamboo-based enterprises in the rural areas. The targets also include the use of bamboo for power generation and as raw materials for the production of pulp and paper. By 2040 the country will have annual available bamboo raw materials in the tune of 80 million culms, more than sufficient to supply the requirements of the various sectors of the industry.

Table 2.1 - Short term goals (2016 – 2020)

By the end of 2017	1. The Philippine Bamboo Development Council is strengthened through Republic Act or an Executive Order
	2. Inventory of bamboo resources and bamboo enterprises is completed
	3. Data management system on resources and enterprises is established
By the end of 2018	4. The first 5-year cycle of bamboo industry development program (including bamboo research program) is enacted by Congress and approved by the President (SB 3206 filed)
By the end of 2020	5. 16,000 ha of bamboo plantation will have been established
	6. 10% growth in exports in the bamboo furniture and handicraft industries will have been attained
	7. 5% growth in the engineered bamboo industry will have been attained
	8. 10 community-based bamboo industries throughout the Philippines will have been developed
	9. At least 1 power generating plant will start to use bamboo chips as fuel to co-fire with coal/rice hull/biomass
	10. At least 50 ha of bamboo plantations will have been established for shoot production

Table 2.2 - Medium term goals (2021 – 2030)

By the end of 2025	1. Second cycle of bamboo industry development program is enacted and implemented
	2. At least 25 million culms will be available annually to the bamboo industries
By the end of 2030	3. An additional 42,000 ha of bamboo plantations will have been established for culm production and an additional 75 ha for shoot production
	4. At least 45 million culms will be available annually for the industry
	5. 10% growth in exports of the bamboo furniture and handicrafts industries will have been sustained
	6. 30% growth in the engineered bamboo industry will have been attained
	7. Additional 40 community-based bamboo industries throughout the Philippines will have been developed
	8. 1 pulp and paper mill will be using bamboo as raw material
	9. At least 1 other power-generating plant will start to use bamboo chips as fuel to co-fire with coal/rice hull/biomass

Table 2.3 - Long term goals (2031 – 2040)

By the end of 2035	1. Third cycle of bamboo industry development program is enacted and implemented
	2. At least 68 million culms will be available annually to the bamboo industries
	3. engineered bamboo industry will have grown by another 30%
By the end of 2040	4. A total of at least 80,000 ha of bamboo plantations for culm production will have been developed
	5. The number of community-based enterprises will have increased to 200 in the long term
	6. The bamboo furniture and handicrafts industries will have grown by 15%
	7. In the long term there would be established an additional 200 ha for bamboo shoot production
	8. At least one other pulp and paper mill will be using bamboo as raw material
	9. At least 1 other power-generating plant will start to use bamboo chips as fuel to co-fire with coal/rice hull/biomass

Objectives

1. To make available a sufficient supply of bamboo raw materials for various industries and end products.
2. To establish vibrant bamboo enterprises for local and foreign markets.
3. To develop bamboo-based communities with elevated income and freedom from poverty.
4. To establish a policy environment supportive to the development of the bamboo industry
5. To use bamboo as a medium to help attain the country's desire for environmental sustainability and climate change adaptation and mitigation, and
6. To realize a significant contribution of the bamboo industry to the Philippine economy and to inclusive growth.

Chapter 3

STATE OF THE INDUSTRY

3.1 Structure

It is difficult to define what the bamboo industry is. This is brought about by its many uses and applications. The continuum from production of planting materials to manufacture of products and the application or utilization of these products has many segments that can be considered as industries by themselves. The production of planting materials can be an industry in itself and there are nurseries that produce and sell planting materials alone. In other instances it can be a combination of production of planting materials for plantation development for culm production and production of ornamentals for home décor or for landscaping

There are production activities using bamboo as raw materials which have been considered as traditional industries. These include handicraft and furniture manufacture. Products that can be considered handicrafts or furniture are many and varied. They can range also in quality from low to very high end. The lower quality handicrafts and furniture can be found in the rural areas and these cater to home use in the communities where they are manufactured. They are sometimes sold in what may be called rolling stores, carts carrying the goods and sold along the way. The high-end handicrafts and furniture are sold to high class hotels or are exported. The rich and famous also buy high quality handicrafts and furniture for their homes.

The construction industry utilizes bamboo in many ways. Traditionally bamboo is used for house construction either in whole or in part. These houses are low cost. However, with the advent of technologies on the production of new materials from bamboo such as the engineered-bamboo and new architectural designs, bamboo materials have been used to construct high-cost residences including airports and convention centers. A church in Columbia has been made entirely of bamboo using the design of Architect Simon Velez (Manda, 2015). One popular use of bamboo poles in construction is as scaffoldings.

The production of construction materials called engineered-bamboo has become an industry by itself. Engineered bamboo comes in the form of lumber and panel products which presently are used as walling or siding but could also be applied as beams and posts. Engineered bamboo can be manufactured into myriads of products such as furniture, handicrafts, flooring materials, doors and door jambs, window jambs and frames, cabinets and fixtures and many others.

Bamboo has also been manufactured into energy products. At the lower end of the spectrum are charcoal and charcoal briquettes. Charcoal briquettes have become a household item particularly in barbecuing and grilling. New methods of charcoal production have produced high quality charcoal that can be used in the production of activated carbon. Bamboo pellets have also been manufactured for fuel in power generation. Bamboo chips have also been used as a biomass fuel for power generation.

The new method for charcoal production made up of a furnace, double-walled cylindrical kiln, includes a system for capturing and condensing the smoke to recover pyroligneous liquor or light distillate (Bisana et al, 2007). This liquor which is oftentimes called bamboo vinegar has been produced into many chemical products. The distillate is a deodorizer, air freshener, humidifier and a bactericide. It has been shown to kill e-coli.

Bamboo is also part of the food sector. Bamboo shoots are a delicacy in most if not all of the Asian countries. It is a regular fare in the menu of households in the rural areas during the rainy season when

bamboos produce shoots. Chinese dishes often incorporate bamboo shoots. And canned bamboo shoots are a lucrative export item particularly by China.

One group of uses for bamboo is the fishpen/cages and banana props. Bamboo culms are used to hold fish nets in place in fish pens and cages in the Laguna Lake and Taal Lake. In the banana growing provinces of Davao and Cotabato bamboo is used as props to hold the banana laden with fruits from falling down. Quite another use of bamboo poles is as outriggers of bancas. Municipal fishermen, those who fish within the 15 km municipal waters, generally use small boats that need outriggers for balance and stability and the material generally used is bamboo.

And quite recently, bamboo has become a medium for carving. With the diminishing supply of wood carvers have turned to the use of the lower part of the bamboo culm for carving. Carved bamboo has also been incorporated in the design of high end furniture and handicrafts.

There are uses of wood where bamboo would be a suitable substitute. Pulp and paper production is one of the highly potential uses of bamboo. In fact one big paper corporation is embarking in the establishment of bamboo plantation for paper production. Another potential use of bamboo is as chips for fuel of boilers for the generation of electricity. Bataan 20-20 a pulp and paper mill in Samal, Bataan is using rice hull as boiler fuel. It is contemplating on substituting bamboo chips for the rice hull.

The following is an attempt to profile the various sectors of the bamboo industry in the country.

3.1.1 Sectoral Coverage Including Subsectors

Supply side sectors

The industry starts in the supply sector and covers those involved in the production of planting materials, the nursery owners and propagators. This can still be subdivided into nurseries producing planting materials for bamboo plantation development and nurseries producing ornamental bamboos for home use or for landscaping, although in most instances nurseries produce both materials. The supply sector includes farmers who own a few clumps and those owning large number of clumps. They sell culms when they need some cash.

Plantations belong to this sector. The plantation can be individually owned or corporate owned or owned by associations or upland people's organizations or cooperatives. Depending upon the resources of the owners the plantations can be one to a few hectares while corporate-owned plantations are at least 10 to a few hundred or thousands of hectares. Upland organizations especially those in Community-Based Forest Management Areas (CBFMA) often have a few hectares of naturally growing bamboos (Lanting et al. 2013).

The Bamboo Propagation Industry Sub-sector

The number of enterprises engaged in the various activities in the this sub-sector is difficult to determine much less estimate because some of the nurseries that produce planting materials crop up only when there are government projects to supply planting materials like the current National Greening Program (NGP) of the DENR. Many of these nurseries close shop once the program comes to a close. The ornamental nurseries will endure because they cater to a different market, the landscape and home garden markets. For as long as there are land-developments of subdivisions, malls and shopping markets being developed there will also be nurseries producing planting materials for landscaping purposes. Ornamental bamboos for landscaping are a new material but it has caught on like wildfire. It is also not known how many there are but obviously they are mostly found around

or near urban areas. The reason for the lack of data and information on bamboo industry sectors is because the products or transactions do not enter into the official statistics on bamboo.

Plantation developers establish their own nurseries to produce their planting materials. This is exemplified by the Guevent Investments Development Corporation (GIDC) which established 10 ha of *kawayan tinik* and 4 ha of *Giant bamboo* in Taytay, Palawan. The Euro Integrated Farms & Supply, Inc. (EIFSI) has established a 4 ha *Giant bamboo* plantation in San Juan, Batangas⁸. The two above companies produced their own planting materials. The CS First Green Agri-Industrial Development, Inc (CSFGADI) is in the process of establishing a bamboo nursery to produce planting materials for its 250-ha bamboo plantation in Pangasinan⁹. The Philippine Bamboo Foundation, Inc. (PBF) is operating a 4 ha bamboo nursery in Dauin, Negros Oriental¹⁰. It is producing bamboo planting materials for sale. It has a capacity of 400,000 propagules a year of different bamboo species which include *kawayan tinik*, *Giant bamboo*, etc. The Ecosystems Research and Development Bureau (ERDB) of the Department of Environment and Natural Resources (DENR) is producing bamboo planting stock for the NGP and also for sale. State Colleges and Universities produce bamboo planting materials for their own use and for sale. The Bambusetum in Baguio (ERDS), the ERDB, Carolina Bamboo Farm in Antipolo, the bambusetum in Malaybalay (ERDS), and the bambusetum Butuan (ERDS) are producing planting materials for their own use and for sale.

- Technologies in bamboo propagation

Few species of bamboo bear seeds and often these are infertile (Razal and Palijon, 2009). Many species die after bearing flowers. Propagation of bamboo through seeds is therefore problematic and unreliable. The industry has settled on the use of one-node cuttings or branch cuttings for species that have large culms such as the *Giant bamboo* (Razal and Palijon, 2009). These are rooted and raised in nurseries (Lapis, et al, manuscript for printing).

Culms used in propagation should be young, not more than two years old. One- to two-year-old culms are the best sources of propagules for most species such as *kawayan tinik*, *kawayan killing* [*B. vulgaris* Schrad. ex Wendl.], and *striated bamboo* [*B. vulgaris* (Schrad. ex Wendl.) cv. Vittata McClure], *laak* [*B. philippinensis* (Gamble) Mc Clure], *bayog* [*B. merrilliana* (Elmer) Rojo and Roxas comb. nov.], and *bolo* [*Gigantochloa levis* (Blanco) Merr.] (Castillo, 1988; Palijon, 2000; Razal & Palijon, 2009; PCARRD, 1991 & 2009). Previous studies showed that one- to two-year-old culms with fully developed branches have active and vigorous root primordia and buds at their base that are capable of producing roots and shoots.

Branch cutting method is less wasteful than the culm cuttings. An entire culm has to be cut and segmented into one-node cuttings for the production of propagules while the branch cutting utilizes only the branches and the culm is kept intact for possible harvest. It is also less bulky and uses smaller and cheaper polybags, less soil media and less space in the nursery (Lapis et al, manuscript for publication).

Another method for producing planting stock is through tissue culture. This method produces greater number of propagules than the cutting methods. There had been attempts to develop the protocol for tissue culture of local bamboo species since the middle of the 1980s.

An experiment on tissue culture was conducted at the Ecosystems Research and Development Bureau (ERDB) (Calinawan and Chicano, 1995). It was initiated to develop tissue culture protocols on

⁸ Palis, E. 2015. Personal communication. June 2015.

⁹ Uy, L. 2015. Personal communication. September 9, 2015.

¹⁰ Manda, E. 2015. President, PBF. Personal communication, September, 2015

economically important bamboo species, namely *bolo*, *laakand kayali* [*Gigantochloa atter* (Hassk.) Kurz]. Explants (tissues) came from branch nodes, inflorescence, shoot tips and leaves.

Bolo nodal explants from young lateral shoots and from young leaves produced shoots using Murashige and Skoog medium supplemented with 5 ppm benzyl adenine (BA). Shoots formed after 6 weeks. Shoot elongation and more leaves were formed when sub-cultured in large bottle for another 4 weeks in the same medium. The cultured shoots were acclimatized in the greenhouse for 7 days then planted in 1:1 sand and soil medium for rooting. However, the young plants were not out-planted.

Earlier at the Institute of Plant Breeding (UP Los Banos) a tissue culture study on bamboo (*Dendrocalamus latiflorus* Munro) was conducted at the by Dr. A. B. S. Zamora and co-workers (1988). Explants from nodes of lateral shoots were used for the experiment using Murashige and Skoog medium supplemented with 5 mg/l of benzyl adenine. Buds and subsequent shoot growth were obtained. Despite these two successful attempts at tissue culture of bamboo there are no established protocols on tissue culture of bamboos found in the Philippines.

Indonesia, however is now commercially producing tissue cultured bamboo planting materials. P.T. Bambu Nusa Verde (BNV) is a biotechnology company that specializes in the micro-propagation of bamboo species. It is located in Yogyakarta, Indonesia. BNV utilizes protocols developed by Oprins in Belgium for numerous bamboo species. BNV can supply plantlets anywhere in the world (<https://www.google.com.ph/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8#q=wwwbambunusaverde>).

Demand side sector

Furniture and Handicrafts

It is difficult to segregate the furniture from the handicrafts sector because most operations especially the smaller ones produce both furniture and handicrafts. However, they can be viewed as formal and informal sub-sectors.

- Informal subsector

The informal subsector is made up of generally micro enterprises and encompasses those that do not register their operations with the Department of Trade and Industry (DTI) although they may obtain a Mayor's Permit to operate. They are characterized by low capital investments, rudimentary tools and equipment which are often manually operated

although some enterprises may have manually operated machines such as handsaws, drills or other hand-held mechanical tools. They also have few workers who are often family members. Their shops are under the house or part of their house converted to workshops. Product designs are simple and are often copied from other shops operating close-by. Products include 3 or 4-piece sala sets, beds, tables, lounging chairs or locally known as *papag*, and cabinets. Handicraft products include kitchen utensils, baskets, decorative articles, etc. Their markets are limited to neighbors and seldom beyond their communities. There is no formal marketing, in many cases marketing is by displaying their products along the road where passers-by would see.



There is another mode of marketing small furniture items such as baby chairs and tables made of bamboo, cribs, fruit baskets, rice winnowing baskets, lamp shades, etc. and this is done by itinerant merchants. Many years back itinerant merchants of bamboo products use carabao/cow drawn carts loaded with goods. Now they use tricycles rigged-up to accommodate and carry their wares. They travel in convoys. One such group of 7 itinerant merchants was interviewed in Bay, Laguna. The group came from San Carlos City, Pangasinan with their load of bamboo and rattan products. Their itinerary includes Rizal, Laguna, Batangas and Cavite. It will take the group 3 months to cover these provinces after which they return to Pangasinan and prepare for another trip. They get their products from producers in San Carlos City¹¹.

A study was conducted on the bamboo processors in Clarin, Misamis Occidental (Garcia et al, 2013) (Appendix 1). The results of that study showed that the furniture manufacturers in that municipality typify the informal sub-sector of the furniture industry. Three bamboo pole traders and 15 bamboo furniture makers and *amakan (sawali)* weavers were interviewed. All the bamboo furniture makers were single proprietorship and their capitalization ranged from Php 10,000 to Php 30,000. None of them borrowed from the bank and to finance their operation they borrowed from informal lenders or cooperatives or used their own funds. The micro nature of their operations is evidenced by the fact that most of them had only from 1 to 3 workers and only 1 had more than 9 workers.

They obtain their raw materials from traders who deliver the bamboo culms. The species commonly used are *kawayan tinik, botong and bayog*. The prices of bamboo poles delivered to furniture producers range from Php 60.00 to Php 125.00 per culm. About half of the respondents processed at least 50 bamboo culms per month while the larger producers processed as many as 200 culms per month. At this rate easily the furniture manufacturers in Clarin, Misamis Occidental utilize 15,600 culms a year.

Product lines include sala sets, beds, rocking chairs, divans, *amakan* or *sawali*, etc. Their product designs are generic, copied, unoriginal, and dependent on skills and know-how of workers. Tools used are rudimentary which usually include bolo, saw, blow torch, brush, chisel, spoke shave, brush, drill, and hammer. Used insecticide spray cans are used for spraying varnish, clear gloss lacquer or other finishing materials. They sun dry their bamboo culms for 4 days during summer and 5 to 7 days during rainy months, which is not enough to dry the materials to acceptable levels of about 15 to 18% for local use. For preservative treatment used engine oil or kerosene is applied by brushing the products after manufacture.

About 4 to 8 sala sets and 8 to 15 beds are produced per month by an average-sized manufacturer. The cost of production, profit margin and competitor's price are all considered in setting the prices of bamboo furniture. Price of sala set ranges from Php 2,500.00 to Php 4,000.00 and beds are priced between Php 700.00 and Php 1,300.00 per piece.

The furniture manufacturers in Clarin, Misamis Occidental do not have formal marketing or product promotions. The most common method is to display their products along the highway for travellers to see. A few of them have signages about the products as well as the prices.

A survey was conducted by some DOST Regional Offices through their provincial offices on the bamboo enterprises within their provinces. The individual provincial reports are shown as Appendix 2 and a summary is shown in Table 3-1. Most of the surveyed enterprises belong to the informal component of the furniture and handicrafts sectors.

¹¹ Martinez, A. and L. Sanchez. 2015. Interview. September 23, 2015.

Table 3.1 – Summary of bamboo enterprises in some provinces

Province/Municipality	No. of enterprise	Species used	Sources	Price Range(Php/culm)	Products	Sum of culms needed/ month	No. of workers
Laguna 7 municipalities	7	K. tinik, bulo, buho,	Within Laguna	45 to 350 depending on size	Sticks, slats, GTH furniture, kiosks carvings, tepees lampshades "bahay kubo" cages,	2,120	62
Rizal 2 municipalities	2	K. tinik, G. bamboo	Talim Is., Pililla	45 to 150	Table top, room divider, sala set, wine holder, lampshade, cell phone holder, poles for fishpens	520	14
Cavite 3 municipalities	3	K. tinik buho taywanak bayog	Maragondon Tarnate	45 to 250	Sala set, sawali furniture handicraft barbecue stick bamboo tiles, fishpen poles	575	10 plus 1 worker per hectare of fishcage
Palawan 1 municipality	1	buho	Local forest	1.00	sawali	500	2
Camarines Sur 2 municipalities	14	K. tinik	Bula, Bato, Buhi, Balatan, Nabua.	50	Dining set, bed, table, engineered bamboo	2,626	49
Ilo-ilo 1 municipality	1	K. tinik	Ilo-ilo and nearby provinces	45.00 1 st class; 26.00 2 nd class	Bbq sticks, chopsticks, toothpicks, briquettes	8,000	50
Batangas 3 municipalities	3	K. tinik, bayog	Tuy, Batangas, Talim Is. Cardona, Rizal, Sto. Tomas and Tanauan, Batangas	85-150	Duyan bamboo stand, nipa hut, chairs & beds, etc., construction, lampshades, etc.	580	25
Quezon 2 municipalities	3	K. tinik	Candelaria, Lucena City, Pagbilao, Sariaya	25 to 70	Sala set, dining set, frames, beds lampshades, cribs, kubo, dining set,	400	15
Occidental Mindoro 1 municipality	1	K. tinik	Ilin Island, Sn Jose, Occ Min.	100 to 120	Sala set, bamboo bed	488	4
Oriental Mindoro 1 municipality	1	K. tinik	Upper Yunot, Nasucob, Bulalacao	80	Sala set, bed	200	19
Marinduque 1 municipality	1	K. tinik	Cawit, Boac & Caganhao, Boac	40 to 100	Sala set divider, bed,sofa bed	25	2
Aklan 4 municipalities	9	K. tinik, botong	Libacao, Ibajay, Kalibo, Nabas, Makato	80 to 250	Cabinet, sala set, dining Set, kubo, fence	4,680	38
Romblon 1 municipality	11	K. tinik	Tuburan, Libertad, Rizal, Recto, Dapawan, Tumingad, Tulay	80 to 100	Sala set, fan	386	24
TOTAL 12 provinces 29 municipalities	57 enterprises	K. tinik, bulo, buho, bayog, G. bamboo, botong	Within the municipality/ province	25 to 350	Sala set, dining set, bed, cabinet, kubo, lampshades	21,100	314

Source: Survey by provincial offices of the Department of Science and Technology, June to July 2015.

Twenty-nine municipalities in 12 provinces were covered in the survey. A total of 57 enterprises were profiled. All the 57 enterprises utilized *kawayan tinik* although other species were used such as *bulo*, *buho*, *bayog*, *Giant bamboo* and *botong*. Nearly all of the enterprises source their raw materials within their provinces and only two source their raw materials outside their provinces. There is a wide range of prices of the bamboo culms, from Php 25 to as high as Php 350. In all likelihood price difference is due to the species, size (diameter and length) of the culms as well as straightness.



There is wide range of products manufactured. Many, however, are common to most of the processors which include sala set, dining set, beds and tables. The more expensive products are the “bahay kubo” and kiosks. Other products are mostly handicrafts in nature such as basket wares, gifts, toys and housewares, wine and cellphone holders and amplifiers and lampshades.

The requirements for bamboo culms run from at least 50 culms per month to 500 per month. The total culm requirements of the 57 enterprises amounted to 21,100 per month or close to 253,200 culms a year. The number of employees of the enterprises ranged from 2 to 50 and the total workers of the 57 entrepreneurs was 314.

- The formal sector: furniture

The furniture industry of the Philippines is known abroad for its “craftsmanship, handmade work (e.g. carving, weaving) antique reproduction, hand-finishing and strict quality assurance applied on good design” (Valenzuela, 2015). The furniture made in the Philippines are so exquisite that it is known as one of the best in terms of design and quality and for which reason the Philippines is regarded as the “Milan of Asia”.

The formal sector of the bamboo furniture industry includes those that produce high-end furniture and geared for the export market as well as high class hotels and restaurants. In most instances the bamboo furniture produced in these firms is part of the total furniture production. Seldom if any export furniture producer manufactures only bamboo furniture. Bamboo often is just used to accent the design of the furniture. Their operations are sophisticated employing varied and modern machines with the newest production technologies. They employ furniture designers to ensure that their designs are fashionable and not passe’. The owners are members of organizations such as the Chamber of Furniture Industries of the Philippines (CFIP), the Philippine Chamber of Handicraft Industries (PCHI), the umbrella association, the Philippine Federation of Furnishings Association (PhilFFA) or the Philippine Exporters Confederation (PHILEXPORT).

The centers of manufacturing of high grade, export quality furniture are Pampanga, Metro Manila, Cebu and Davao. There are also producers of fine furniture in Ilo-ilo and Bacolod. The resurgence of bamboo furniture especially the high quality ones owes from the fact that wood and rattan raw materials have been on the decline particularly when harvesting from the natural forest was banned (EO 23, 2011). Since then furniture manufactures started to incorporate bamboo in their design of furniture with exceedingly successful outcomes. In addition buyers overseas and also local hotels and restaurants started to use bamboo furniture in their lobbies and rooms.

The other factor that promoted the integration of bamboo in high grade furniture is the engineered bamboo technology. To be able to apply bamboo in furniture parts that require wide areas such as table tops and headboards of beds furniture manufactures produced their own engineered bamboo or buy from reliable producers of engineered bamboo. Since bamboo carving has been introduced through artisans in Asin, Baguio hand-carved bamboo parts have been incorporated in furniture designs.

The furniture industry of the Philippines is estimated to have a direct and indirect employment of 1.9 million and that 5.4 million Filipinos are employed in the supply chain Valenzuela, (2015). However, it is not known how many are employed in the manufacture of bamboo furniture. It is difficult to disaggregate because bamboo furniture production is part of the entire line of furniture products of an integrated furniture exporting enterprise.

- The formal sector: handicrafts

By definition handicrafts are products made by hand exemplified by woven products although some handicrafts, nowadays, are made of parts that are machine made like engineered bamboo. The types of handicraft products of high end or export grade handicrafts are similar to those produced by the informal sub-sector, the difference is that those produced by the former are more exquisitely done. The most common handicraft products that are exported are those that make use of woven parts such as basket wares of varying designs.

Unlike the furniture industry where there are identified centers of production there are none in the manufacture of handicrafts because they are scattered around major cities and urban centers in the country.

- Musical Instruments

A very small sub-sector of the handicraft industry is bamboo musical instruments. Across Asia, bamboo plays an important role in shaping the cultural identities of ethnic groups who utilize this abundant resource to fashion musical instruments. In the Philippines, there are xylophones or *gabbang* in Mindanao, bamboo slit drums of Bukidnon, struck quill-shaped tubes of Mindano, stamping tubes, scrapers, bamboo buzzers and clappers of the Cordilleras and the various types of flutes, pan pipes and reed pipes (Dioquino, Corazon Philippine Music Instruments, posted April 15, 2015, <http://ncca.gov.ph/subcommissions/subcommission-on-the-arts-sca/music/philippine-music-instruments/>). These instruments, which are handcrafted by ethnic communities for their own use do not enter the bamboo industry value chain.

Two companies (based on Internet search) produce bamboo music instruments for commercial use, the most common of which is the bamboo flute. These are retailed in large music stores and bookstores. Other instruments are made-to-order. These are the *angklung*, marimba, pan pipes, Jew's harp and other ethnic bamboo instruments. Schools who form their own pangkat kawayan bands are the major buyers of these bamboo musical instruments.

Specialized products sector

In this sector the sizes of the products are small but the demand for them is big and used in large quantities every day. The products cannot be classified as handicrafts since they are disposed of once they are used. They are used mainly in eateries and restaurants and often at home. This is the sector that produces toothpicks, barbecue sticks and chopsticks.

Among the products, the barbecue sticks have the largest demand. They are used not only in food stalls and in "carinderias" but also in large chains of restaurants. Probably the largest food-chain user is "Inasal" and "Chic-boy", restaurants that serve barbecued chicken and pork¹².

Probably the largest supplier of barbecue sticks, toothpicks and chopsticks in the country is the Ilo-ilo Kawayan Marketing (IKM) located in Maasin, Ilo-ilo. IKM produces toothpicks, chopsticks and round and flat barbecue sticks. The weekly production of IKM is shown in the table below (Table 3.2):

¹² Naming the entities does not constitute an endorsement of these eateries

Table 3.2 - Weekly production of specialty bamboo products by the Ilo-Ilo Kawayan Marketing

Type of Products	Number of packs/pairs	Number of boxes	Number of pieces
Toothpicks	80,000	4	320,000
Chopsticks, various sizes	10,000	35	125,000
Barbecue sticks			
Round sticks	1,300	51	520,000
Flat sticks	100	50	250,000

Source: IKM brochure (provided through Mr. Butch Marquez of ERDB-DENR)

IKM at its present capacity cannot supply all the orders for barbecue sticks thus it has farmed the production of flat sticks to other suppliers such as those producing bamboo furniture and handicrafts in Maasin, Ilo-ilo. These other suppliers utilize trimmings and short poles in the production of the flat barbecue sticks. These other suppliers provide an additional 350,000 flat barbecue sticks to the IKM.



Mechanized barbecue stick production at IKM

IKM was established in 2006 with its plant located at Brgy. Naslo, Maasin, Iloilo. It employs the latest technologies in the production of toothpicks, chopsticks and barbecue sticks. There are 50 well trained workers in its employ. The current culm requirement of IKM is about 2,000 a week or 96,000 culms a year.

Another producer of specialty bamboo products is the Berris Agricultural Corporation (BAC) located in Calauan, Laguna. The products include chopsticks and banana/camote cue sticks. It has the capacity to produce 500,000 sticks per month. Its production is on order basis. It employs 3 workers. When in operation its bamboo requirement is about 300 culms/month.

Engineered-bamboo Sector

Engineered bamboo is produced by laminating or gluing together two or more layers of slats, crushed bamboo mats, flattened bamboo veneered bamboo. Engineered bamboo can be further processed into floor tiles, turned products (balusters), panels, furniture parts, handicrafts and if in lumber form can be used as posts or beams (Villanueva et al, 2010).

Although the use of engineered bamboo spans the broad spectrum from handicrafts to high rise erect structures and the demand is apparently growing, there is however a reported limited technologies in processing, inadequate promotions and slow commercialization of engineered bamboo (Villanueva et al, 2010). Presently engineered bamboo is not mass-produced. Processors rely on customer order basis of production although the furniture and construction industries are potential large markets. There is a need to promote the product to the construction industry.

One reason why the use of bamboo in construction is limited is the variable quality of the product as produced by engineered bamboo manufacturers. Studies at the FPRDI showed that the locally produced engineered bamboo has higher bending strength and stiffness than imported ones.

However, the study also showed that the quality of locally produced engineered bamboo is highly variable (Villanueva et al, 2010). There is a need to standardize the production of engineered bamboo.

Production of engineered bamboo was started by the Far East Bamboo Exports Company of Cebu City in 1996 (Villanueva et al, 2010). Since then Razal et al (2012) reported other 12 processors that went into engineered bamboo manufacture, but two more have been added to the list (Table 3.3). Quite recently another enterprise went into engineered bamboo production. This is the San Francisco Association of Differently Abled Persons Multi-purpose Cooperative (SAFRADAP MPC). SAFRADAP-MPC is located in Damilag, San Francisco, Agusan del Sur. The cooperative is already producing wooden school furniture which it is supplying to the local DepEd and in Manila. It has recently gone into producing school furniture using engineered bamboo on a trial basis. However, the cost of production is quite high, Php 1,200.00 per piece which is higher than the ceiling price of Php 930.00 of DepEd .

Of the 13 processors mentioned by Razal et al (2012), 3 stopped operation for various reasons. Razal et al (2012) suggested that higher production costs and consequently higher price of engineered bamboo dissuaded customers to buy locally produced engineered bamboo and to turn to lower priced imports from China (Villanueva et al, 2010). The cost of producing 1 cubic meter of engineered bamboo lumber using flattened bamboo by Buglas Bamboo Institute (BBI) is Php 3,800 (Koerkamp, 2015). This is compounded by the unfamiliarity of the product by construction firms.

There are several factors constraining the development of engineered bamboo production in the country. Foremost of these is the inadequacy of raw materials. There is great competition among the various industry sectors for the available bamboo culms. This increases the cost of engineered bamboo products. The cost of bamboo raw materials can be as high as 40-50% of the total cost of production of an engineered bamboo product (LBNP, 2015)¹³. Base Wood Products in Luna, Isabela has supplied about 18,000 chairs made of bamboo to DepEd but has to stop operation because of the lack of raw materials.

Another factor that drives the cost of production of engineered bamboo high is the inefficiency of processing machines. Engineered bamboo processing machines usually are imported from Taiwan or China. There are a few fabricators of machines in the country but the machines produced have low volume capacity and consequently the production cost is higher. Some producers of engineered bamboo are using wood working machines and they are not fitted to process bamboo which makes the cost of production higher because of low machine productivity.

Table 3.3 - Engineered bamboo processors, name, location, and year established

Name	Location	Year started	Status
Luzon			
1. Balbin's Furniture	Bangued, Abra	1998	Stopped operation
2. InHand Abra	Bangued, Abra		Production by customer order basis
3. Cottage Industries Technology Center (CITC)	Marikina City, Metro Manila	2009	Production by customer order basis
4. Mariano Marcos State University (MMSU)	Batac, Ilocos Norte	2004	Production by customer order basis
5. Wing An Construction	San Juan Metro Manila	2008	Stopped Operation
6. Philippine Furniture Training Center	Mabalacat, Pampanga	2010	Production by customer order basis
7. Base Wood Products	Luna, Isabela	2011	Stopped producing bamboo chairs and desks

¹³ Lubao Bamboo Nature Park. 2015. Personal communication

Visayas			
8. Bamboza	Sta. Barbara, Ilo-ilo	2008	Production by customer order basis
9. Buglas Bamboo Institute	Dauin, Negros Oriental	1999	Production by customer order basis
10. Far East Bamboo Exports	Cebu City	1996	Production by customer order basis
11. Southern Leyte Employees Multipurpose Cooperative, Inc(SLEM)	Maasin, Southern Leyte	2006	Production by customer order basis
Mindanao			
12. Barangay Luinab Multipurpose Cooperative (BALUMCO)	Iligan City, Lanao del Norte	2005	Production by customer order basis
13. MSU Bamboo Technology Resource Center	Iligan City, Lanao del Norte	2005	Experimental stage
14. Sidlak Pinoy, Inc.	Valencia, Bukidnon	2001	Stopped operation
15. SAFRADAP	San Francisco, Agusan del Sur	2014	Just started producing engineered bamboo

Source: Razal, R. A., P. C. Dolom, A. B. Palacpac, M. M. B. Villanueva, S. C. Camacho, M. A. Alipon, R. B. Bantayan, and S. C. Malab. 2012. Mainstreaming Engineered-Bamboo Products for Construction and Furniture. Forestry Development Center, UPLB College of Forestry and Natural Resources, College, Laguna. Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development, Department of Science and Technology

Another factor is labor cost. It contributes significantly to the high production cost (Razal et al, 2012). The bamboo undergoes several stages of preparation prior to assembly of the engineered bamboo. In many instances the materials require to be re-worked. This drives the labor cost higher. In the manufacture of school chairs by the Lubao Bamboo Nature Park (LBNP) the calculated percentage of cost accountable to labor is 30% (LBNP, 2015). At the Base Wood Products labor cost constitutes a little over 50% of the cost of production (Base, 2015)¹⁴.

The other factor is the high cost of power (electricity). The Philippines is claimed to have one of the highest cost of electricity among the ASEAN countries. High electricity cost of course contributes to higher cost of the product. Buglas Bamboo Institute in Dauin, Negros Oriental estimated the cost of adhesives is about 23% of the cost of production. Other constraints SAFRADAP-MPC identified include susceptibility of bamboo to powder post beetles, lack of established supplier of reasonably priced adhesive and chemicals for preservative treatment and inadequate knowledge of bamboo suppliers on the maturity of bamboo culms to harvest.

There are certain initiatives of government that provides opportunities for a better outlook for the sector. In May 2010 EO No. 879 was promulgated with the intention of providing the environment for the development of the bamboo industry. The EO specifically directed the Department of Education to procure at least 25% of the public elementary and secondary school desks and chairs made of bamboo and to prioritize the use of bamboo in furniture and fixtures and other construction requirements of government facilities (EO 879, 2010).

Engineered bamboo is used in the manufacture of school desks and arm chairs. The DepEd allocates Php 1 billion annually for the procurement of desks and arm chairs (Angeles 2015). EO No. 879 requires that 25% of the amount, or Php 250 M, is used to procure desks and arm chairs made of bamboo. The ceiling price of DepEd for arm chairs is Php 930 a piece (LBNP, 2015). The Php 250M would translate to 269,000 arm chairs. One arm chair requires 4.5 culms (LBNP, 2015). The 269,000 arm chairs would need 1.21 million culms.

¹⁴ Base, E. 2015. Personal communication



The Department of Trade and Industry (DTI) has embarked on a program to popularize the production and use of engineered bamboo especially in the rural areas rich with bamboo resources. This is the Shared Service Facilities (SSF) program. It consists of establishing Nodes and Hubs (DTI, 2010). The Nodes are the primary processors. They cut the culms to the desired length, split the poles into slats and process the slats into equal widths with squared sides. The Nodes also conduct preservative treatment on the slats. The slats are then sent to the Hubs.

The Hubs, on the other hand, continues the processing of the slats where the Nodes stopped. The slats are dried, either with the use of a dry kiln or simply exposed the slats under the sun or air drying. The slats then undergo thickness planing to have slats of the same thicknesses. The slats are then composed and glue is applied. The assembly is then pressed with the use of a hot press or cold-pressed with clamps. The assembly is then planed to uniform thickness and width (DTI, 2010). The Hubs sell the engineered bamboo to processors or process it to the final products. The aim of the program is to make the Nodes progress into Hubs and the Hubs to expand in capacity.

The construction industry offers great opportunities for the application of engineered bamboo. It could be applied as panels, balusters and steps for stairs, doors and door jambs, builders' wood works such as mouldings and in lumber form could be used as columns or beams and trusses. However, engineered bamboo cannot be used for buildings, towers and other vertical structures. As of now there are no accepted and adopted specifications for minimum quality of the product although a draft standard for engineered bamboo has been submitted to the Bureau of Product Standards for approval (Cabangon, 2009) (Appendix 2), there are no design and construction requirements, no specifications for durability or resistance against termites, decay fungi and beetles, support to masonry and concrete, no specifications for wall framing, or floor framing, interior panelling and sheathing (NSCP, 2001). Those specifications should be accepted and adopted into the National Structural Code of the Philippines. Standard specifications for engineered bamboo for structural applications should be formulated and accepted into the National Structural Code of the Philippines.

There are a number of enterprises that are establishing bamboo processing for the production of engineered bamboo. This includes the Guevent Investment and Development Corporation (GIDC) whose operations are located in Taytay, Palawan. The factory is being constructed and the machines that they will be using come from a local fabricator in Antipolo City. GIDC has established a 10-ha *kawayan tinik* and 3-ha *giant bamboo* plantations that are now about 3 years old. The other enterprise that is planning to go into engineered bamboo production is the CS First Green Agro-industrial Development, Inc. (CSF GAIDI). The factory being constructed is located in Bayambang, Pangasinan. Machineries from China costing approximately US\$ 1 million arrived in October 2015. CS First is also in the process of establishing a 250-ha bamboo plantation in Pangasinan.

Construction Sector

The construction sector spans a wide range of types of construction from residential to commercial, industrial and institutional buildings. Residential buildings can range from single, detached houses to apartment buildings, row houses to high rise condominiums. In commercial, industrial and institutional buildings, the materials used in their construction are mostly concrete and steel. Wood and other types of construction materials are limited to flooring, panelling, fixtures and cabinetry.

Bamboo in construction has been used probably for millennia. In the Philippine rural areas the traditional house is still "the bahay kubo" made mostly of bamboo for various parts except maybe the roof. Posts, beams, trusses, floors and walls, doors and windows are made of bamboo in round form or split into slats or flattened. When well and properly constructed the "bahay kubo" can withstand

strong winds and mild flooding. The “*bahay kubo*” typifies the spirit of the Filipino, resilient and stable in the face of adversity.

Architect Dominic Galicia points out in the introduction to *Philippine Style* (Loraga, 2013) that the *kubo* has a "geometric simplicity: a pyramidal roof hovering like a parasol over a bamboo box of stilts. Rain slid off the steeply pitched *cogon* roof, while fresh air, flowing in through the slatted floor and the wide windows, cooled the interior before exiting through the permeable roof thatch." It is considered by Architect Rosario Encarnacion Tan as the DNA of Philippine architecture¹⁵. Architect Rosario "Ning" Encarnacion Tan has waged a heroic one-woman battle in behalf of "bamboo's possibilities." She says that, "Bamboo was seen as a poor man's material, not strong and sturdy. Actually, bamboo is the ideal generic medium to express what is vernacular, authentic, sustainable, culture, reflective, and spiritual." Her bamboo houses are unique for they are "portable and dismantlable," i.e., they can be assembled in one space and moved to another, just like the *bahay kubo* of old portrayed in paintings as a form of *bayanihan*, with the town's menfolk carrying the hut on poles on their shoulders (Loraga 2013).

It is ironic that houses made of bamboo are looked-down as a poor man’s structure. Now-a-days in the rural areas a family who can afford builds a house using other materials than bamboo such as concrete and steel. In other countries, however, bamboo is considered an *avant-garde* construction material. Architect Rosario Encarnacion Tan spoke of Elora Hardy having a 24-bamboo house project in Indonesia costing about Php 67,000/square meter¹⁶.

The amount of bamboo used in construction of houses is difficult to estimate. What is estimated here is the amount of bamboo materials that could be potentially used in construction in the urban areas.

The demand for new housing including possible backlog in housing are shown in Table 3.4. The housing backlog from 2001 to 2011 was estimated to be 6,226,940 units. The estimated housing needs for the various housing segments categorized according to price range is likewise shown in Table 4.4. The annual average housing needs is also estimated to be 345,941. The annual production capacity for housing is only 200,000 units. If this trend continues it will bring the housing backlog to 6,546,106 units by 2030 (SHDA, undated).

Table 3.4 - New housing needs, 2012-2030

Market Segment	Price Range	Units Needed	% of Total Need
Can't afford, need subsidy	400k and below	1,449,854	23.28
Socialized housing	400k and below	1,582,479	25.41
Economic housing	400k-1.25m	2,588,897	41.58
Low cost housing	1.25 – 3 m	605,692	9.73
Mid cost housing	3-6m	No need	
High end housing	>6m	No-need	
Total Need		6,226,940	100
Housing backlog 2001-2011		3,919,566	
Annual average needs		345,941	
Housing production capacity		200,000	
Backlog by 2030		6,546,106	

Source: Philippine Housing Industry Roadmap, Subdivision and Housing Developers Association, Inc.

¹⁵ Tan, 2015. Personal communication. Round Table Discussion on Bamboo for Construction. November 26, 2015. Architect Tan has built has been commissioned to design houses made of bamboo and her own 3 storey house is made of bamboo. She is also author of book entitled: “100 Things About Building with Bamboo”

¹⁶Tan, 2015. *Op cit*

Housing construction is a large market for engineered bamboo. However, it is difficult to estimate the amount of construction materials with just the number of units needed to be built per year as indicated in Table 4.4. The demand for construction material in the other types residential building is easier to estimate. While the Structural Code of the Philippines does not have yet specifications for bamboo construction materials bamboo can be applied in non-structural building components, again such as flooring and panelling. Another application of bamboo in round form is as scaffolding during construction or repair or painting of buildings. The amount of culms used for this purpose may be substantial but it is also not easy to estimate. When FPRDI had its buildings re-painted the number of culms used for scaffolding was about 200 pieces. For scaffolding GI pipes have also been used.

In 2013 the Philippine Statistics Authority reported that the number of approved building permits was 120,775. Of this 87,767 were for residential houses (FPRDI, 2014a). The higher end of residential houses would have an average of 3 bedrooms with possibly an average area of 8 m². The total bedroom area of the 87,767 residential houses would be 2,106,408 m². Assuming that a mere 10% of these residential houses use engineered bamboo for flooring, the area of engineered bamboo needed would be 210,640.8 m².

Agriculture and Fisheries sector

One of the bigger users of bamboo poles are the banana industry and the fish culture industry in inland waters.

- The banana industry sub-sector

The banana industry is concentrated in Davao del Norte, Compostela Valley, Davao Oriental in Region 11 and South Cotabato in Region 12. Executive Director Mr. Stephen Antig of the Philippine Banana Growers and Exporters Association (PBGEA) said in an interview in 2013 that they expect the banana growers to increase the area of banana plantations from the current 42,000 ha to 50,000 ha in 2015 (<http://www.zambotimes.com/archives/news/75841-PBGEA-sees-50T-hectares-farm-expansion-of-exportable-bananas-in-2015.html#stash.alvKh7gm.dpuf>). The total area of banana plantations in the country is not just the 42,000 ha that are owned and operated by the PBGEA. The actual area is greater than the 42,000 ha because the small banana planters and growers, which have their own association, the Mindanao Farmers and Banana Exporters Association (MBFEA) also own and operate banana plantations.

In the early stages of banana growing in the Davao area bananas laden with fruits were propped using bamboo poles as well as wood saplings. The use of saplings which were sourced from nearby forests was later discouraged because it was depleting the forests of growing stocks. The use of bamboo props suffered some set-backs because firstly it deteriorates easily and therefore has a short service life of less than 2 years and secondly they were stolen (along with the saplings). The industry shifted to the use of guy wires but it was more expensive so later on some of the industry members shifted back to the use of bamboo as props.

The length of the bamboo prop is about 16 ft or a little longer than 5 meters. A whole culm can provide two props or a single culm can prop one banana plant. It is not readily known how many hectares of banana plantations are using bamboo as props but an assumption can be made.

Mr. Ray Millan is a bamboo farmer in Tagum City in Davao del Norte. He has a 60 ha of bamboo plantation consisting of about 30,000 clumps. Most of the species planted is *laak* but with a sprinkling of *kawayan tinik*, *kayali*, *butong* (local name of *bolo*), *tiger* (*B. maculata* Widjaja) and *Giant bamboo*. The 30,000 clumps are already harvestable. He supplies a weekly average of 7,000 poles (16 ft) or

3,500 culms¹⁷. If this is done regularly he is supplying the banana industry through agents about 168,000 culms a year which is within the capacity of the 30,000 clumps to supply. The poles are not treated and the buyers do not require treatment of the poles. The agents come to his farm and pick up the culms. Mr. Millan claims that prices fluctuate according to the distance of the banana farms from his bamboo farm. He claims that he has no problem obtaining a permit from the DENR. Occasionally personnel from the DENR visit his farm to confirm that the bamboos come from a private plantation.

Another supplier of banana proprs is the 25-ha Caasi plantation of *laak*¹⁸ in Davao del Norte.

- The fish pens and cages sub-sector

There are 3 inland water bodies where fish culture is practiced, the Laguna Lake and Sampaloc Lakes, the Taal Lake and Lake Sebu. The fish culture cages and pens are built with bamboo or anahaw [*Livistona rotundifolia* (Lam.) Mart. var *luzonensis* Becc.] poles. However, the supply of anahaw poles has greatly diminished and bamboo is widely used for pens.

Fish pens and fish cages in the Laguna Lake use about 50% bamboo and 50% anahaw trunks for posts. There are 3,122 structures in the Laguna Lake as of June 30, 2015 (LLDA, 2015) (Table 3.5). Of these, 323 are fish pens and 2,799 are fish cages. Of the 323 structures, 219 were registered and 104 unregistered. The total area covered by the fish pens and cages amounted to 11,948.94 ha (LLDA, 2015). At 50%, the area of pens and cages that use bamboo poles is 5,974.47 ha. The distance of the bamboo poles in the pens and cages is 1 m.

Table 3.5- Number and area of fish pens and fish cages in the Laguna Lake

Type of structure	Registered		Unregistered		Total	
	No. of structures	Area (ha)	No. of structures	Area (ha)	No. of structures	Area (ha)
Fish pen	219	5,966.34	104	4,304.83	323	10,271.17
Fish cage	1,024	630.21	1,775	1,047.56	2,799	1,677.77
	1,243	6,596.55	1,879	5,352.39	3,122	11,948.94

Source: Clearances and Permits Division, Laguna Lake Development Authority, September 9, 2015

There is one fish pen with an area of 50 ha using bamboo culms. Assuming a square configuration of the pens for easy estimate of the number of bamboo culms used, there would be 2,828 bamboo culms used. The distribution of the rest of the area to various sizes of pens is not known. What is sure is that the fish cages are small in area but most of them are less than a hectare. It is estimated that there are about 1,000 fish cages in the lake and most of them are less than a hectare in area. Assuming the 50% of the fish cages use bamboo for posts, there would be 500 cages using bamboo culms.

The estimated number of bamboo culms used for fish pens and cages is shown in Table 3.6. There are a total of 1,141,653 bamboo poles used for these purposes in Laguna Lake. The bamboo culms have a life span of about a year and about half of the number of culms is replaced. The annual requirement of bamboo culms in Laguna Lake for pens and cages is 570,827 culms.

¹⁷ Mr. Ray Millan, bamboo farmer in Tagum City, personal communication, July 2015.

¹⁸ Virtucio, F. 2015. Personal communication.

Table 3.6 – Estimated number of poles/pen-cage/number of poles per size of pen or cage¹

Area (ha)		Number of pens/cages		Number of poles/pen or cage		Total number of poles	
Fish pens	Fish cages	Fish pens	Fish cages	Fish pens	Fish cages	Pens	Cages
50		1		2,828		2,828	
20		20		1,789		35,780	
15		30		1,549		46,470	
10		100		1,265		126,500	
5		500		894		447,000	
2		500		565		282,500	
1	1	575	500	575	400	575	200,000
Total culm						941,653	200,000
Grand Total						1,141,653	

¹Extrapolated from data coming from the LLDA

Floating cages are also maintained in the Sampaloc Lake in San Pablo City. It is estimated by the Clearance and Permits Division of LLDA that one floating cage covers a total area of 600 m². No data was available on the number of cages in Sampaloc Lake.

Another lake where there are fish cages is Taal Lake. Taal Lake is part of the Taal Volcano Protected Landscape which was established under Presidential Proclamation No. 923 issued on November 19, 1996. According to Forester Vic Mercado who is the Protected Area Supervisor (PASu)¹⁹ there are about 6,000 fish cages in the Taal Lake. About 60% of the fish cages use bamboo for poles. It was also estimated that a fish cage would use 50 to 60 bamboo culms. The others use metal poles.

At 60% there would be 3,600 fish cages that use bamboo culms, and at an average of 55 bamboo culms a fish cage the total number culms utilized for fish cages would be 198,000 culms. At 50% replacement a year the annual requirement of bamboo culms for cages in the Taal Lake would be 99,000.

- Bamboo banca outriggers

Another important use of bamboo is as outriggers of fishing boats, either motorized or non motorized. As of April 21, 2016 there is a total of 1,679,350 fisherfolks in the Philippines (http://www.bfar.da.gov.ph/BFAR_ANNOUNCEMENT?id=72#post retrieved April 22, 2016). The fisherfolks may be classified into those that conduct municipal fishing and commercial fishing. Municipal fishing is conducted in municipal waters, within 15 km from shore, while commercial fishing is done beyond 15 km from shore (2014 Fishery and Aquaculture Country Profile. <http://www.fao.org/fishery/facp/PHL/en#CountrySector>-retrieved April 22, 2016). Municipal fishing is normally done using small boats with bamboo outriggers. The boats used in commercial fishing are larger vessels and do not use bamboo outriggers. The boats used by majority of the municipal fishermen consist of a narrow main hull with two attached bamboo outriggers, commonly called banca.

Only a small portion of the registered fisherfolks is involved in commercial fishing operations. The majority are municipal fisherfolks who use bancas with two bamboo outriggers to conduct their livelihood activities. Of the registered 1,679,350 registered fisherfolks in the country there are about 1,614,000 fishermen involved in municipal waters extending up to 15 km offshore, while 16,500 fishers are involved in commercial fishing operations in waters beyond 15 km (Fishery and Aquaculture Country Profile 2014. <http://www.fao.org/fishery/facp/PHL/en#CountrySector>-retrieved April 22, 2016). Assuming that 75% of the 1,614,000 municipal fisherfolks have bancas there would be

¹⁹ Mercado, V. Protected Area Supervisor of the Taal Volcano Protected Landscape, personal communication. September 15, 2015.

1,210,500 bancas. Each banca has two bamboo pole outriggers making a total of 2,421,000 bamboo poles used at any given time. One outrigger would require almost the entire length of the culm such that one outrigger would be equivalent to one culm.

The fishermen do not change their outriggers every year. The lifespan of the outriggers is from 3 to 5 years, the bamboo being damaged mostly by decay fungi, seldom by marine borers. At the average lifespan of 4 years, the amount of bamboo needed for replacement would be 605,250 culms annually. The species used is commonly *kawayan tinik*.

Bio-fuel Sector

- Charcoal (Lump charcoal)

Charcoal production is widely practiced in the country as an alternative source of income and livelihood in the rural areas particularly near forests. This is especially true in communities near mangrove forests. Mangrove wood has high heating value and it is valued for baking, cooking and grilling. The impact however, is the decimation of mangrove forests. This is true as well in upland forests where trees are cut for charcoal production.

With proper charcoaling technology bamboo can be a good raw material for producing charcoal. The yield of charcoal is affected by the temperature at which the bamboo charcoal is produced. Table 3.7 shows the yield of charcoal at various temperatures. As the charcoaling temperature increases the yield decreases. On the other hand the yield of ash increases as the temperature increases. It appears that the optimum temperature for charcoaling is at 300°C where the yield is 40.70 per cent (Kwaku, undated).

Table 3.7 - Yields of bamboo charcoal made at various temperature

Items of properties	Temperature of carbonization (°C)							
	300	400	500	600	700	800	900	1000
Yield rate in %	40.70	35.6	29.68	28.96	27.52	27.43	26.39	26.69
Ash %	2.93	3.48	3.54	3.92	4.07	4.58	4.69	4.57

Source: Michael Kwaku (Undated). Bamboo as sustainable biomass Energy: A suitable alternative for firewood and Charcoal Production in Africa. INBAR. http://commonfund.org/fileadmin/user_upload/Projects/INBAR/INBAR_10FT/3. Bamboo_Charcoal_and_Briquette_training_Manual-Ghana.pdf

Results of studies on charcoaling of bamboo at FPRDI showed that *kawayan tinik* yielded 44.50 per cent and 43.98 per cent from *botong* (local name of *bolo*) (Bisana et al, 2007).

Charcoal can be used in the production of activated carbon. As activated carbon it can be used as water purifier, deodorizer, air freshener, and when mixed with the soil it can increase soil alkalinity (Bisana et al, 2007). Activated carbon is produced by either the thermal or the chemical method, the former is through the use of zinc chloride while the latter employs steam or carbon dioxide at temperatures in the range of 800°C (Bisana et al, 2007). In 1995 the Philippines exported 30.25 million kg of activated carbon valued at US\$30.20 M. This increased to US\$ 37.56 M in 1997 (FTS, 1998).

The heating value of bamboo is about 4,600 cal/g which is comparable to wood which has a heating value in the range of 4,700 to 4,900 cal/g (Table 3.8) (<http://en.oprins.com/bamboo-plantations-products/bamboo-for-bioenergy.html>). Among the biomass materials coconut shell has the highest calorific value at 5,500 cal/gm (Banzon, 1980).

Table 3.8 - Heating value of bamboo and other fuel materials

Materials	KJ/kg	Cal/gm	Ave, cal/gm
Corn stalks	17,636 - 18,519	4,212 - 4,424	4,318
Sugar cane bagasse	17,817-19,407	4,136 - 4,635	4,386
Bamboo	19,000-19,750	4,538 - 4,717	4,628
Hardwoods	18,635-20,734	4,451 – 4,952	4,702
Coconut shell			5,500 ¹

Source: Jenkins, B. 1993. Properties of biomass, Appendix to Biomass Energy Fundamentals, EPRI Report, TR-102107, Jan 1993

¹Banzon, J. A. 1980. Coconut as a renewable energy source. Philippine Journal of Coconut studies, June 1980.

There are several ways of charcoaling biomass. The oldest way is the pit method. A pit is dug in the ground and the materials for charcoaling are arranged and fire is started. The pit is then covered with soil with a little opening for the smoke to come out. Care is taken not to allow too much oxygen otherwise the materials will turn to ash rather than charcoal. In the charcoaling of mangroves a kiln is used. It is a dome built with a frame covered with mud and has a chimney. Likewise the materials are arranged in the kiln and lighted. The kiln is closed and smoke is allowed out of the chimney. Again care is taken not to allow too much oxygen into the kiln.

FPRDI has been doing charcoaling research since the 1960s. It has developed several types of charcoal kilns. The latest design is with the use of a 55-gallon capacity drum (FPRDI, undated). The top cover is welded with a 10 cm diameter and 100m long chimney which serves as the smoke outlet during the carbonization process. Three sets of four holes are bored on the side of the drum. The first set is about 3-4 cm from the base of the drum. The second set is about 30 cm above the first set and the third set of holes is also 30 cm above the second set. Each set is made up of 4 equidistant holes around the circumference of the drum, the holes being about 1.5 to 2 cm in diameter.

There are no records of the production of charcoal. Not even the Philippine Forestry Statistics has a report on the production of charcoal. Yet lump charcoal can be found in local markets and in some grocery stores in urban areas. One of the uses of lump charcoal which requires considerable volume is the roasting of pigs or lechon. The biggest “lechoneros” in the country are located in La Loma, Quezon City. During Christmas time more than 200 “lechons” are sold per day in La Loma. The largest “lechonero” buys a truckload of charcoal per month equivalent to 500 to 600 sacks of charcoal (FPRDI, 2014b). One sack of charcoal is about 25 kg.

The prices of lump charcoal and the volume sold in selected local markets are shown in Table 3.9 (FPRDI, 2014c). Although there is a wide range in the volume of lump charcoal sold in public markets it can be seen that the volume of lump charcoal produced is quite substantial. A vendor in Asuncion, Tondo, Manila can sell 600-800 sacks a month. The price of lump charcoal in the rural areas does not vary so much but the price in Tondo and Quiapo is much higher than in the rural areas.

Table 3.9 - Prices and volume of charcoal sold in selected public markets

Public Market	Ave vol sold per month per vendor	Buying prices (Php) per sack	Selling price (Php) per sack	Approximate weight
Camarines Sur	20 sacks	120	140	20-23 kg/sack
Siniloan, Laguna	100 sacks, 1 sack=16 bundles, 1 bundle = 3 bags	160	12/bundle of 3 plastic bag or 4/bag	¾ kilo per bundle of 3 bags or ¼ kilo per bag
Pagsanjan, Laguna	10 sacks	150-190	180-200	15-20 kg/sack
Sta Cruz, Laguna	120-150 sacks	120-150	150-160	23 kg/sack
Asuncion, Tondo	600-800 sacks	220-280	320	21-24 kg/sack
Quiapo	150 sacks	250	320	20 kg/sack

Source: FPRDI. 2014c. Prices and volume of charcoal sold in selected public markets. Market Updates. October 2011.

The production of charcoal using mangroves and trees in forest lands has dire environmental consequences. The destruction of the Bicol National Park is believed to have been due to the cutting of trees for charcoal production. This is another opportunity to substitute bamboo for wood for the livelihood of rural families. Bamboo has the advantage over trees in that only culms are harvested and not the entire clump and therefore does not require replanting unlike trees once harvested must be replaced by planting.

- Charcoal briquettes

A briquette (or briquet) is a compressed block of combustible biomass material such as charcoal, sawdust, wood chips, peat, or paper used for fuel and kindling to start a fire. The term comes from the French language and is related to *brick* (<https://en.wikipedia.org/wiki/Briquette>). The industrial use of biomass briquettes is as boiler fuel replacing coal or furnace oil. In India several companies have switched from fossil fuel to biomass briquettes to heat their boilers for power generation and in running their machineries (<https://en.wikipedia.org/wiki/Briquette>). It is claimed that the use of briquettes can reduce fuel cost by 30-40 per cent. Briquettes have the advantage of less smoke and easier handling and transport.

Briquettes can be made from almost all biomass in raw form. A type of briquette that is popular locally is charcoal briquette. The biomass material is first converted into charcoal, crushed, mixed with a binder and formed into briquettes. The advantage of charcoal briquettes from briquettes made of biomass in raw form is that it emits less smoke and for the same weight has higher heating value. Charcoal briquettes are used mostly in homes and for outside cooking such as barbecuing. Charcoal briquettes can likewise be a substitute to fossil fuel in heating industrial boilers for electricity generation and for steam to drive industrial machineries. The heating value of charcoal briquettes from various raw materials is shown in Table 3.10.

Table 3.10 Heating value of charcoal briquettes of various biomass

Materials	mJ/kg	Cal/gm
Coco shell	30.48	7,280
Sawdust	29.84	7,127
Coco husk	27.69	6,614
Pili shell	26.93	6,432
Sawdust & rice hull (50-50)	18.65	4,454
Coffee bean hull	19.71	4,708
Rice hull	12.71	3,036
Bamboo		4,445 ¹

Source: Bisana, B. B. and D. Pulmano. 2015. Investment Profile No. 1 FPRDI

¹ PCAARRD. 2008. Bamboo charcoal briquette technology.

Bamboo Information Network.

<http://www.pcaarrd.dost.gov.ph/home/momentum/bamboo/index.php?option=com>

content&view=article&id=822:bamboo-charcoal-briquette-technology&catid=116:

technology-for-dissemination&Itemid=8

A comparison was conducted at the FPRDI among various biomass materials converted into briquettes and other types of fuel such as wood charcoal, liquified petroleum gas (LPG) and kerosene (Pulmano, 2011). The cost of boiling one liter of water using charcoal briquettes ranged from Php 0.20 (coco shell and saw dust) to Php 0.31 (combination of sawdust and rice hull). Kerosene showed the highest cost of boiling one liter of water at Php 0.50 followed by LPG (Php 0.40) and wood charcoal (Php 0.34) (Table 3.11). Of course using briquettes for cooking entails some inconveniences such as a bit of smoke and soot compared to smokeless and sootless LPG.

Table 3.11 - Cost of boiling one liter of water

Type of briquettes	Cost (Php)
Coco shell	0.20
Sawdust	0.20
Coco husk	0.21
Pili shell	0.22
Sawdust and rice hull	0.31
Coffee bean hull	0.30
Other fuels	
Wood charcoal	0.34
LPG	0.40
Kerosene	0.50

Source: Pulmano, D. B. 2011. Cost of boiling 1 liter of water. Market Update FPRDI. October 2011. Issue No. 1.

Charcoal briquettes have found a niche in the home-fuel market in the Philippines. It can be found in small grocery stores and in large supermarkets. At a Supermarket in Makati City a pack of 2 kg costs Php 81.00 while a box of imported charcoal briquettes containing 16 pieces weighing 300 gm costs Php 54.75 which is 4.5 times higher than the price of locally produced briquettes. In Divisoria the Ethan Trading Corporation sells a kilo of charcoal briquettes at Php 21. It is able to sell 20 sacks of briquettes a month (1 sack weighs 15 kg) (Pulmano,2011). The stable markets of charcoal briquettes are Korean and Japanese restaurants. According to Mr. Juanito Kaw, the owner and manager of the Ethan Trading Corporation, Korean, Japanese restaurants and supermarkets are his major buyers of charcoal briquettes (FPRDI, 2012). He sells about 300 kg of briquettes per month.

Philippine made charcoal briquettes have also found markets abroad. EFAB, a company in Tagum City owned by Efren Abracia produces charcoal briquettes and *shisha* (a large charcoal briquette block used to pre-heat machines in Korea) at an average rate of 5 tons per month (FPRDI, 2012). Exporters buy Abracia's briquettes and export them to Korea, Japan and Australia. The briquettes which are made of carbonized rice hull with banana flour as binder have passed the quality requirements of these countries. Abracia also supplies stores in Davao City with at least 150 kg a week at Php 10 per kg.

Another producer of charcoal briquettes is Mr. Ken Arboleda. His markets include Korean restaurants and also hotels. His plant is in Baesa, Quezon City. He is exporting to Japan where his product is used to heat rooms in winter. He sells his briquettes at Php 25 per kg. His business is brisk and he has to turn down orders from new customers to be able to meet his commitments to regular customers (FPRDI, 2012).

- Bamboo charcoal briquettes

Like the other lump charcoal, bamboo lump charcoal can be converted into charcoal briquettes. Studies at the Mariano Marcos State University (MMSU) in Batac, Ilocos Norte showed that the characteristics of bamboo charcoal briquettes are comparable to commercial products in other Asian countries. The briquettes produced had an average density of 0.46g/cc, 8-11% ash content and a heating value of 7,995 BTU/lb (4,444.64 cal/gm)(PCAARRD, 2008). This value however, is lower than the reported heating value of lump bamboo charcoal which is 4,628 cal/gm (Jenkins, 1993).

The heating value of bamboo charcoal briquettes is about the same as the combination of sawdust and rice hull (4,454 cal/gm) but higher than that of rice hull (3,036 cal/gm) as shown in Table 3.10). It was also found by the study that one ton of bamboo wastes can produce 264 kg of charcoal briquettes or a conversion rate of about 26 per cent. Bamboo can be manufactured into briquettes using the

wastes generated by processing factories such as the micro-enterprises like those producing “bahay kubo”, chicken coops, tepees, handicrafts like baskets and furniture like tables, sala sets, chairs, benches and the like. A ton of bamboo wastes can generate an income of Php 5,200 (FPRDI, 2015).

Bamboo charcoaling and briquetting can be a viable livelihood in bamboo rich localities where bamboo tops and branches can be converted to briquettes and can also provide additional income to bamboo processors, large and micro alike.

The production of bamboo charcoal briquettes would entail investing in the following equipment (Table 3.12):

Table 3.12 - Equipment in the production of charcoal briquettes

Equipment	Cost per unit (Php)	Recommended equipment per daily production rate		
		120 kg/day	240 kg/day	2 tons/day
Charcoaling drum kiln	3,500	3 units	6 units	
Carbonizer for sawdusts and shavings	30,000	1 unit	1 unit	
Crusher	35,000	1 unit	1 unit	1 unit
Manual fines-binder mixer	30,000	1 unit	1 unit	
Mechanized fines-binder mixer	400,000			1 unit
Manual briquettor	30,000	1 unit	2 units	
Mechanized briquettor, tube type	300,000			1 unit
Dryer, small scale	150,000	Optional	1 unit	
Dryer, large scale	480,000			1 unit
Accessories: weighing scale, stove, cooking vessel, containers for charcoal fines, screen/sieve	10,000			

Source: FPRDI, 2015

For a micro-scale enterprise in a bamboo rich locality or in a bamboo processing mill the equipment to select would be for the production of about 120 kg/day of briquettes. The equipment needed would be: 3 units of charcoaling drum kilns, 1 carbonizer, 1 crusher, manual mixer, manual briquettor and the accessories. This would require an investment of Php 145,500 (FPRDI, 2015). For a start-up business, drying can be done by air drying or exposing the newly produced briquettes under the sun or under a roof. As the business develops the manufacturing capacity can be expanded by adding the needed pieces of equipment.

Bamboo charcoal and briquettes as replacement for wood charcoal and briquettes - In 2004 the recorded number of households that switched from the use of LPG to fuelwood and charcoal was 7 million or 43 per cent of all Filipino households (Remedios, undated). The main reasons for the switch were higher cost, unavailability and inaccessibility of LPG. About the same proportion of households who previously used electricity as their primary cooking fuel switched to LPG, kerosene and fuelwood instead. The main reasons for switching were increased price of their previous primary cooking fuel, change in family income, availability of new cooking fuel, convenience, among others. It is interesting to note that fuel switching was from a more superior fuel to an inferior fuel.

The DENR projected that there would be fuelwood deficits from 16.6 to 18.7 million cubic meters for 2000, and from 14.9 to 20 million cubic meters for 2015 (Remedios, undated). It is possible that the deficit may have increased due mainly from increase in population and in the number of families that could not afford the more expensive fuels. Unfortunately the DENR projection did not disaggregate the use of the fuelwood, i.e home cooking, industrial and commercial uses as in restaurants or bakeries. However, it can provide the basis for estimating the amount of bamboo charcoal and briquettes that can substitute for wood.

If we take the average of the estimated deficit for 2015 this would be around 17.45 million cubic meters of wood. Assuming a density of 0.5 kg/cum at 10% moisture content the weight of the 17.45

million cubic meters would be 8.725 million kilograms. If bamboo lump charcoal were to replace 30% of the 8.725 million kg of wood this would be 2.6175 million kg. At a conversion rate of 30% wood to charcoal the 2.6175 million kg of wood would produce 0.78525 million kg of lump wood charcoal.

The percentage yield in charcoaling of *kawayan tinik* is 44.5 per cent (Bisana et al, 2007). The weight of 1 culm of *kawayan tinik* at around 10% MC is about 25 kg. The number of culms needed to produce 0.78525 million kg of bamboo charcoal would be 70,584 culms. Bamboo wastes in processing plants and bamboo tops from harvested culms and even branches can be converted to charcoal.

Food products sector



The many and varied uses of bamboo includes shoots for food. Bamboo shoots are a delicacy in all of the Asian countries and the taste has captured the palate of people in western countries such as the US where there are Asian restaurants especially Chinese restaurants where bamboo shoots are served as part of the recipes. Canned bamboo shoots are regular export item of some Asian countries particularly Taiwan and China (Choudbury, 2012).

On the local scene, bamboo shoots are sold mostly in the local markets in fresh form but sometimes these are offered as chopped or pre-cooked. Bamboo shoots suffer as food source from the fact that it is seasonal and that sources of bamboo shoots come mostly from natural stands in public or private lands. There are no known plantations devoted mainly for the production of shoots for food.

A survey was conducted on bamboo shoot resources in the country (Caasi-Lit et al, 2010). The survey was undertaken in 26 provinces. The survey included the species that are the priority shoots eaten in the different provinces. The following table (Table 3.13) is based on the results of the survey conducted by Caasi-Lit et al (2010). It shows the species predominantly used as food.

There are 5 species used as food but *kawayan tinik* is the predominant species. It is consumed in 16 of the 26 provinces/cities surveyed. The other predominant species are *Kawayan kiling*, *Bayog*, *Giant bamboo* and *bolo*. The obvious reason for the predominance of a species as food is the presence of sources of the shoots. *Kawayan tinik* is predominant in the entire country is because it is widely distributed throughout the archipelago. In Nueva Ecija the predominant species is *bayog* because there are plenty of sources (Caasi-Lit et al 2010). And in Davao del Norte and Compostela Valley *laak* is the preferred species because there are several plantations of this species raised for banana props, the major crop of the two provinces.

Table 3.13 Species used as food in the surveyed provinces

Provinces	Municipalities	Local Names	Predominant species used for food
Pangasinan	Alaminos, Bani, Mangatarem, Urdaneta	Rabong	<i>Bambusa blumeana</i>
Nueva Ecija	Cabanatuan	Dabong	<i>B. blumeana</i> , <i>B. vulgaris</i> , <i>B. merrilliana</i>
Nueva Vizcaya	Bambang	Dabong	<i>B. blumeana</i> , <i>B. vulgaris</i> , <i>B. merrilliana</i>
Isabela	Ilagan	Dabong	<i>B. merrilliana</i>
Pampanga	Magalang	Rabong	<i>B. blumeana</i>
Tarlac	Camiling, Tarlac City	Rabong	<i>B. blumeana</i> , <i>B. merrilliana</i>
Bulacan	Pulilan	Labong	<i>B. blumeana</i> , <i>B. vulgaris</i> , <i>B. merrilliana</i>
Laguna	Los Banos, Sta Cruz, Majayjay, Binan	Labong	<i>B. blumeana</i>
Quezon	Sariaya, Tayabas, Gumaca	Labong	<i>B. blumeana</i> , <i>Gigantochloa levis</i>
Manila	Quiapo	Labong	<i>B. blumeana</i> , <i>B. merrilliana</i>
Camarines Norte	Daet, Labo	Lambo, Labong	<i>B. vulgaris</i>
Camarines Sur	Naga, Sipocot, Bula, Rinconanda District	Lambo, Lambong, Puwag	<i>B. vulgaris</i>
Negros Oriental	Dumaguete	Dabong	<i>B. blumeana</i>
Cebu	Cebu City	Dabong	<i>B. blumeana</i> , <i>B. merrilliana</i>
Leyte	Baybay, Ormoc City	Dabong	<i>B. blumeana</i> , <i>B. vulgaris</i> , <i>B. merrilliana</i>
Bukidnon	Malaybalay	Dabong	<i>B. blumeana</i> , <i>B. vulgaris</i> , <i>B. merrilliana</i>
Misamis Oriental	Cagayan de Oro	Dabong	<i>G. levis</i>
Davao del Norte	Tagum, Mawab, Panabo	Dabong	<i>B. philippinensis</i>
Compostela Valley	Nabunturan	Dabong	<i>B. philippinensis</i>
Davao del Sur	Calinan DC, Sta. Cruz	Dabong	<i>B. blumeana</i>
South Cotabato	Lake Sebu	Dabong	<i>Dendrocalamus asper</i>
Agusan del Norte	Butuan City	Dabong	<i>B. blumeana</i>
Agusan del Sur	Bayugan	Dabong	<i>D. asper</i>
Surigao del Sur	Tandag	Dabong	<i>G. levis</i> , <i>B. merrilliana</i>
Davao Oriental	(Mandaya Tribe)	Dabong	<i>D. asper</i>
Ifugao	Lagawe, Banaue	Hubwal, Harepeng	<i>B. merrilliana</i> , <i>D. asper</i>

Source: Caasi-Lit, et al. 2010. Bamboo shoot resources of the Philippines: Edible bamboo and current status of the local bamboo shoot industry. Philippine Journal of Crop Science. August 2010. 35(2) 54-68.

The bamboo shoot industry in the Philippines may be considered to be still in its nascent stage when compared with other countries despite the centuries bamboo shoots have been part of the food items of Filipinos. The reason for this is that bamboo shoots are merely gathered from existing natural stands and no plantation has been established and dedicated solely for the production of bamboo shoots. The average production of bamboo shoots from 2002 to 2007 is shown in Table 3.14 below:

Table 3.14- Average bamboo shoot production from 2002 to 2007

Region of production	Area harvested (ha)	Volume of production (mt)
Philippines	7,722	2,935
CAR	2	2
Ilocos Region	1,967	486
Cagayan Valley	52	26
Central Luzon	88	24
CALABARZON	31	27
MIMAROPA	15	18
Bicol Region	9	9
Western Visayas	2,449	798
Central Visayas	1,014	116
Eastern Visayas	97	21
Zamboanga Peninsula	382	1,076
Northern Mindanao	290	48
Davao Region	1,029	51
SOCCSKSARGEN	136	50
ARMM	3	5
CARAGA	162	180
Total	15,448	5,871

Source: Bureau of Agricultural Statistics, 2007, cited in Caasi-Lit et al. 2010.

China earns about US \$130 million annually from the export of bamboo shoots with the US importing about 44,000 tons or 14.5% of the total world imports. Australia imports yearly around 8,000 tons. Taiwan consumes around 80,000 tons of bamboo shoots annually valued at US \$50 million. In Japan the annual per capita consumption is about 3 kg compared to 1.2 kg per person in the 1950s. Thailand has devoted 30,000 ha for bamboo shoot production producing around 380,000 tons a year (<http://www.organicfacts.net/health-benefits/other/health-benefits-of-bamboo-shoots.html>).

The main reason for the popularity of bamboo shoots in Asia and most parts of the world is its health benefits. Table 3.15 shows the nutritional value of bamboo shoots (Choudbury, 2012). Bamboo shoots are touted to aid in weight loss, reduce risk of cancer, strengthen the immune system, help improve cardio-vascular health, provide relief from stomach aches, and effective against respiratory diseases. It also helps control cholesterol levels. The other claimed medicinal properties of bamboo shoots include: aid in digestion; keep blood pressure at normal levels; anti-bacterial, anti-fungal, anti-oxidants (flavones, phenols, steroids), anti-viral; aid in cell activation; curative for respiratory diseases, wounds, infections, ulcers, diarrhea, measles; and have no harmful effects (e.g. diabetes, heart problems, cancer).

Table 3.15 - Health benefits of bamboo shoots

Nutrients	Amount (%)
Dietary fiber	9
Carbohydrates	2
Protein	5
Calories	1
Minerals	
Potassium	15
Manganese	13
Copper	9
Zinc	7
Vitamins	
B6	12
C	7
E	6
Thiamin	10

Source: Choudbury,D; Sahu J; Sharma, GD. "Bamboo Shoot: Microbiology, Biochemistry and Technology of fermentation-a review". Indian Journal of Traditional Knowledge Vol.11 (2) April 2012 . P. 243 as cited by Punzalan, D. 2015. Traditional bamboo shoot food products, "That Thing Called Kawayan" DOST-FPRDI Technology Forum on Bamboo, NSTW, July 28.2015. SMX Convention Center

One advocate which is actively promoting the consumption of bamboo shoots is Filbamboo Exponents, Inc. It has already developed what it describes as "innovative, unique, healthy and delicious food/beverages/health supplements made from bamboo shoots which have won several awards. Filbamboo Exponents Inc. has partnered with communities in making non-food/packaging products using bamboo combined with leather and indigenous materials (Punzalan, 2015).

To industrialize the production of bamboo shoots, plantations have to be developed dedicated solely for shoot production with minimal culm production on the side. Thailand's annual shoot production of 380,000 tons comes from 30,000 ha of plantation or an average production of 12.67 tons per ha/yr (<http://www.organicfacts.net/health-benefits/other/health-benefits-of-bamboo-shoots.html>). These are fully developed plantations and newly established ones would have lower yields. Furthermore, the average yield would also be a function of the species used in the shoot production. In addition to being used for food the shoots could also be the base for chemical and nutraceutical industry.

It was estimated that a small canning factory would need about 180 tons of bamboo shoots a year (<http://www.ediindia.org/FP%20Profile/02%20Plantation%20&%20Spice%20Products/04%20Canned%20Bamboo%20Shoots.pdf>). Using the average production of shoots per year in Thailand which is 12.67 tons/ha, the area needed to produce 180 tons would be 14.2 ha. The reported average annual production of bamboo shoots in the country is more than 5,000 tons (Table 3.14) enough to support more than 25 small canning factories. However, the bamboo shoots are dispersed and would be expensive to consolidate to supply raw materials for the canning factories. Furthermore, the production would be unpredictable.

The country can start with a modest 50 ha to provide raw materials for a modest canning factory as well as raw materials for chemical and nutraceutical laboratories.

Potential Future Sectors of the Bamboo Industry

Pulp and paper production from bamboo

Bamboo is the main raw material for pulp and paper production in India and many other countries. One big paper company, Kimberly Clark, is planning to use bamboo as raw material (Manda, 2015). Bamboo has long fibers, longer than most hardwoods, and has also the advantage that there is no need to replant because only culms are harvested from a clump, unlike wood plantations that need replanting once the plantation is harvested.

Table 3.16 - Fiber dimension of some Philippines bamboos

Species	Fiber length, mm	Fiber width, mm	Cell wall thickness, mm
Bamboo			
Kawayan tinik	1.95	0.018	0.007
Giant bamboo	3.78	0.019	0.007
Bulo	1.80	0.027	0.006
Kawayan killing	2.33	0.017	0.004
Bayog	2.16	0.014	0.004
Buho	2.42	0.014	0.006
ITP wood species			
Falcata	1.068	0.036	0.0034
Mangium	1.019	0.024	0.003
Gmelina	1.161	0.033	0.004

Source: Tamolang, F. N. et al. 1957. Fiber dimension of certain Philippine broadleaved woods and bamboos ascited in FPRDI Monograph on Production and Utilization of Philippine bamboos, February 2007.

Bamboo is very suitable for the production of pulp and paper because of its long fibers. The length of fibers, fiber width and cell wall thickness of some bamboo species are shown in Table 3.16 (Tamolang et al, 1957). *Giant bamboo* has the longest fibers with an average of 3.78 mm followed by *buho* and *kawayan killing* and *bayog*. The fibers of *kawayan tinik* is only 1.95 mm. *Falcata* [*Paraserianthes falcataria*(L) Nielsen] which was the raw material of the defunct Paper Industries Corporation of the Philippines (PICOP) has a fiber length of only 1.068 mm (Alipon et al, 2015).



Kawayan killing (*Bambusa vulgaris* Schrad. Ex Wendl.), left and *Giant Bamboo* [*Dendrocalamus asper* f. (Schultes f.) Backer ex Heyne], right, are suitable for pulp and paper production.

There are a number of values on the weight of newly harvested kawayan tinik. One value ranges from 60 to 80 kg, another from 40 to 50 kg²⁰ and 25.8 kg²¹. The last one however, refers to the dry weight of the culm while the first two are fresh weight of the culm. The lower the weight of culms from which

²⁰ Virtucio, F. 2015. Personal communication. His personal experience

²¹ FAO/INBAR 2005. Forest Resources Assessment

the fibers are obtained the more raw materials are needed for pulp production. On the basis of 25.8 kg dry weight the amount of raw materials needed to provide fibers for the production of 100 tons of writing paper is estimated, thus:

The fiber content of dry bamboo is about 30%. The 25.8 kg dry bamboo would yield 7.74 kg of pulp. To produce writing paper the pulp undergoes bleaching and bleaching would reduce the pulp by 10%. After bleaching the remaining pulp would weigh 6.966 kg. To produce 100 tons of writing paper per day it would require 100,000 kg divided by 6.966 kg pulp per culm or 14,355.44 culms a day. On the basis of 300 working days a year, the annual requirement would be 4,306,632 culms. A hectare of mature bamboo plantation would yield about 1,000 culms a year. The area of plantation needed to provide the raw material requirements of a 100 ton paper mill would be 4,307 ha of bamboo plantation.

The national consumption of paper in 2011 was estimated to be 1.643 million tons (Table 3.17). The estimated production was 0.95 million tons and the import was 0.823 million tons with an export of 0.130 million tons. A pulp and paper mill with a daily production of 100 tons would produce about 30,000 tons of paper a year. To reduce the importation of 0.823 million tons, the country should be producing that much paper a year. It would take 27.43 pulp and paper mills of 100 tons daily capacity to produce an amount of paper equivalent to our importation. Assuming that only 30 per cent of the imported paper is made from bamboo raw materials there would be a need for 8 mills with a daily production of 100 tons of papers. The total annual culm requirement for the 8 mills would be 34,452,896. At 1,000 culm production per hectare per year, the total area of plantation needed to supply the requirements of the eight 100 ton capacity mills would be 34,453 ha.

Table 3.17 - Paper Industry in the Philippines: Current state and background

	2001	2010	2011 Estimate	Historical trend % p.a.
Number of paper mills	43	27	24	
Industry capacity, '000 tons	1,580	1,297	1,100	-3%
Production	1,056	1,038	950	-1%
Imports	533	961	823	+5.4%
Exports	139	165	130	-2.8%
Consumption	1,450	1,834	1,643	+2.2%
Paper and board per capita consumption	16	20	19	+2%

Source: Proposed Roadmap for the Pulp and Paper Industry

Bamboo chips as fuel

The Philippines has the 2nd highest electricity rates in Asia and the 4th highest in the world. The high cost of electricity is partly attributed to high costs related to importing fossil fuels (Energy Situationer Department of Energy, www.doe.gov.ph)

Of the 277 countries surveyed the Philippines ranked 41 in the amount of electricity consumed. China had the highest registered consumption of 4.69 trillion kWh in 2011 (Table 3.18) followed by the United States with a consumption of 3.89 trillion kWh ([http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption\[assessed](http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption[assessed) 2001-2012]²². The electricity consumption of the Philippines in 2010 was reported as 56.84 billion kWh. The reported electricity consumption by the Department of Energy (Energy Situationer Department of Energy, www.doe.gov.ph) rose by 9.4 per cent in 2010. In terms of energy sales, the country posted an increase of 8.6 per cent from 50,868 GWh in 2009 to 55,266 GWh (55.266 trillion kWh) in 2010 which is slightly different from the reported

²²Countries compared by energy >electricity> consumption. International Statistics at NationMaster.com, CIA World Factbooks 18 December 2003 to 28 March 2011. Aggregates compiled by NationMaster, [http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption\[assessed](http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption[assessed) 2001-2012]

consumption in Table 3.18. This was primarily attributed to the increased demand for cooling appliances due to the intense summer heat. This also brought the Luzon grid to an all-time high temperature of 38 degrees centigrade in 2010. Correspondingly, peak demand in Luzon shoot up to 7,656 MW which was 10.5 percent higher than the peak in 2009. The highest increase was noted in the commercial sector at 10.2 percent driven by the expansion of commercial establishments and services sector. On a per grid basis, Visayas recorded the highest growth due to the recovery from the previous year's suppressed demand.

The total electricity generation of the country in 2010 was 76,742 GWh which was 9.4 per cent increase from the 61,922 GWh in 2009.

The Philippines has been dependent on fossil fuel for its source of energy. This is exemplified by the coal powered generating plants accounting for 41.4 per cent of power generation and oil-based power plants accounting for 32.0 per cent. Natural gas-fired power plants provided 29 per cent of the total power generated in 2010. In the attempt to reduce dependency of fossil fuels for energy generation and to contribute to reducing the countries carbon footprints the Philippines enacted RA No. 9513 in 2008 (RA 9513, 2008). It is the purpose of the law to accelerate the development and use of the nation's vast renewable energy resources through fiscal and non-fiscal incentives. It also assures investors in wind, solar, ocean, run-of-river hydro power and biomass a secure market in electricity generated from these clean sources through feed-in tariffs. In addition several other incentives provided include duty-free importation of equipment, tax credit on domestic capital equipment and services, special realty tax rates, income tax holidays, net operating loss carry-over, accelerated depreciation and exemption from the universal charge and wheeling charges.



Pellets from bamboo sawdust produced using the FPRDI pelletizing machine.

As far as the bamboo industry sector is concerned the point of interest is in the use of biomass as fuel for the generation of electricity. Bamboo as fuel for electricity generation could be in the form of chips or as pellets. Some companies are using rice hull as fuel to run boilers to generate steam to run power generators to produce electricity and to run machineries in the factories. Rice hull is getting expensive and it is seasonal in most part of the country. Bamboo chips could be a good substitute. The world's first power generating plant using bamboo as fuel feed for boiler is the Fujisaka Electric Co. in Yamaguchi Prefecture in Western Japan²³. The power plant has a capacity of 15.8 MW and is supplying power to 4,860 households. The investment cost was US\$ 19.5M.

²³ Natividad, R. 2015. Personal communication, October 2, 2015.

Table 3.18 - Energy consumption among countries

Rank	Countries	Consumption, kWh	Year
1	China	4.69 trillion	2011
2	United States	3.89 trillion	2010
3	European Union	2.86 trillion	2007
4	Russia	1.04 trillion	2012
5	Japan	859.7 billion	2012
23	Thailand	169.4 billion	2012
24	Indonesia	158 billion	2011
29	Malaysia	112 billion	2012
32	Vietnam	104 billion	2012
41	Philippines	56.84 billion	2010
52	Singapore	40.62 billion	2010
106	Burma	6.06 billion	2010
227	Northern Marianas Island	48,300 kWh	2009

Source: Countries compared by energy >electricity> consumption. International Statistics at NationMaster.com, CIA World Factbooks 18 December 2003 to 28 March 2011. Aggregates compiled by NationMaster, [http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption\[assessed 2001-2012\]](http://www.nationmaster.com/country-info/stats/Energy/Electricity/Consumption[assessed%202001-2012])

There have been several studies conducted on the suitability of bamboo as energy source. Among these is the study by Engler et al (2013) which concluded that *Bambusa emeiensis* L.C. Chia & H.L. Fung and *Phyllostachys pubescens* Mazel ex H. de Leh, are potentially suitable as a fuel in biomass-fed combustion plants. Except for the high ash content bamboo shares desirable fuel characteristics with other wooden biomass. On the basis of the calorific value, even 1 year old culms are suited for combustion. With respect to its chemical content, low-moisture, ash and low chloride content are preferred. The moisture content of bamboo is in general higher, compared to wood species, but it decreases with maturation time at a given age. The chloride content of the bamboo is higher compared to wood, but is lower than agricultural crops. Bamboo has high potential as fuel in biomass-fed combustion plants (Engler et al, 2013).

The Bataan 20-20 Pulp and Paper Mill (B20-20PPM) located in Samal, Bataan is generating electricity using rice hull as fuel (Parico, 2015)²⁴. Its main source of rice hull is Nueva Ecija and it is paying Php 1.60 per kilo. The moisture content of the fuel should be about 10 per cent. Presently, B20-20PPM is constructing a new boiler with a rated capacity of 12.5 MW of electricity. It intends to connect to the grid to sell excess electricity. It is looking at bamboo chips as fuel and it is estimated that it will need an additional 310 tons of dry fuel for a total of 720 tons of dry fuel per day for all its boilers. This corresponds to 10.271 million culms a year. This certainly is a large potential market for the bamboo industry.

Chemical Products and nanocrystals

Chemical products from bamboo would come from bamboo shoots in the production of “nutraceutical”, from pyroligneous liquid from the carbonization process during the production of charcoal, from the leaves in the production of bamboo beer and energy drinks, and from fibers in the production of viscous rayon and its by-products. Pulp and paper as well as charcoal (activated carbon) are in fact chemical products but these are the subjects of discussion in other sections of the report.

Development of the above-mentioned chemical products would need extensive research before they can be commercialized.

Bamboo has also been found to be a good source of cellulosic nanocrystals as a DOST-PCIEERD funded project showed. Cellulosic nanocrystals were extracted and prepared from *kawayan tinik*. The resulting nanocrystals were incorporated in xylan and thermoplastic starch films, which showed significant

²⁴ Parico, R. 2015. Plant Manager, personal communication. August 3, 2015.



improvement in strength and resistance to vapor transmission at low (1.5-3%) incorporation rates. Trials to incorporate cellulosic nanocrystals from *kawayan tinik* in composites for wrapping fruits with nanocellulose and termiticide as protection from insect infestation while waiting for them to ripen are also underway.²⁵

²⁵Dr. Ramon Razal, personal communication, April 3, 2016

3.1.2 Linkages with other sectors

Existing Linkages

The bamboo industry is not a stand-alone industry. Its survival and success depends upon linkages that are strongly developed with other industries. Figure 3.1 is a diagram of the current linkages that the bamboo industry has with other industries. The industry has linkages with suppliers, processors and the market.

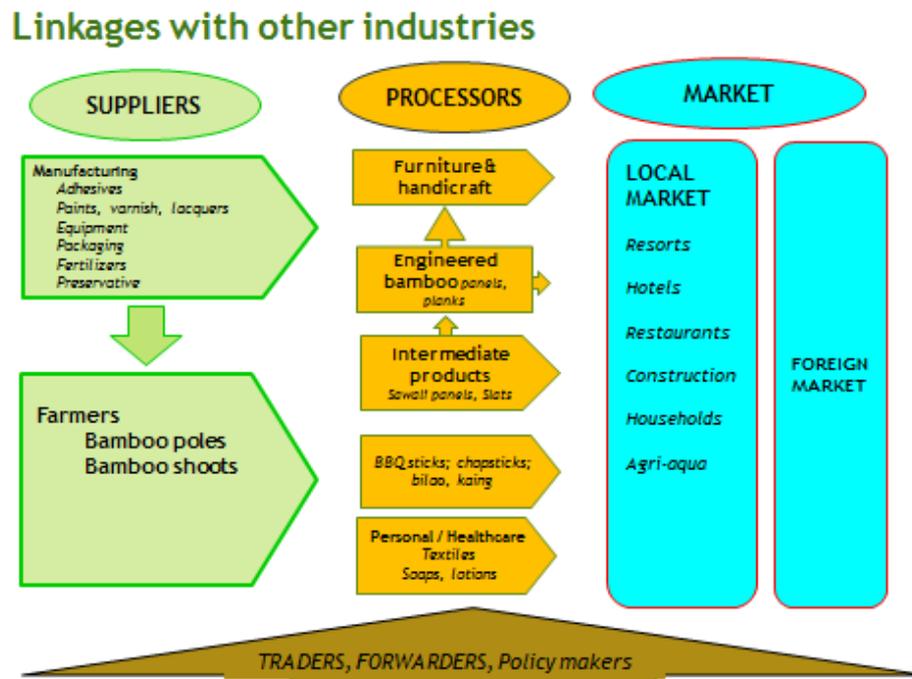


Figure 3.1 - Linkages of the bamboo industry

Suppliers

At the very start bamboo propagators need supplies like rooting hormones and fertilizers. Farmers and plantation owners who manage their farms require fertilizers for their clumps and plantations. The susceptibility of bamboo to deterioration by fungi and insects require that the newly harvested bamboos are subjected to preservative treatment. Such preservatives are sourced from suppliers.

Bamboo culms are supplied to processors by farmers or plantation owners. Often, middlemen source or consolidate the culms from farmers and supply them to processors. Consolidators who do not own conveyors or trucks rent or lease one to be able to deliver the materials to buyers. Farmers who harvest bamboo shoots usually sell these in the local markets.

Processors

Processors include furniture and handicrafts producers, manufacturers of engineered bamboo products, producers of *sawali* and other woven products, producers of shaped items like barbecue sticks, tooth picks, chop sticks and coffee stirrers. Furniture and handicrafts manufacturers source their raw materials directly from farmers/plantation owners or from middlemen. They also need in



some of their products engineered bamboo and if they do not produce these themselves they source these from engineered bamboo manufacturers.

The production of engineered bamboo requires many linkages from suppliers of raw materials, machineries, glue, finishing materials such as varnishes and paints. Raw culms are sourced from farmers or middlemen while semi-processed materials such as slats come from primary processors such as the Nodes in the SSF project of DTI. The production of panel products would sometimes require the use of *sawali* and the engineered bamboo producers must link with *sawali* weavers.

One product that is the source of livelihood of many Filipinos in the rural areas is charcoal. At the moment it is estimated that bamboo is not as widely charcoaled compared to wood but bamboo is gaining acceptance as a material for charcoaling especially with technologies on its production coming from the research sector. Wastes from harvesting such as bamboo tops and branches are produced into charcoal by the farmers themselves or are supplied to charcoal producers.

Markets

The third group of linkage in the continuum of bamboo production is markets. Markets of these products are constituted by local and by foreign markets. The local markets for furniture and handicrafts produced by micro and small manufacturers especially those found in the rural areas are local communities. Local markets of high quality furniture and handicrafts are high class hotels, resorts and restaurants. Some high quality products are sold to local outlets or consigned to retailers who cater to foreigners of high-end local buyers.

The usual markets of furniture and handicrafts of high quality are export markets. Producers of these products are usually members of organizations that have linkages with foreign markets or local government institutions with the mandate of assisting local producers market their products abroad.

Engineered bamboo can be a material for construction, for furniture and handicrafts, manufacture of toys, bicycles and vehicle parts. As a construction material, manufacturers of engineered bamboo must establish linkages with the construction industry, developers, architects and designers, civil engineers. These markets must begin to understand the material, its properties and advantages over other competing materials such as wood before they even consider it for use. It is incumbent to the manufacturers of engineered bamboo to promote their product to the construction industry.

Another very important linkage that the industry must establish, develop and nurture are the policy and decision makers particularly the government, in this case, the DENR. Many operations of the industry are dependent upon the policy of government and often policies of government can change very abruptly. It is always to the advantage of the industry if it opens a link with policy makers. The industry must also establish, develop and nurture champions in the legislature. Often there is a need to legislate changes in the policy of government and it pays to establish these linkages.

The industry likewise would need to work with other National Government Agencies (NGA) especially those that re mandated to provide assistance to the bamboo industry. Premier among the NGAs would be with DTI since it is patently the agency whose primary function is to assist industries. Another is DOST which has a program (SET-UP) and venture financing designed to assist micro-small-medium enterprises access technology. The banks also provide financial assistance to plantation developers and processors, linkage with them would be beneficial.

Often the local government units could also facilitate the growth of the industry through local resolutions or ordinances supportive of the industry. It would pay to work with the local government units by emphasizing the potential of the industry in creating jobs and livelihood for the local people.

Future Linkages

The advent of new technologies and products coming from bamboo necessitates the formation of new linkages among raw material suppliers, primary processors, main processors, markets and facilitators. These new linkages are illustrated in Figure 3.2.

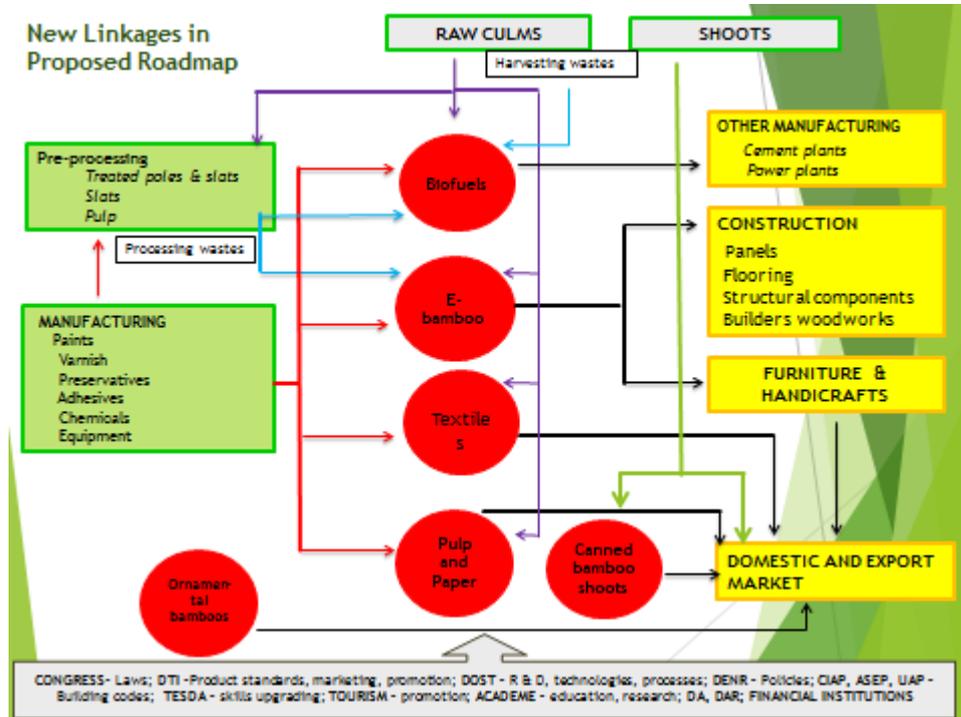


Figure 3.2 - New linkages to be formed by the industry

Among the potential products/uses of bamboo could be as raw materials for bio-fuel, pulp and paper, textiles, canned bamboo shoots, chemical products and nutraceuticals. As bio-fuel, bamboo wastes such as tops and branches and even stumps could be chipped and dried and use as fuel for boilers for the production of steam. The steam is used to run machineries or it could be used to run generators for the generation of electricity. Bataan 20-20, a pulp and paper mill, is contemplating of using bamboo chips should there be enough supply as fuel for its boilers. Should there be sufficient market for bio-fuel there is prospect for the development of plantations dedicated as raw material source for bio-fuel. Linkage here is between producers of chips and operators of boilers for the production of steam. Bamboo chips need also to be trucked to power plants and linkage with truckers and forwarders will have to be established.

Another highly potential product that bamboo is an excellent raw material is in pulp and paper production as well as the production of textiles. Producers of pulp and paper would need large tracts of land and this would generally be available in forest lands. Investors must link with the DENR or with Indigenous Peoples who have obtained titles for their ancestral lands. Linkage must also be formed with suppliers of chemicals for the processing of bamboo into pulp and paper.

Canning of bamboo shoots is a highly potential use of bamboo. Linkages to be formed are with suppliers of machineries, ingredients and bamboo shoots if the operator of the canning enterprise does not its own plantation for bamboo shoots.

The markets for these new products are similar to the markets of the current and traditional products.

Other sectors that require formation of new linkages are with policy makers, stakeholders in the construction industry, technology generators, training and skills service providers and entities approving standards.

3.2 Performance

3.2.1 Global trade in bamboo and bamboo products

It is estimated that the domestic bamboo sector in China is now worth US\$ 19.5 billion annually. It provides employment to 7.75 million people. In India, about 8.6 million people are dependent on bamboo for their livelihood (INBAR, 2015). In 2012, the domestic market for bamboo and rattan products in major producing countries was estimated at US\$ 34.2 billion.

Foreign trade of bamboo and rattan has been increasing steadily. In 2007 the value of exports of bamboo and rattan reached US\$ 2.485 billion. There were exported items that combined bamboo and rattan as raw materials especially in furniture and handicrafts. The share of exported items made entirely of bamboo raw materials in the 2007 export value was US\$ 1.442 billion.

The trend in export value of bamboo and rattan products from 2007 to 2010 is shown in Table 3.19 (INBAR, 2015). There are items in the table that lumped bamboo and rattan in terms of raw materials, furniture seats, and mats and baskets. The export items that are entirely made of bamboo included flooring and plywood, mats and baskets, and charcoal and pulp and paper.

Since the values of export of the bamboo-rattan items were not disaggregated the share of bamboo in the values is not known. The following discussions are focused on the items that are solely made of bamboo. The total export value of the 4 bamboo items was US\$1.142 billion. There was a slight increase in the export value in 2008 when it rose to US\$1.615 billion, an increase in 41 per cent. When the 2008 financial crises set in the export value in 2009 posted a substantial decline, from US\$ 1.615 billion to US\$ 1.117 billion or a decline in about 31 per cent. However, 2010 posted an increased export value of bamboo products. This may have been due to the recovery of the economy world-wide.

Table 3.19 - Global trade of bamboo products (Million US\$)

Item	2007		2008		2009		2010	
	Value	%	Value	%	Value	%	Value	%
Bamboo								
Flooring/ plywood	569	23	589	23	363	20	364	19
Mats/ baskets	532	21	755	29	510	28	438	22
Charcoal/ pulp/paper	119	5	59	2	51	3	36	2
Shoots	222	9	212	8	193	11	222	11
Sub-total	1,142		1,615		1,117		1,060	
Bamboo- rattan								
Raw material	113	4	119	5	98	5	110	6
Furniture seats	644	26	542	21	390	21	557	28
Mats/ baskets	286	12	294	11	218	12	238	12
Sub-total	1,043		955		706		905	
Total	2,485	100	2,570	100	1,823	100	1,965	

Source: www.inbar.int/trade

The 15 major exporters of the bamboo products in the world are shown in Figure 3.3. China topped the list with an export value of US\$ 1.398 billion. Indonesia is a distant second with an export value of US\$ 354 billion followed by Vietnam with an export value of US\$ 116 million. The Philippines was ranked 5th with an export value of US\$ 54 million. With a recorded export value of US\$ 8 million Canada was ranked No. 15.

It should be noted with interest in the list of export products (Table 3.19) that charcoal and bamboo shoots are highly traded products. This opens up opportunities for the Philippines to go into the production of charcoal utilizing harvesting and processing wastes. Bamboo shoot production is also an option for the country with high potential for the benefit of rural areas.

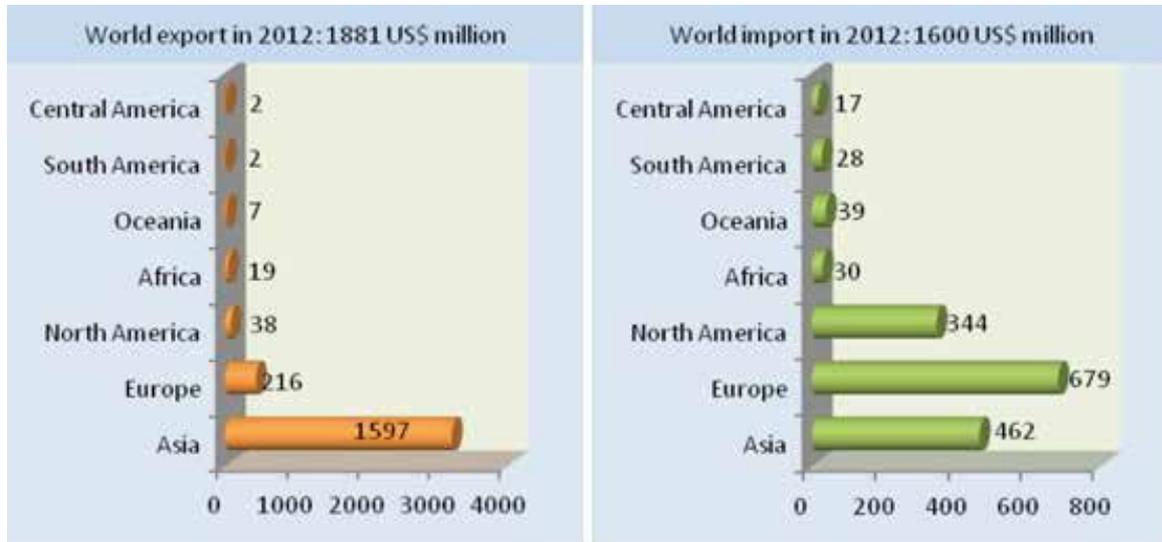


Figure 3.3 - Top exporters and importers of bamboo products in 2014.

Source: INBAR. 2015. www.inbar.int/trade

Figure 3.3 also shows the top 16 importers of bamboo products (INBAR, 2015). The European Union topped the list with an import value of US\$568 million followed by the USA with an import value of US\$ 352 million.

3.2.2 Local trade, exports and imports

Again, there is dearth of data and information on domestic trade of bamboo and bamboo products. Whatever values that can be derived are estimates anchored on a set of assumptions. The value of traded raw bamboo culms can be estimated from the reported number of culms produced as reported by the FMB of the DENR which is 1,427,985 (FMB, 2013). At an average farm gate price of Php 50 per piece, the total value of the bamboo culms would be Php 71,399,250. The value of these culms delivered to intended buyers who are producers of bamboo products the price per piece would have escalated to Php 100 and the value of the reported bamboo production in 2013 would be Php 142,798,500.

However, the FMB report highly under-estimates the actual production of bamboo culms in the country. Judging from the requirements for culms by various sectors, the production of culms in a given year would be closer to 10 million in which case the value of the product at an average price of Php 100 per piece would be around Php 1 billion. In addition to the value of raw culms would be the value of manufactured goods that are sold locally, which is also difficult to estimate.

Exports

The total reported export values of bamboo commodities (furniture/furnishings and housewares) by the Exports Marketing Bureau of DTI from 2010 to 2014 are shown in Table 3.20 (EMB, 2015). Over the five-year period the value of exports increased from US\$2.05 million to US\$ 10.8 million. However, within the period there were large increases and decreases in the export values (Table 3.20 and Figure 3.4). The export value decreased in 2011 followed by a larger decrease in 2012. This corresponded to the decrease in exports of the country in 2011 (Agcaoili, 2015). This may have corresponded to the economic downturn in the importing countries. When the economy started to improve so did the export of bamboo furniture and housewares. In 2013 the value of exports posted a hefty US\$ 6.3 million from a low of US\$ 0.498 million the previous year. This jumped to US\$ 10.8 million in 2014. The percentage change in export values is shown in Table 3.21. Under a healthy economy bamboo exports can capture a significant share of the world market.

Table 3.20 - Philippine bamboo exports, in US dollars

Products	2010		2011		2012		2013		2014	
	Qty	Value	Qty	Value	Qty	Values	Qty	Value	Qty	Value
Furniture/furnishings	702,784	763,631	656,713	1,020,285	90,447	377,817	90,593	6,153,963	227,109	10,306,445
Housewares	450,374	1,290,207	126,163	395,851	32,294	120,065	106,614	143,687	80,812	485,081
Total		2,053,838		1,416,136		497,882		6,297,650		10,791,526

Source: Export Marketing Bureau, DTI, October 6, 2015

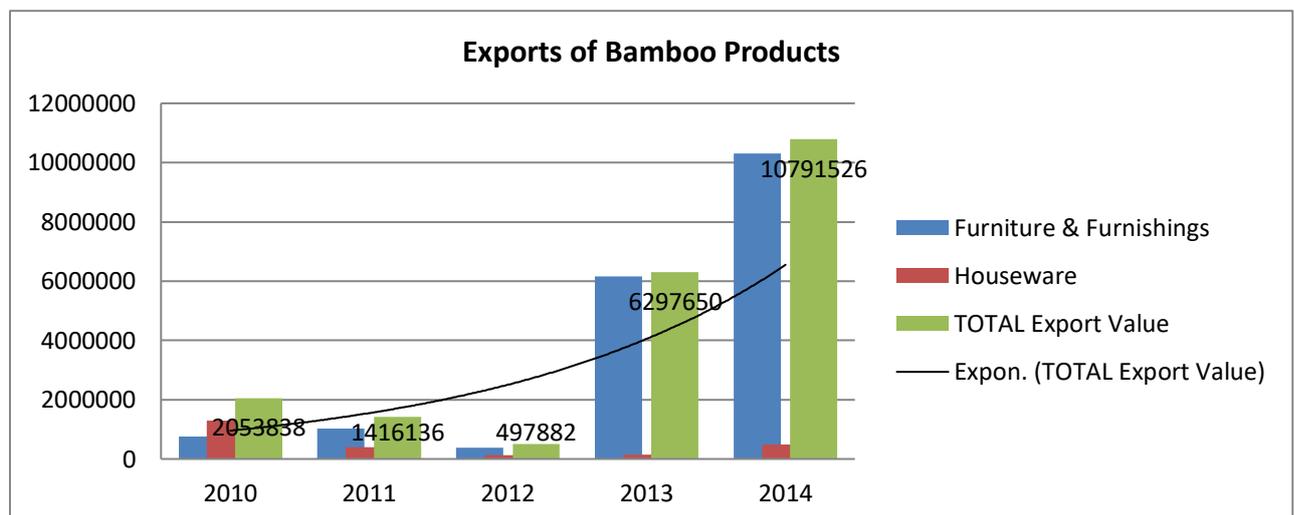


Table 3.21 - Percentage change in value of exports of furniture and handicrafts (value in million US dollars)

Products	2010		2011		2012		2013		2014	
	Value	% change	Value	% change	Value	% change	Value	% change	Value	% change
Furniture/ furnishings	763,631	-	1,020,285	+33.61	377,817	-62.97	6,153,963	+1,528.82	10,306,445	+67.48
Housewares	1,290,207	-	395,851	-69.33	120,065	-69.67	143,687	+19.67	485,081	+237.60
Total	2,053,838	-	1,416,136	-31.05	497,882	-64.84	6,297,650	+1,164.89	10,791,526	+71.36

Source: Export Marketing Bureau, DTI, October 6, 2015

Imports

From 2007 to 2012, the value of imports of bamboo furniture, basketware and poles exhibited an increasing trend, dropping sharply in 2013 (Table 3.22 and Figure 3.5). The largest share to import value was contributed by bamboo poles.

Table 3.22 - Imports of bamboo products, 2007-2013

YEAR	Bedroom, dining room or living room sets of bamboo Plus seats of bamboo		Basketware		Bamboos		TOTAL VALUE
	FOB US\$	QTY (kg)	FOB US\$	QTY (pcs)	FOB US\$	QTY (kg)	FOB US\$
2007	3,799	5,558	0	0	29,284	28,077	33,083
2008	23,984	9,035	3,482	23,133	68,766	101,144	92,750
2009	64,866	89,829	7,488	2,804	96,823	50,331	161,689
2010	15,493	64,016	15,693	38,184	66,309	63,519	81,802
2011	0	0	29,686	96,412	36,779	30,375	36,779
2012	71,165	44,670	124,145	31,396	112,561	75,528	183,726
2013	13,665	5,612	4,818	9,644	17,556	23,760	31,221

Source: Philippine Forestry Statistics, various years

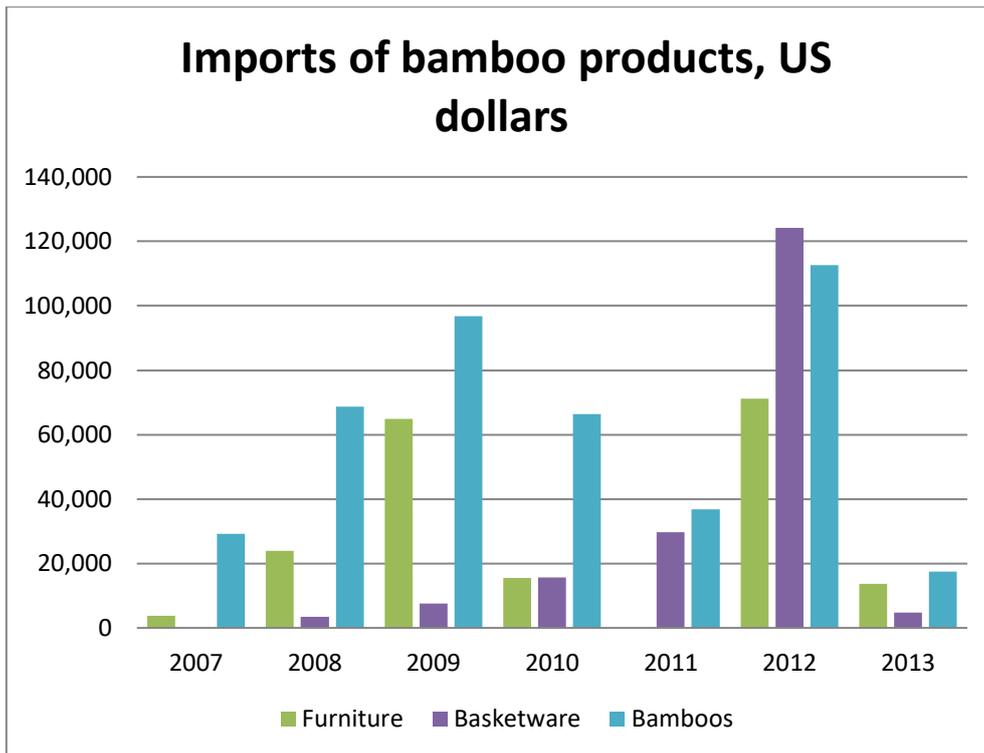


Figure 3.5 Imports of bamboo products. 2007 -

The Philippines is a net exporter of bamboo products. In 2007 net exports of bamboo products reached 6 million US dollars, the highest within the period 2007 to 2013. Net exports fell to 2 million in 2008, after which it registered a series of dips and rises up to 2013 (Table 3.23 and Figure 3.6).

Table 3.23 Philippines' Net Exports of Bamboo Products

YEAR	Net Exports US \$
2007	6,010,727
2008	2,311,654
2009	781,801
2010	1,929,356
2011	953,270
2012	398,878
2013	1,079,048

Source: Philippine Forestry Statistics, cited by

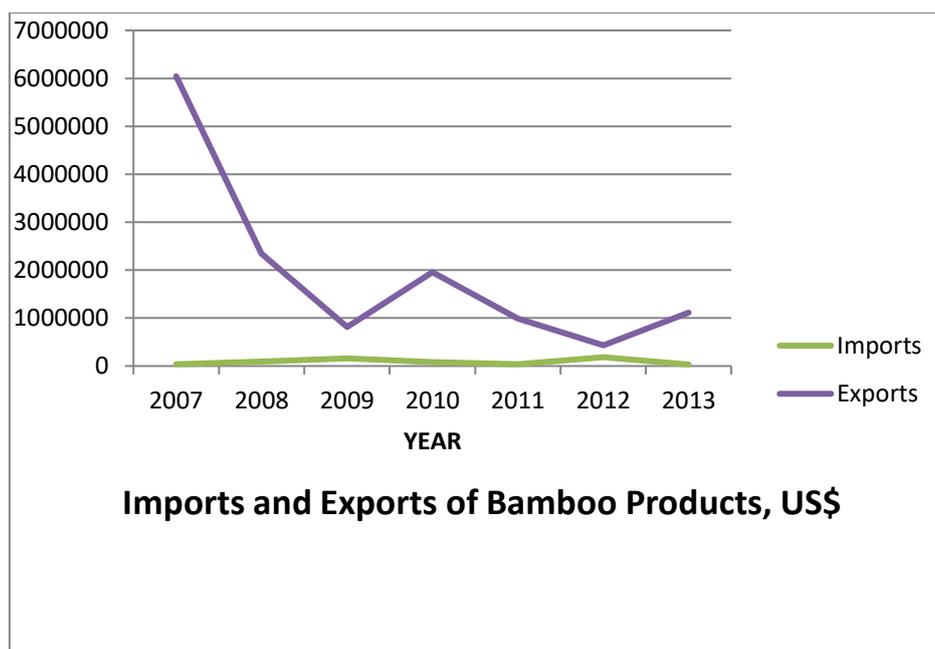


Figure 3.6. Exports and Imports of bamboo products, 2007 -2013
Source of data points: Philippine Forestry Statistics, various years.

3.2.3 Contribution to GDP

The exact contribution of the bamboo industry to the GDP is difficult to estimate because of the lack of reliable data. Most of the activities, from bamboo culm trading to micro scale furniture and handicraft manufacturing belong to the informal or underground economy where transactions largely remain unrecorded. In the Philippine Statistics Authority (PSA) National Accounts, bamboo is integrated with wood, cane and rattan articles. It is a generally accepted assumption that wood takes up the largest share of these four raw materials. Thus, smaller shares are contributed by rattan, cane and bamboo. The contribution of the bamboo industry can thus be inferred relative to the movements of this commodity group.

From 2008 to 2014, manufacturing value added of the wood, rattan, bamboo and cane group was at its highest in 2008 registering at 16 million pesos and at its lowest in 2011, at 12 million pesos (Table 3.24, Figure 3.7). In general manufacturing value added of this group exhibited a decreasing trend from 2008 to 2014 even as total manufacturing value added increased from 2009 to 2014.

Table 3.24 Manufacturing value added in 2000 constant prices, 2008 – 2014, in million pesos.

	2008	2009	2010	2011	2012	2013	2014
Wood, bamboo, cane and rattan articles	16,336	13,984	14,009	12,788	14,316	13,316	13,390
Total Manufacturing Value Added	1,194,921	1,137,534	1,264,525	1,324,332	1,395,714	1,538,912	1,664,231

Philippine Statistics Authority (PSA) National Accounts <http://www.nscb.gov.ph/sna/default.asp>

The percentage contribution of manufacturing to GDP from 2008 to 2014 ranged from 21% to 23%, in general exhibiting a slightly increasing trend. On the other hand, the percentage share of the wood, rattan, bamboo and cane commodity group was consistently less than 0.5% from 2008 to 2014, and exhibited a fairly constant trend within the period (Table 3.25 and Figure 3.8).

Table 3.25 Percentage share of wood, rattan, bamboo and cane to manufacturing.

	2008	2009	2010	2011	2012	2013	2014
% share of wood, bamboo, cane and rattan articles to total manufacturing	0.31	0.26	0.25	0.22	0.23	0.2	0.19
% share of total manufacturing to GDP	22.82	21.47	22.18	22.36	22.13	22.75	23.20

Philippine Statistics Authority (PSA) National Accounts <http://www.nscb.gov.ph/sna/default.asp>

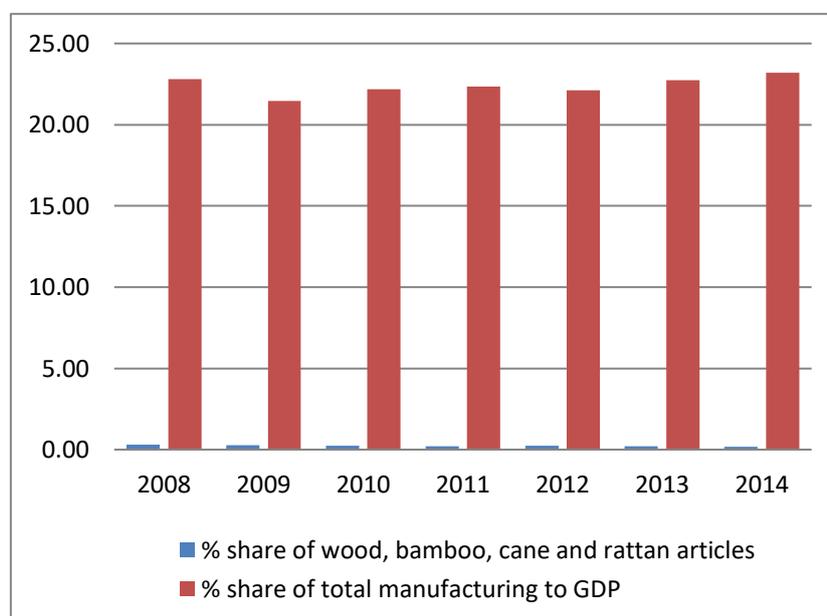


Figure 3.7 - Percentage share of manufacturing to GDP

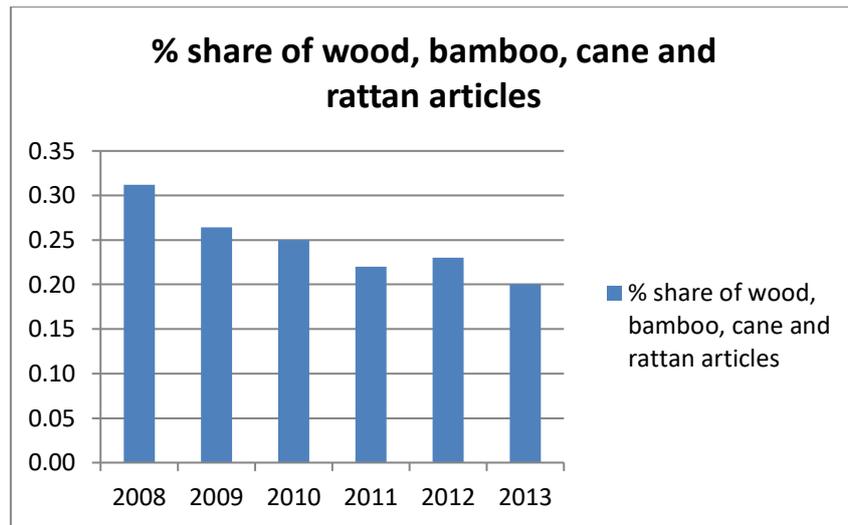


Figure 3.8 Percentage share of wood, bamboo, cane and rattan articles to manufacturing

3.2.4 Employment

The bamboo industry spans many sectors and thousands of workers depend on the industry for their livelihood—bamboo clump owners, gatherers, traders, sawali and basket weavers, and furniture and handicraft producers. Most of them work in small unregistered shops or are engaged in informal market transactions.

A 1979 study estimated the number of workers involved in the various activities of the bamboo value chain at 70,000, including licensees, processors, exporters, manufacturers and workers (Pabuayon and Espanto, 1997). In a recent consultation with representatives of the furniture industry, the estimated numbers of workers in the bamboo industry was estimated to be around 190,000 or 10% of the total workers in the furniture and handicraft sectors.

In Luzon, bamboo craft making is concentrated in Pangasinan, particularly in the towns of San Carlos, Binmaley and Urbiztondo. However, since bamboos can be found all throughout the country, bamboo craft making can also be found in all the provinces. Estimates of the number of workers in some provinces are shown in Table 3.26.

Table 3.26. Labor force estimates in the bamboo industry, selected provinces.

Province	Number
Pangasinan	
Urbiztondo Bamboo Handicrafts Workers Association	80 members ^a , each member has 2-3 workers (our estimate)
Throughout the province	611 weavers ^b
San Carlos (the center of the bamboo industry in Pangasinan)	No estimate; 71 out of 86 barangays are engaged in bamboo craft production;
Bicol Region ^c	
Growers	876
Producers	150
Capiz Brgy Mongoso, Sigma ^d	- 50 households producing bamboo furniture; 2-3 workers each - 1 bamboo furniture middleman
Misamis Occidental ^e Ozamiz Clarín	- 12 bamboo pole and bamboo slats traders - 4 bamboo furniture makers and sawali weavers
12 provinces, 29 municipalities ^f	314 workers
Throughout the Philippines ^g	190,000 workers

^a<http://news.pia.gov.ph/article/view/1941439430615/dole-boosts-bamboo-craft-industry-in-pangasinan-town> (downloaded 12/5/2015)

^b<http://newsinfo.inquirer.net/700352/in-san-carlos-bamboo-brings-life-to-native-craft#ixzz3tV57GZcb> (downloaded 12/5/2015)

^c xa.yimg.com/kq/groups/22102079/.../name/region%205-bamboo.doc, Chapter 15, Region 5: Bamboo Industry Cluster (downloaded 12/5/2015)

^d Personal interviews, June 2015

^e Personal interviews, 2014

^f DOST survey, 2015

^g from consultations with Furniture and Handicraft representatives,

The development of the bamboo industry as envisioned in the roadmap is expected to create new industries, expand existing ones, and generate new jobs across its path. Sources of employment opportunities will come from plantation development, pulp and paper mills, bamboo shoot production and canning, and engineered bamboo production. Plantation development will require a workforce equivalent of 123 mandays per hectare. From 2016 to 2040, the targeted 80,300 hectares will require a workforce equivalent of 9.9 million mandays—additional employment for farm workers. Employment from the processing of bamboo for food, engineered bamboo and chemical products will require from 968 to 1,165 workers (Table 3.27).

Table 3.27 Projected employment from plantation development and new manufacturing

Source	Number of units	Number of direct workers per unit	Total
Plantations	80,300 ha (from 2016 to 2040)	123 mandays per ha	9,876,900 mandays
Pulp and paper mills	8 mills	121- 130	968 - 1040
Engineered bamboo	3 mills	10	30
Bamboo shoots processing	5	13	65
Bamboo charcoal and distillate	10	3	30

These are estimates of direct labor only. Additional employment will be created from activities linked to bamboo processing/manufacturing such as transport and trading, machine fabrication, and semi-processing of bamboo.

3.3 Supply and Demand

3.3.1 Bamboo resources

Bamboo species in the Philippines

It has been cited (Virtucio, 2008) that there are 70 bamboo species growing in the Philippines. Of these, 53 are classified as erect and 17 species as climbing (Lapis et al, undated). Of the erect species Rojo et al, (2000) described only 42 erect species. These species are listed in Appendix 3. On the other hand Escobin et al (2005) described only 16 of the 17 climbing bamboo species. The list of the 16 climbing bamboo species is shown in Appendix 3. There are 21 native bamboo species in the country, and six of these are also native to Indonesia, Malaysia, and Thailand. The 15 remaining species are endemic in the Philippines or only found naturally growing in the country. Of these 15 endemic bamboo species, 10 are climbing and five are erect (Rojo et al., 2000).

Lately there has been an introduction of about 30 bamboo species from China²⁶. This makes a total of about 100 bamboo species now found in the Philippines, excluding the unrecorded ornamental bamboos growing in the country. These introductions from China have been grown mostly in Benguet province and belong to the following genera: (a) *Acidosasa*; (b) *Bambusa*; (c) *Chimona*; (d) *Dendrocalamopsis*; (e) *Indocalamus*; (f) *Neosinocalamus*; (g) *Oligastachyum*; (h) *Phyllostachys*; (i) *Pleiblastus*; (j) *Pseudosasa*; (k) *Sasa*; and (l) *Shibataea*.

A fairly recent development is the description by Dransfield (1998) of a new genus of climbing bamboos in the Philippines, the genus *Cyrtochloa*. It has five species, two of which are new, *C. hersula* S. Dransf. and *C. Puser* S. Dransf. *Puser* is endemic in the Philippines and it is its local name in Abra province. It is also found in Ilocos and other Cordillera provinces. *Puser* exhibits a climbing and scrambling habit after reaching a length of about 5-6 m. It is the main species used for weaving, fencing, furniture, and handicraft. Because of its economic potentials, this wild species is worth cultivating (Lapis, et al, undated).

²⁶ Roxas, C. 2010. Personal communication.



Kawayan tinik (*Bambusa blumeana* J. A. & J. H. Schultes)

Bamboo Resources of the Philippines

One of the biggest constraints in moving forward in the bamboo industry is the limited supply of raw materials. This is the common complaint of manufacturers of various bamboo products. Many furniture manufacturers have difficulty meeting their orders because of insufficient raw materials of the species that they need. Many bamboo operations have closed down for this reason.

During the Bamboo Forum in 2008 held at the Philippine Trade Training Center, Virtucio (2008) presented historical estimates of bamboo resources of the country, which are shown in the Table 3.27 below:

Table 3.27 Estimates of bamboo resources of the Philippines

Year	Estimate	Source
1910	200,000 ha	Gamble, J. S. 1910. Bamboos of Philippine Islands. The Phil. J. Sci. 5:627-681
1978	7,200 ha	Bureau of Forest Development
1981	350 million clumps in government lands	Bureau of Forest Development
1983	4,890 ha in 9 provinces	Virtucio et al
1988	10.73 million lineal meters	RP-German Forest Inventory Project
1997	39,200-52,000 ha	Bamboo Master Plan (DTI)
2008	48,403 ha	Virtucio et al

Source: Virtucio, F. 2008. Presentation during the Bamboo Forum held at the PTTC

- **The Virtucio Report**

The bamboo resources of the country based on the Virtucio (2008) survey are shown in Table 3.28:

Table 3.28 Bamboo resources of the country, Virtucio survey, 2008

Region	Number of clumps ^a	Bamboo stand (ha)
Cordillera Admin Region	4,702,200	23,050
Region 1	357,102	1,750.5
Region 2	934,891	4,582.8
Region 3	166,648	816.9
Region 4A & 4B	105,998	519.6
Region 5	461,489	2,262.2
Region 6	847,396	4,153.9
Region 7	855,392	4,193.1
Region 8	75,990	372.5
Region 9	21,418	104.99
Region 10	299,103	1,466.19
Region 11	958,229	4,697.2
Region 12	127,072	622.9
Caraga Region	65,402	320.6
Total	9,978,330	48,913

^aNumber of clumps per ha is taken as 204 clumps/ha

Source: Virtucio, F. 2008. Presentation during the Bamboo Forum held at the PTTC.

The Virtucio (2008) survey was a consolidation of data provided by the Community Environment and Natural Resources Offices (CENROs) and Provincial Environment and Natural Resources Offices (PENROs) to the Ecosystems Research and Development Bureau (ERDB), all of the Department of Environment and Natural Resources (DENR). The survey determined the number of clumps in a given location and converted the number of clumps to area in hectares. The conversion was done by dividing the number of clumps by 204, this number being the standard number of clumps per hectare for a planting distance of 7m x 7m. The corresponding areas covered by the clumps per region are shown in Table 3.28. The Cordillera Administrative Region (CAR) as shown in Table 3.28 was found to have the highest number of clumps (4,702,200 clumps). However, 2,187,288 clumps are climbing bamboos leaving only a total of 7,791,042 clumps of erect bamboos in the country.

According to the Virtucio (2008) report Region 11 has the highest area of *kawayan tinik*, 932 ha, Region 10 has the highest area of *giant bamboo* while Region 11 also has the highest area of *laak* (3,376 ha). CAR has the largest area of *buho* with 6,000 ha and *bulo* with 118 ha. On the basis of the total number of clumps and 5 culms per clump, there are 49.9 million poles available for utilization. However, the 49.9 million poles include all species planted and not only the highly commercial species. It also includes the climbing bamboos. For erect bamboos only, 38.96 million culms are available for harvest annually.

Virtucio (2008) attempted to disaggregate the areas occupied by the highly commercial species (*kawayan tinik*, *giant bamboo*, *laak*, *bulo* and *buho*) and by regions but there were regions where such disaggregation was not possible and the 5 species were lumped together. Table 3.29 shows the disaggregation by species done by Virtucio (2008). Out of the 48,913 ha (Table 3.29) area covered with bamboo, there were 23,773 ha with the five highly commercial species. On basis of 1,000 poles per ha there are about 23.8 million poles.

Table 3.29 - Regional distribution of commercial species and area

Region	Species	Area (ha)
CAR	Buho	6,000
	K. tinik	892
	Bolo	118
Total		7,010
Region 1	K. tinik	770
	Buho	195
Total		965
Region 2	K. tinik, buho, bayog, killing)	4,566
Total		4,566
Region 3	K. tinik	408
	Buho	218
Total		626
Region 4	K. tinik	141
	Buho	82
	Bulo	28
Total		251
Region 5	K. tinik	907
	K.tinik/buho	20
Total		927
Region 6	K.tinik/Bolo/Kiling	2,496
Total		2,496
Region 7	K.tinik/Bolo	2,496
Total		2,496
Region 8	K. tinik	138
	G. bamboo	42
	Buho	49
Total		229
Region 9	Various species	95
Total		95
Region 10	G. bamboo	1,119
	Laak	140
	K. tinik	120
Total		1,379
Region 11	Laak	3,376
	K. tinik	932
Total		4,308
Region 12	K. tinik/G. bamboo/Laak	601
Total		601
Region 13 (Caraga)	K. tinik/G.bamboo/Buho/Bolo	320
Total		320
GRAND TOTAL		23,773

Source: Virtucio, F. 2008. Presentation during the Bamboo Forum held at the PTTC.

- **The FDC Report**

In 2012 Dolom et al (2012) reported in a Terminal Report of a project conducted by the Forestry Development Center (FDC) of the UPLB College of Forestry and Natural Resources (UPLB CFNR) and funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) on a survey undertaken on bamboo resources of the country. The data of the survey came from reports provided by CENROs and from PENROs.

The data gathered by the FDC researchers came from only the following regions: CAR, 1, 3, 5, 6, 7, 10, 11, 12, and 13. No data were obtained from the rest of the regions. The data from the CENROs and

PENROs came mostly from different tenured areas in the public lands while those from the private lands came from their records of those who requested for Certificates of Verification (CoV) of the bamboos harvested. Private plantation owners are not required to register their plantations. Furthermore, it is highly probable that many owners of bamboo clumps in private lands did not request for CoV and therefore did not enter into the official records.

Table 3.30 shows the summary of the FDC (Dolom et al, 2012) survey of bamboo resources of the country. Accordingly, there were 15,121.82 ha of bamboos in forest lands and 735.41 ha in private lands. *Kawayan tinik* was the most prevalent species and reported in all the responding regions except Region 12. *Giant bamboo* comes next and reported in 6 of the 10 regions. Similarly, *bayog* was reported to be located in 6 regions.

Table 3.30 – Summary of bamboo plantations in the FDC Report

Regions	Species	Area (hectares)	
		Forest lands	Private lands
CAR	Kawayan tinik, Bayog, Giant bamboo, Matchiko, Kawayan killing, bikal, buho, Chinese bamboo, anos	675.78	-
Region 1	Bayog, Kawayan tinik	49	-
Region 3	Bayog, Kawayan tinik, Indian bamboo, Chinese bamboo, Kawayan killing, patong	158.3	-
Region 5	Kawayan tinik	66	-
Region 6	Kawayan tinik, Giant bamboo, Kawayan killing B. luzonensis	8,942.51	-
Region 7	Kawayan tinik, Giant bamboo, bulo, bagakay, Botong, Kawayan killing, Bayog, buho, Chinese bamboo	4,492.08	-
Region 10	Kawayan tinik, Giant bamboo, Yellow bamboo	151	-
Region 11	Kawayan tinik, Botong, Buho, Laak, Bagakay, Yellow bamboo, Bayog	419.71	716.41
Region 12	Giant bamboo, Bayog, Botong, Laak	164.44	-
Region 13 (Caraga)	Kawayan tinik, Bayog, Laak, Giant bamboo, Kayali	3	19.00
Total		15,121.82	735.41
Grand Total		15,857.23	

Source: Dolom et al 2012. Marketing and IEC of Engineered Bamboo Products. Terminal Report. Forestry Development Center, UPLB College of Forestry and Natural Resources

About 95% of the reported bamboo plantation in the FDC (Dolom et al, 2012) report was located in forest lands and the balance of less than 5% was in private lands.

- **The Forest Resources Assessment (FRA) Reports for 2005 and 2010**

The Philippines through the Forest Management Bureau (FMB) of the DENR has been participating in the World Forest Resources Assessment (FRA) project of the FAO. Because of the growing importance of bamboo in construction and in other uses brought about by the decline in wood resources, the International Network for Bamboo and Rattan (INBAR) and the Food and Agriculture Organization (FAO) decided to conduct a Global Bamboo Resources Assessment (Lobovikov, et al, 2007) in 2007. For this FAO/INBAR project, the Philippines submitted the results of the National Forest Resources Assessment (NFA) conducted in 2003 (Table 3.31).

The reported total area of bamboos and other wooded lands (see Table 3.31) in the country in 2003 was 172,000 ha. It is not known how much of this area was occupied by bamboo because the bamboo

was lumped with vegetation in Other Wooded Lands (OWL). The estimate of the volume of bamboo resources was 5.36 million m³ and the average volume per hectare was 31.2 m³. It is also not known how much of this volume was contributed by bamboo.

Table 3.32 shows the estimate of area of bamboo resources of the country in 2005. There was a slight increase in the area of bamboo resources from 172,000 ha to 188,000 ha representing an increase in area of 9.3 per cent. However, this figure is the sum of bamboo and trees found in other wooded lands. Again, it is not known how much of this is actually area occupied by bamboo. The data for bamboo were obtained from the bamboo Country Report for 2000 and the FRA 2005 country report for 2005. Data for 1990 and 2010 were extrapolated. The increase in the area of bamboo resources (Table 3.32) is attributed to the continuing establishment of bamboo plantation by private land owners as well as in some government projects.

Table 3.31 - 2003 National Forest Assessment (FAO-supported NFA Project)

Natural Forest	Area (1,000 ha)	Gross Volume (1,000 m ³)	Volume/ha
Broadleaf forest	6,029	1,175,643	195.0
Coniferous forest	211	27,919	132.1
Mixed forest	83	1,277	70.5
Bamboo/buho	172	5,363	31.2
Mangrove forest	41	5,121	126.1
Total (Natural Forest)	6,535	1,215,322	186.0
Planted Forest			
Broad-leaved Forest	617	31,308	50.8
Coniferous Forest	11	1,228	117
Subtotal (Plantation)	627	32 537	51.9
Total	7,163	1,247,859	174.2

Details may not add up to totals due to rounding

Source: FMB 2010 Forest Resources Assessment submitted to FAO for the Global Forest Resources Assessment.

Table 3.32 - 2010 Forest Resources Assessment

Categories	Area (1,000 ha)			
	1990	2000	2005	2010
Rubber plantations (forest)	NA	NA	7.9	8
Mangroves (Forest and OWL)	NA	257	257	257
Bamboo (Forest and OWL)	127	156	172	188

Source: 2010 FRA (FAO)

- **The ERDB Report**

In 2011 to 2013 the Ecosystems Research and Development Bureau (ERDB) of the Department of Environment and Natural Resources (DENR) conducted a comprehensive national survey of bamboo resources (Lanting et al, 2013) to determine the extent and distribution of economically important bamboo species in the Philippines. The ERDB project staff, headed by Sr. Science Research Specialist Lanting was supported by staff from the Ecosystems Research and Development Service (ERDS) of the DENR Regional Offices. The project was coordinated with the Forest Management Service (FMS) of the Forestry Sector of the DENR Regional Offices, Provincial Environment and Natural Resources Offices (PENRO) and the Community Environment and Natural Resources Offices (CENRO), other government agencies [e.g. Department of Trade and Industry (DTI) and the Department of Science

and Technology (DOST)]. Assistance in the conduct of the survey was also provided by the Local Government Units (LGUs) especially in linking with owners of clumps in private lands.

It was also the objective of the survey to establish regional and national databases on bamboo. The species-focus of the Lanting (2013) survey were four economically important species: *kawayan tinik*, *Giant bamboo*, *bolo* and *buho*. There are other important bamboo species. *Bayog* and *kawayan kiling* are likewise extensively used especially in the Ilocos provinces. *Kayali* which is found in Regions 10, 11, and 13 is also a widely used species. Because of the extensive and growing use of *laak*²⁷ for props in the banana growing provinces in Mindanao it was deemed necessary to include it in the list of economically important bamboo species.

Digitized maps of the locations of the bamboo clumps and plantations were generated. Likewise a list of owners of clumps and plantations including their locations indicated by global positioning systems (GPS) data were also generated. The total number of clumps, culms and hectareage of the eight economically important species is shown in Table 3.33 below.

Table 3.33 Number of clumps, culms and hectareage of the economically important species

Species	Number of clumps	Number of culms	Area (ha)
Kawayan tinik	580,480	16,617,991	6,679.00
Giant bamboo	69,458	2,396,754	740.91
Bulo	53,565	1,457,454	548.34
Buho	184,908	9,449,909	511.63
Laak	98,074	3,529,635	795.33
Bayog	41,490	1,324,258	302.84
Kawayan kiling	39,655	1,314,804	450.34
Kayali	12,395	374,143	37.10
Total	1,080,025	36,464,948	10,065.49

Source: Lanting, M. V. Jr. et al 2013. Survey of Bamboo Stands and Establishment of a National Database of Economically Important Bamboo Species in the Philippines. Terminal Report. Ecosystems Research and Development Bureau. Department of Environment and Natural Resources

The number of culms was estimated by actually counting the culms in a given clump and then used the average for estimating the number of culms for the rest of the surveyed clumps. On this basis the average culms per clump was 34. With respect to the area, if a number of clumps are found in one (1) hectare even if the number of clumps is less than 204, the standard number of clumps in a hectare of bamboo plantation, the area is taken as one hectare of bamboo plantation. Because of the lack of standardization in determining the hectareage of plantations in the Lanting (2013) report the number of clumps was used in estimating the number of culms available for use.

Table 3.34 Regional distribution of the eight economically important bamboo species

²⁷Sources of scientific names include: Virtucio, F. D. and C. A. Roxas. 2003. Bamboo Production in the Philippines. Ecosystems Research and Development Bureau. Department of Environment and Natural Resources, and Rojo, J. P., C. A. Roxas, F. C. Pitargue, and C. A. Brinas. 2000. Philippine Erect Bamboos: A Field Identification Guide. Forest Products Research and Development Institute, Department of Science and Technology

Region	Species	No. of Clumps	No. of Culms	Area (ha)
CAR	Kawayan tinik	7,318	92,468	129.48
	Buho	6,711	246,612	96.53
	Giant bamboo	4,885	66,687	67.23
	Bayog	3,737	42,149	43.38
	Kawayan kiling	899	37,164	13.23
	Total	23,550	485,080	349.85
Region 1	Buho	2,286	96,860	15.23
	Giant bamboo	43	785	0.10
	Kawayan tinik	32,857	834,538	172.96
	Bayog	4,829	131,931	12.66
	Kawayan kiling	39	966	0.12
	Total	40,054	1,065,080	201.07
Region 2	Bolo	13	78	0.05
	Buho	1,056	11,320	26.15
	Giant bamboo	1,354	7,345	24.61
	Kawayan tinik	2,244	21,053	52.42
	Bayog	1,429	12,835	18.78
	K. kiling	3,846	37,013	67.16
	Total	9,942	89,644	189.17
Region 3	Bolo	4,558	203,499	30.57
	Buho	15,599	291,858	33.22
	Giant bamboo	3,072	92,138	15.05
	Kawayan tinik	111,314	3,556,751	672.39
	Bayog	23,949	887,202	133.46
	Kawayan kiling	19,598	707,217	120.60
	Total	178,090	5,738,665	1,005.29
Region 4A	Bolo	1,447	25,717	101.20
	Buho	1,761	33,898	8.24
	Giant bamboo	778	17,052	20.68
	Kawayan tinik	18,867	426,973	147.52
	Laak	5	75	0.89
	Bayog	1,914	34,790	23.28
	Kawayan kiling	4,968	56,049	41.94
	Total	29,740	594,554	343.75
Region 4B	Bolo	291	7,540	5.21
	Buho	30,716	2,614,547	13.56
	Kawayan tinik	2,326	63,588	57.76
	Bayog	115	4,558	2.41
	Total	33,448	2,690,233	78.94
Region 5	Bolo	5,388	117,129	27.49
	Buho	636	11,977	1.94
	Giant bamboo	17	340	0.09
	Kawayan tinik	18,902	548,778	121.97
	Bayog	23	529	0.03
	Kawayan kiling	1,886	48,730	10.92
	Total	26,852	727,483	162.44
Region 6	Bolo	12,667	225,692	61.00
	Buho	296	8,763	1.00
	Giant bamboo	62	787	2.14
	Kawayan tinik	238,092	5,584,438	1,176.78
	Kawayan kiling	34	494	0.12
	Total	251,151	5,820,174	1,241.04
Region 7	Buho	123,699	6,059,781	285.05
	Giant bamboo	570	15,168	17.98
	Kawayan tinik	129,820	4,425,563	3,654.32
	Kawayan kiling	10	150	0.03
	Total	254,099	10,500,662	3,957.38

Region 8	Bolo	5,997	152,588	99.97
	Buho	1,359	36,774	12.54
	Giant bamboo	1,117	22,133	15.36
	Kawayan tinik	3,884	125,738	76.82
	Bayog	4	72	0.02
	Kawayan kiliing	371	7,434	4.44
	Total	12,732	344,739	209.15
Region 9	Bolo	1,308	41,127	35.07
	Buho	226	7,543	12.36
	Giant bamboo	325	11,858	17.93
	Kawayan tinik	2,962	129,708	187.71
	Laak	790	39,600	23.30
	Bayog	1,220	30,500	30.00
	Kawayan kiling	2,190	98,500	84.80
	Total	9,021	358,836	391.17
Region 10	Bolo	3,198	117,852	28.46
	Buho	163	13,874	0.95
	Giant bamboo	54,540	2,010,505	440.70
	Kawayan tinik	4,879	238,003	41.30
	Laak	215	8,848	1.10
	Bayog	556	20,067	3.01
	Kayali	370	10,480	1.84
	Total	66,983	2,615,541	539.49
Region 11	Bolo	14,610	309,466	33.25
	Buho	32	896	0.16
	Giant bamboo	12	660	0.04
	Kawayan tinik	1,715	67,260	5.06
	Laak	91,625	3,273,790	183.8
	Bayog	2,226	69,634	3.70
	Kayali	10,699	319,763	20.17
	Total	120,919	4,041,469	246.18
Region 12	Bolo	2,887	214,792	97.51
	Buho	55	4,152	2.37
	Giant bamboo	1,794	122,878	78.71
	Kawayan tinik	5,098	494,404	176.29
	Laak	5,239	201,322	584.24
	Bayog	1,410	87,934	21.04
	Kawayan kiling	794	69,641	34.12
	Total	17,277	1,195,123	994.28
Region 13	Bolo	1,201	41,974	28.56
	Buho	313	11,054	2.33
	Giant bamboo	889	28,418	40.30
	Kawayan tinik	202	8,728	6.23
	Laak	200	6,000	2.00
	Bayog	78	2,057	11.07
	Kawayan kiliing	1,958	55,534	43.80
	Total	6,167	197,665	149.38
Grand Total	1,080,025	36,464,948	10,065.49	

Source: Lanting, M. V. Jr. et al 2013. Survey of Bamboo Stands and Establishment of a National Database of Economically Important Bamboo Species in the Philippines. Terminal Report. Ecosystems Research and Development Bureau. Department of Environment and Natural Resources.



Bayog (*Bambusa merrilliana* Elmer)



Bolo [*Gigantochloa levis* (Blanco) Merr.]

The distribution of the clumps of the eight economically important bamboo species in the regions is shown in Table 3.34 above. Region 7 has 254,089 clumps which is the highest among the regions followed by Region 6 which has 251,117 clumps. The aggregate number of clumps of *laak* in 6 regions amounted to 98,074 with an estimated number of culms of 3,529,635. On the basis of 5 culms harvest per clump the total available laak per year is around 490,370 culms.

Available raw material supply

The survey results presented by Dr. Virtucio (2008)²⁸ during the 2008 Bamboo Forum were a consolidation of data obtained in 1980, 2003, and 2008. The 2003 survey was done when Dr. Virtucio was consultant to the Asian Development Bank (ADB) and the International Network for Bamboo and Rattan (INBAR) and only for the provinces of Abra, Davao del Norte and Bukidnon were surveyed. The 2008 survey reported was a result of survey done by field offices of DENR and reported to ERDB. Because the different surveys were done during various times and because there is the possibility that several areas were reported more than once, the report of Dr. Virtucio during the 2008 Bamboo Forum may not provide a true picture of the bamboo resources of the country.

The FDC (Dolom et al, 2012) report was basically bamboo resources in forest lands with very little amount of bamboo reported in private lands.

The Lanting (2013) report seems to be the most comprehensive with respect to bamboo resources in private lands. Furthermore, it disaggregated the economically important species and their distribution in the various regions. In addition the owners of the bamboo clumps were identified, the areas geo-tagged and therefore can be verified and monitored electronically and can be the basis of a baseline data/information on bamboo resources in the country.

Table 3.35 shows the annual available culms of the various highly commercial bamboo species on the basis of the Lanting (2013) report. There would be about 2.9 million culms of *kawayan tinik* available annually. Region 7 has the highest number of available culms yearly with 129,820 clumps that would be able to supply 649,100 culms. This is followed by Region 3 with 111,314 clumps or 556,570 culms per year. For *Giant bamboo*, Region 10 has 54,540 clumps which would translate to 272,700 culms.

²⁸ Personal communication on June 6, 2015 at Chino's Diner at Grove, Batong Malake, Los Banos, Laguna

Region 11 has the greatest number of clumps of *bulo* with 14,610 clumps or 73,050 culms per year. For *buho*, Region 7 has the most number of clumps amounting to 123,699 or 618,495 culms available each year. *Laak* is mostly found in the southern part of Mindanao where it is used mostly as banana proprs. Region 11 has the highest number of clumps amounting to 91,625 which would be able to supply 458,125 culms a year.

Table 3.35 – Available culms of the commercially important species

Species	Number of clumps	Available culms/yr
<i>Kawayan tinik</i>	580,480	2,902,400
<i>Giant bamboo</i>	69,458	347,290
<i>Bulo</i>	53,565	267,825
<i>Buho</i>	184,908	924,540
<i>Laak</i>	98,074	490,370
<i>Bayog</i>	41,490	207,450
<i>Kawayan kiling</i>	39,655	198,275
<i>Kayali</i>	12,395	61,975
Total	1,080,025	5,400,125

Source: Lanting, M. V. Jr. et al 2013. Survey of Bamboo Stands and Establishment of a National Database of Economically Important Bamboo Species in the Philippines.

Terminal Report. Ecosystems Research and Development Bureau. DENR

The annual available culms shown in Table 3.35 are very conservative. It is highly probable that the actual available culms for harvest each year is much higher than that indicated in Table 3.35. At 5 culms per clump there would be about 5.4 million culms available for harvest per year. The number of culms that can be harvested in a mature clump could be more than 5. It depends greatly on the maturity of clump and the number of culms in the clump.

Other surveys of bamboo resources

Negros Occidental conducted a survey on bamboo resources in all the municipalities of the province. Table 3.36 shows the results of that survey.

Table 3.36 Bamboo resources in Negros Occidental

Municipalities	No. of barangays	No. of clumps	Species
Himamaylan City	15	27,770	K. tinik, butong, bolo, bagtok, tiling
Sagay City	7	11,602	K. tinik, dalusan, butong, Chinese bamboo
Calatrava	9	1,552	K. tinik
D. S. Benedicto	3	1,331	K. tinik
Toboso	4	5,106	K. tinik
Isabela	15	13,114	K. tinik
Manapla	9	5,277	K. tinik, dalusan, butong
Cadiz City	3	1,615	K. tinik, dalusan, butong
Ilog	7	903	K. tinik
Cauayan	8	10,391	K. tinik, butong, tiling
San Enrique	9	1,135	-
Pontevedra	12	15,926	K. tinik, Giant bamboo
San Carlos	10	19,800	K. tinik, butong
Total	111	115,522	

Source: The data was provided by the DOST Regional Office of Region 6.

The total number of clumps of the 13 municipalities/cities of Negros Occidental was 115,522 which is 10.7 per cent of the number of clumps in the Lanting (2013) survey. This shows that the Lanting (2013) report under-estimated the amount of bamboo resources of the country.

The difficulty in assessing the extent of available bamboo resources of the country is the inadequacy of information/data on the material despite the several surveys that have been undertaken. This points out the necessity of conducting an intensive and systematic inventory of bamboo resources of the country disaggregated by species, in forestlands and in private lands, planted or naturally growing and the location where they are found. Among those surveys conducted it was only the Lanting (2013) survey where the clumps were geo-tagged. There is also a necessity for providing the traceability of the raw materials especially if they are made into products for export to countries that require certification and traceability. While the raw data of the Lanting (2013) survey could be a base of a database for bamboo resources in the country a more accurate inventory of the bamboo resources of the country is needed.

FMB Statistics on Bamboo Production

The bamboo production for 6 years from 2008 to 2013 according to statistics obtained from the Philippine Forestry Statistics is shown in Table 3.37. The production data are culled from reports of the different DENR regions, specifically from applications for certificates of verification (CoV), a requirement for transporting culms where the requesting party has to disclose the number of culms to be harvested or transported. As such culms produced by owners who did not request for a CoV were not included in the statistics of culms produced. The total number of culms reported in 2013 was only 1.42 million.

Table 3.37- Bamboo culm production, 2008-2013

Region/Year	2008	2009	2010	2011	2012	2013
CAR	30,329	18,819	16,099	39,156	1,282	35,476
Region 1	427,681	437,020	352,351	464,777	504,122	659,898
Region 2	50	8,868	-	-	-	-
Region 3	17,472	104,262	22,880	11,324	108,100	97,860
Region 4A	111,160	104,290	156,774	195,324	187,990	219,181
Region 4B	-	-	-	-	-	-
Region 5	4,923	4,992	8,115	10,852	10,409	6,164
Region 6	-	-	-	-	-	-
Region 7	2,600	750	-	-	-	813
Region 8	-	-	-	-	-	-
Region 9	-	-	-	-	-	-
Region 10	-	-	-	-	-	-
Region 11	19,700	23,738	7,100	11,013	8,300	28,110
Region 12	257,736	265,661	365,226	368,686	323,143	380,483
Caraga	-	-	-	-	-	-
Total	871,651	968,399	928,945	1,101,132	1,143,346	1,427,985

Source: Philippine Forestry Statistics, Forest Management Bureau, DENR

Culm production according to the data has been slowly but steadily increasing in the last 6 years. Region 1 has been consistently the highest producer of bamboo culms followed by Region 12 with Region 4A a close third. Within Region 1, Pangasinan (FMB, 2013) is the highest producer of bamboo culms according to the FMB Philippine Forestry Statistics.

What is surprising is that there were no production reported in Regions 6, 8, 9 and 10. The most glaring is that of Region 10 because banana plantations are using bamboo poles as banana props. Region 6 has many bamboo processing enterprises, most popular of which are those producing barbecue sticks. There are also furniture manufacturers who are exporting their products.

The 1.42 M culms produced in 2013 is of course way below the estimated 8M poles monthly demand for bamboo poles (DTI, 2015). However, there was no breakdown on the reported amount with

respect to demands by the different industry sectors. This is a manifestation of the paucity of information/data brought about by the inability of government system to capture the needed information.

Status of bamboo plantation development

Because of the advocacy of the Philippine Bamboo Foundation, Inc. (PBFI) and other non-government organizations on the need to develop bamboo plantations many private corporations and local government units are planning to develop plantations. PETRON has planned to establish 300 ha of bamboo plantations in Limay, Bataan as part of its Corporate Social Responsibility, starting with 10 ha²⁹.

Provincial governments are getting interested in developing bamboo resources. Ilocos Sur has established a bamboo corridor consisting of the 5 northernmost municipalities of the province namely: Sto. Domingo, Magsingal, San Juan, Cabugao, and Sinait. In addition the Provincial Board of Ilocos Sur passed Resolution No. 350-XV on July 28, 2015 establishing the Bamboo Industry Development Council of Ilocos Sur with the mandate of developing bamboo industries in the province³⁰.

Another initiative in bamboo plantation development is the CS First Green Agri Industrial Development Corporation, Inc. (CS1stAIDCI) plan to establish 250 ha of bamboo plantation in Pangasinan. This is part of the 25,000 ha that the corporation plans to establish in 8 municipalities in Pangasinan. The corporation has allocated Php 6 billion for the entire project that includes a processing mill for the production of engineered bamboo. The processing equipment worth US\$ 1 million ordered from China just arrived in October 2015. Presently, the corporation has already spent Php 170 million which include expenses for infrastructures including roads, water supply and buildings³¹.

The Bamboo Technology and Development Park, Inc. located in San Enrique, Ilo-ilo will commence the establishment 15,000 ha of bamboo plantation in January 2016. The company plans to establish a bamboo processing mill to produce engineered bamboo basically for export, a pulp and paper mill and a textile mill. It is reportedly investing about Php 15 billion for the entire project³².

The Ecosystems Research and Development Bureau (ERDB) entered into an agreement with the Department of National Defense (DND) to develop 3,000 ha of bamboo plantation in Fort Magsaysay in Laur, Nueva Ecija. Accordingly about 500 ha have already been planted³³.

²⁹ Manda, E. 2015. Personal communications. President Philippine Bamboo Foundation, Inc. January 8, 2015.

³⁰ Rabena, K. 2015. Technical Assistant, Provincial Board of Ilocos Sur, personal communication

³¹ Uy, L. 2015. Gen. Manager, CS 1stGreen Agri-industrial Development Corporation. Personal communication. November 6, 2015.

³² Caranza, E. 2015. Personal communication, October 28, 2015.

³³ Adornado, H. and F. Santos, 2015. Director and Supervising Research Specialist. ERDB. DENR. Personal communication.

3.3.2 Demand for bamboo culms

Estimates of demand for bamboo culms from the individual industry sectors/sub-sectors were derived by estimating the amount of raw materials that would be needed to produce a product, taking into consideration material losses from processing operations. The amount obtained was then used to calculate the culms needed to supply the requirements of the sector. The details in the estimation of the number of culms needed by an industry sector are shown in Appendix 4. Table 3.38 shows the estimated bamboo culm requirements for each of the sectors.

The estimated demand for bamboo culms by the traditional (present) bamboo industry sectors and sub-sectors amounts to 21,250,874 culms. If in the future the government or industry decides to invest in pulp and paper production as well as in the production of bamboo chips for boiler fuel the total requirements would amount to 107,058,770 culms per year.

Estimated growth rates of the various sectors of the industry were based on the share that these sectors would capture. Table 3.39 shows the projected growth rates of the various sectors and their demand for culms within a five-year period. The estimate of current demand based from surveys and round table discussions as well as personal consultations with industry players is also shown in Table 3.39. The estimate of current demand is 21,250,874 culms. Based on Lantings' (2013) report on the survey of bamboo resources in the country there are about 5 million culms available. However, this is considered very conservative and underestimates the amount of bamboo resources. A closer value would be double that amount or 10 million culms. On this basis there is a deficit of more than 11.25 million culms.

Table 3.38 Estimate of demand for bamboo culms^a

Industry/Users	Monthly	Annual	Species
Furniture			
School desks & Chairs		1,210,000	K. tinik, bulo, G. bamboo
Export/hotel type furniture		14,141 ^b	K. tinik, mixed species
Local/lower grade furniture/handicrafts	21,100	7,500,000 ^c	K. tinik, bulo, G. bamboo, bayog, buho, botong
Handicrafts (export quality)		6,370 ^d	K. tinik, mixed species
Banana props/fish pens/cages			
Banana props (PBGEA)		10,500,000	Laak
Fish pens/cages (LLDA)		570,827	Bolo and K. tinik
Fish cages (Taal Lake)		99,000	K. tinik
Banca outriggers		605,250	K. tinik, mixed species
Barbecue sticks/tooth picks/chop sticks			
Ilo-ilo Kawayan Marketing			
Berris Enterprises	8,000	96,000	K. tinik, butong
	300	3,600	K. tinik, bulo, G. bamboo
Engineered bamboo production (Construction)		575,102	K. tinik
Charcoal/briquettes		70,584	K. tinik, mixed species
Chemical products			
Sub-total demand		21,250,874	
Anticipated/potential Demand			
Pulp and paper industry (8 mills of 100 ton a day capacity)	2,871,075	34,452,896	K. tinik
Biomass energy			
Chips (Bataan 20-20), 5 units	720t/d@10%MC	51,355,000 ⁴	Mixed species (any species)
Pellets			
Sub-total		85,807,896	
Grand Total Demand		107,058,770	

^aEstimation of culm requirements of various uses of bamboo is shown in Appendix 3

^bEstimated from the total weight of furniture and handicrafts exports

^cDemand of 28 municipalities which is 1.71% of total number of cities and municipalities; 50% of estimate is taken as the demand for traditional (lower grade) furniture and handicrafts

^dEstimated at weight of green culm at 70%MC and weight of green culm at 32.5 kg

Projected Demand for Culms, 2016-2035 by Various Industry Sectors

Table 3.39 shows the projected demand for culms from various sectors.

For school desks and chairs, the estimated 1,210,000 culms will be the total demand if the industry were to supply all the 269,000 chairs and desks, the equivalent number of pieces that the annual allocation of Php 250 million or 25% of the Php 1 billion budgeted by the DepEd. However given the constraints in raw material supply and the capacity of present-day machineries used by the sector this is hardly possible. A much lower estimate was made over the periods covered in the Roadmap. By 2035 it is projected that the industry would be able to supply all the requirements of DepEd for desks and chairs made of bamboo.



(Left) Laak (*Bambusa philippinensis*(Gamble)McClure) is widely used as props in banana plantations in Mindanao (above).

Table 3.39 Projected demand for bamboo culms, 2016 - 2035

Industry users	Current demand	% inc	2016- 2020	% inc	2021 - 2025	% inc	2026 - 2030	% inc	2031 - 2035
Furniture									
School desks & chairs	1,210,000	10	121,000	20	242,007	60	726,000	100	1,210,000
Exports ^a	14,141	10	15,555	20	16,969	30	22,060	35	29,781
Traditional furniture/ handicrafts ^b	7,500,000	5	7,875,000	10	8,250,000	15	8,625,000	30	9,750,000
Handicrafts (exports)	6,370	10	7,007	20	7,644	30	9,937	35	13,415
Banana props/fish pens									
Banana props (PBGEA)	10,500,000	5	11,025,000	10	11,550,000	15	12,075,000	30	13,650,000
Fish pens/cages (LLDA)	570,827	2	582,244	5	599,368	15	627,910	20	684,992
Fish cages (Taal Lake)	99,000	0	99,000	0	99,000	0	99,000	0	99,000
Banca outriggers	605,250	5	635,513	10	665,775	15	696,038	20	726,300
Barbecue sticks, tooth picks, chop sticks									
Ilo-ilo Kawayan Mrktng	96,000	10	105,600	20	115,200	30	124,800	40	134,400
Berris Enterprises	3,600	10	3,960	20	4,320	30	4,680	40	5,040
Engineered bamboo (Construction)	575,102	5	603,857	20	690,012	50	862,653	80	1,035,184
Charcoal briquettes	70,584	5	74,113	10	77,642	15	81,172	20	84,700
Chemical products									
Sub-total culms needed	22,918,874		22,982,362		24,023,999		26,014,822		29,804,241
Available culms from existing sources	10,000,000		10,000,000		10,000,000		26,300,000		47,300,000
Area planted (ha)			16,300		21,000		21,000		11,000
Available culms from new sources					16,300,000		21,000,000		21,000,000
Total available culms	10,000,000		10,000,000		26,300,000		47,300,000		68,300,000
Deficit/excess	-11,250,874		-11,147,849		+3,982,063		+23,345,750		+40,877,188
Anticipated/Potential Demand									
Pulp & paper industry (8 mills of 100 tons daily capacity)	34,452,896						4,306,612 ^c		8,613,224 ^d
Bio-mass energy									
Chips (Bataan 20-20) 5 units	51,355,000 ^e	Half unit	5,135,500 ^f	1 uni t	10,271,000	1.5 units	15,406,500	2 units	20,542,000
Pellets									
Total demand for culms	108,726,770		28,117,862		34,294,999		45,727,934		58,595,465
Grand Deficit/Excess			-12,982,362		-2,276,001		+21,285,178		+38,495,759
Bamboo shoots plantation	50 ha ^g		50 ha		75 ha		150 ha		200 ha

^aEstimate of requirements of export bamboo furniture and handicrafts is based on gross weight of exports

^bDemand of 28 municipalities which is 1.71% of total number of cities and municipalities; 50% of estimate is taken as the demand for traditional (lower grade) furniture and handicrafts

^cOne mill will be operating using bamboo as raw material during this period

^dTwo mills operating during this period

^eEstimated at weight of green culm at 70%MC and weight of green culm at 25 kg

^fSome power generating plants start to use bamboo chips as fuel

^gInitial area for production of bamboo shoots to supply canning and chemical products sectors

Demand for bamboo culms coming from the sub-sector producing lower grade furniture and handicrafts will depend largely on the improvement of the buying capacity of customers in the rural areas, establishment of marketing centers and improved bamboo culm supply situation.

Demand for culms by the furniture and handicrafts export sector was based on the gross weight of the export products of these sectors. The gross weight was divided by the dry weight of one culm of bamboo which was assumed as 25 kg.

The demand for bamboo in the export market is expected to increase given an improving worldwide economy. In this respect the local industry is also expected to expand its production capacity. There is competition in the type material used as props. Saplings of fast growing tree species such as *Gmelina arborea* (Roxb.) are used for props. Furthermore, it is possible that the bamboo industry will use treated bamboo props which will increase the service life of the props. This could increase the demand in this sub-sector as the treated bamboo poles will replace the treated tree saplings.

The increase in the demand for bamboo poles for fishpens in Laguna Lake will be due to decreases in the supply of anahaw poles. In the case of the Taal Lake the Protected Area Management Board (PAMB) of the Taal Volcano Protected Landscape has put a cap on the number of fish cages that can be established in the lake and therefore it is expected that there will be no increases in the demand for bamboo poles in Taal Lake.

The demand for bamboo culms for banca outriggers is taken as 1% per year or 5% for each of 5-year periods. Each year an additional 1% of the fisherfolks will acquire banca with outriggers.

The market for barbecue sticks, toothpicks, and chopsticks is likely to increase due to the expanding reach of fast food chains and increasing population. Furthermore, as more cities and urban areas ban the use of plastics (including coffee stirrers) bamboo can easily fit in as a substitute.

Another potential market for bamboo is the construction sector which is a big potential market for engineered bamboo, assuming that the supply of bamboo raw materials is sufficient and engineered bamboo construction materials will be included in the National Structural Code of the Philippines. It is also expected that building contractors will begin to use it in vertical structures as there are indications that bamboo is slowly gaining acceptance as material in modern-day building. It is also expected that round poles will see an increase in use as structural materials once architects include them in their designs and connection systems will be improved.

Lump charcoal and briquettes will continue to be used by restaurants and food stalls as well as in homes. Bamboo charcoal will begin to penetrate these markets as technologies for their production become more efficient and prices become more affordable.

Estimates of bamboo plantation development

Table 3.40 shows organizations that are assisting investors or are the investors themselves in the establishment of bamboo plantations including the projected areas that will be developed by each of the developers over the period covered in the Roadmap. The number of culms available for the periods indicated is also shown in the table. By 2035 it is projected that there will be 68,300,000 culms available for the bamboo industry in the country. What is unpredictable among the investments are those identified as "Others" because their involvement would depend upon several factors among them are government policies on bamboo utilization and on incentives that will be provided by government.

The assumptions in making these projections of plantation establishment are that there is established a strengthened institution that will oversee the development of the bamboo industry, a revised policy

that supports the industry, availability of land for plantation development and set of incentives for those who invest in plantation establishment.

Table 3.40 - Plantation establishment (ha) and projected available culms at the end of the period^a

Resource Generators	2016-2020	2021-2025	2026-2030	2031-2035	2036-2040
Established from bank loans	1,000	1,000	1,000	1,000	1,000
Private industries	11,000	18,000	18,000	8,000	8,000
Government plantations	3,000				
CSR projects	300	1,000	1,000	1,000	1,000
Others	1,000	1,000	1,000	1,000	1,000
Total new plantations (ha)	16,300	21,000	21,000	11,000	11,000
Available culms from new plantations		16,300,000	21,000,000	21,000,000	11,000,000
Available culms from existing sources	10,000,000 ^b	10,000,000	26,300,000	47,300,000	68,300,000
Total available culms at the end of the period	10,000,000	26,300,000	47,300,000	68,300,000	79,300,000

^a1,000 culms harvestable from 1 ha of bamboo plantation, cutting starts 5 years after plantation establishment

^bDouble Lanting's data on available culms from 8 commercial species

3.4 Regulatory agencies and procedures

3.4.1 Institutional

Bamboo is classified as a minor forest product under PD No. 705. As such it is regulated by the Department of Environment and Natural Resources. There are no specific issuances regarding bamboo unlike that of rattan which is the subject of DENR Administrative Order No. 1989-04. However, Section 14.5 of DENR Administrative Order No. 99-53 (DAO 99-53, 1999) entitled Regulations Governing the Integrated Forest Management Program (IFMP) issued on December 23, 1999 allows the planting of bamboo in Integrated Forest Management Agreement (IFMA) areas.

Furthermore, Section 20.3 of DENR AO No. 99-53 allows the IFMA holder to export without restriction forest products harvested from forest plantations including bamboo. In addition products from plantations, including bamboo, are exempted from the payment of forest charges.

With respect to harvesting and transport of bamboo and other non-timber forest products, if the product comes from public land a permit to harvest is required, if it comes from a plantation established and developed by a private entity there is no need for a permit to cut. Likewise, there is no need for a permit to cut if the bamboo comes from private lands. There are however, permits needed to transport forest products. If the products come forest lands, planted or from the natural forest, a Certificate of Origin (CoO) is required to transport the forest products. If the bamboo comes from private lands a Certificate of Verification (CoV) is needed for transport (DAO No. 7, 1994). The CoV is issued by the Community Environment and Natural Resources Office (CENRO). The fee for the issuance of a CoV is Php 20.00.

Contrary to Section 20.3 of DENR AO O. 99-3 allowing the export, without restrictions, of forest products harvested from forest plantations including bamboo, the Department of Trade and Industry (DTI) approved in December 2013 a list of prohibited and regulated products for export under EO No. 1016. In the said list, bamboo is listed as a regulated product. To export a regulated product one must obtain permits from concerned agencies. For bamboo a permit to export is needed from the DENR and from the DTI.

On July 29, 2015, DENR through Director Ricardo L. Calderon of the Forest Management Bureau (FMB) wrote Director Senen M. Perlada of the Export Marketing Bureau of the DTI to clarify what should be covered as regulated product with respect to bamboo (Calderon, 2015). Director Calderon wrote that as far as bamboo is concerned what are regulated are raw poles that have not undergone any processing or manufacturing, raw poles cut into desired sizes, and raw poles that have undergone application of preservatives. Furthermore, Director Calderon clarified that manufactured bamboo products such as furniture are not regulated products. Also that DENR regulates only bamboo that comes from forest lands. This means that bamboo covered with CoV are not regulated.

In a policy brief prepared by Elomina and Oliveros (2015) of the Policy Section of the FMB it was recommended that DENR should issue a policy regulating the harvest, utilization and transport of bamboo from public and private lands. Among the other recommendations were:

1. Encourage private land owners to register their bamboo plantations to the DENR Field offices;
2. Private land owners who opt to register should receive incentives such as exemptions from obtaining other transport permits, increase market demand due to certified products, provision of technical assistance and innovative techniques in improving plantation development from the DENR;
3. ERDB to design a system for the inventory of all existing bamboo plantations in public lands and inventory all existing bamboo plantations in private lands; and
4. Create a reliable database on bamboo production and consumption for guiding decision making, planning and policy improvement.

3.4.2 Infrastructure and Facilities

Another constraint in the development of the bamboo industry in the Philippines is the inadequacy of infrastructure and facilities supportive of the industry. It is not that there is total lack of facilities, It is just that existing facilities are not enough to service the needs of the industry. Profiles of some of these facilities supportive of the industry are described below:

Furniture testing laboratory at the FPRDI and in Cebu - A furniture testing laboratory is being maintained and operated by the FPRDI for testing of different types of furniture, but mostly chairs are being requested by manufacturers to be tested. Tests are to evaluate the strength, durability and stability of chairs, stools, desks/tables, beds, monobloc chairs and stools and plastic tables, and storage furniture by applying loads and simulating the normal functional use and acceptable misuse following test standards. The FPRDI National Furniture Testing Center(NFTC) makes use of different test standards for various furniture properties such as strength, durability and stability. These standards include the Philippine National Standards (PNS), British Standards, and the American National Standard for Office Furnishings-Desk Products.

The NFTC is accredited with the ISO 17025 an international organization for standardization. It is also a member of the International Safe Transit Association (ISTA) (Revilleza, 2015)³⁴. Technicians at the NFTC took and passed the examination on Certified Packaging Laboratory Professional Program. It has recently been accredited by the Furniture Industry Research Association (FIRA) of the United Kingdom in March 2015.

Some pieces of furniture are finished with paints or similar materials that contain lead. To be qualified to test for the presence of lead in the finishes of furniture, the National Furniture Testing Center of FPRDI needed to get an accreditation from the Food and Drug Administration (FDA). To be able to obtain a License to Operate (LTO) the technicians of NFTC had to undergo a seminar on lead detection

³⁴ Revilleza, V. 2015. Head of the FPRDI National Furniture Testing Center. Personal communication. November 3, 2015.

conducted by the Philippine Nuclear Research Institute (PNRI) of DOST. NFTC is now accredited with FDA for the testing of lead in finishes of furniture.

Buyers in the US have test protocols under which the furniture they buy have to be tested. Thus Pier 1, Crate and Barrel, and Cinmar (furniture stores) require that the testing laboratory must be accredited with the Consumer Product Safety Improvement Commission which implements the Consumer Product Safety Improvement Act of the United States.

The Cebu Furniture Testing Center located at the DOST VII is a satellite laboratory of the FPRDI NFTC to provide services to furniture manufacturers in the Visayas and Mindanao. The NFTC in Cebu has the capability to evaluate the strength, durability and stability of furniture. It also has the competence to ensure that both product and process are safe based on the Philippine National Standards (PNS), the International Organization for Standardization (ISO), the British and European Standards (BS EN) and other test protocols required by foreign buyers (FPRDI, 2015).

Mechanical properties testing laboratory at FPRDI - A laboratory at the FPRDI exists for testing of mechanical properties of beams, trusses and columns, properties that are needed to establish specifications for various structural parts for building construction. The laboratory is capable of testing material's structural reliability and if it can withstand load requirements set by construction firms. Full-Size Beam Bending Test can also be done to determine beam bending strength and elasticity using state-of-the art data acquisition system with real-time load deflection graph for instantaneous data analysis. The laboratory is capable of testing the shear strength of glued products, very important property of engineered bamboo (www.fprdi.dost.gov.ph). The physical and mechanical properties of wood and non-wood forest products such as moisture content, relative density, shrinkage, water absorption, thickness swelling, static bending, compression parallel, compression perpendicular, shear, toughness and hardness can also be assessed at the testing laboratory of FPRDI.

Pulping and paper properties laboratory at FPRDI - The pulp and paper testing laboratory at FPRDI has facilities for testing paper and paper boards, physical and optical properties such as texture, grammage, brightness, thickness and density. Proximate chemical analysis for moisture, ash, and extractives can likewise be studied in the laboratory. The laboratory is also capable of determining strength properties such as resistance to bending, puncture, tearing and crushing force of paper and boards.

Other properties that the testing laboratory is capable of doing include: oil penetration, water absorption, pulp evaluation and paper chemical evaluation. The FPRDI Pulp and Paper Testing Laboratory is accredited with ISO 17025. It is a member of the Pulp and Paper Manufacturers Association (PPMA) and the Technical Association of the Pulp and Paper Industry of the Philippines (TAPPIP).

Sawmilling, kiln drying and preservative treatment facilities - Sawmilling converts logs or flitches into lumber, boards, or dimensions using a headrig such as the FPRDI portable horizontal bandsaw mill or Wood-Mizer. In addition to using the sawmill for research purposes, FPRDI also provides sawmilling services to customers for a fee. FPRDI also possesses a number of kiln drying facilities for drying wood, bamboo and other forest materials. The kiln is a furnace type drying facility providing heat to the materials being dried by burning biomass in the furnace and hot gases are moved through the materials being dried.

The FPRDI also has a portable High Pressure Sap-Displacement equipment for treating sapling, timber and bamboo. It makes use of artificial pressure provided by a pump to move the preservative into the materials being treated. The Institute also provides treatment services for a fee.

Facility for testing heating value of charcoal and briquettes and raw materials - FPRDI has a laboratory for determining the heating value of materials including bamboo charcoal and bamboo briquettes.

MIRDC - The Metals Industry Research and Development Center (MIRDC), is an agency of the Department of Science and Technology that is providing direct support to the metals and engineering industry with services designed to enhance its competitive advantage.

Design Center of the Philippines - The Design Centre of the Philippines (DCP) is an agency of Department of Trade and Industry. Its mandate is to promote industrial design as a tool for improving the quality and competitiveness of Philippine products. It serves the design needs of entrepreneurial groups and associations from every level of industry. In cooperation with the Metals Industries Research and Development Center of DOST, assisted in the design of industrial machineries such as freeze dryer. The Center can also assist in the design of processing equipment for the bamboo-based industries.

Cottage Industry Technology Center - The Cottage Industry Technology Center (CITC) is an attached agency of the Department of Trade and Industry (DTI) that is mandated to promote the establishment of cottage and small-scale industries working to generate employment and livelihood opportunities. It provides production-related training and technical assistance to furniture, gifts and housewares, fine jewelry and leather footwear industries throughout the country.

With respect to bamboo, CITC has designed and fabricated machines for pole splitting, cross cutting and thickness planer. These prototype machines have been used by CITC in the training of workers in the bamboo industry.

CITC also serves as an incubator for newly established enterprises. One of the tenants of CITC was ABK 101 a fledgling enterprise manufacturing engineered bamboo. It has a production capacity of 45 m² of engineered bamboo per month. ABK 101 has become a sub-contractor for a school chair supplier producing engineered bamboo for back rests, seats, arm rests and legs. It was able to win a contract to supply engineered bamboo floor planks for a 30 m² bedroom floor (FPRDI, 2013). ABK 101 planks sell for Php 1,800 per m² (10 planks make 1 m²).

Processing facility in Pampanga that can serve as incubator for fledgling enterprises in bamboo processing - The Chamber of Furniture Industry of the Philippines (CFIP) is maintaining a furniture training facility in Pampanga specifically for start-up furniture enterprises. It serves as an incubator. It is basically a wood processing facility since most of the pieces equipment are wood working machines. Members of the CFIP can also make use of the facilities if they do not have their own equipment.

Last year, DTI Region 3 provided facilities to the processing center through the SSF for engineered bamboo so the group can also do training and produce engineered bamboo (Angeles, 2015)³⁵.

Resins Incorporated

Resins Incorporated (RI) is a private corporation engaged in the manufacture of glues and adhesives for the wood-based industries. It has been supplying glues and adhesives to the plywood industries for over 50 years. During a discussion on the adhesive needs of the bamboo industry particularly in

³⁵ Angeles, J. 2015. Regional Director, DTI, Region 3



the manufacture of more affordable glues for the bamboo industry, Mr. Meneleo Carlos, Jr. indicated that his company is willing to partner with manufacturers of engineered bamboo in developing an effective glue at reasonable price³⁶. This is an opportunity for the engineered bamboo sector to work with glue manufacturer with the aim of producing a low-cost but effective glue for the industry.

Shared Service Facilities Project

DTI is implementing a project aimed at providing support to MSMEs so that they can improve and expand. A full discussion of this project is found in Chapter 4: Support to Industry Development.

³⁶ Carlos, M. Jr. 2015. Personal communication

Chapter 4

SUPPORT TO INDUSTRY DEVELOPMENT

General Support

In spite of the general lack of support of some agencies of government to the bamboo industry there are pockets of support and assistance provided by some sectors. These are described below:

- **Executive Order No. 879 – Creation of the Philippine Bamboo Industry Development Council**

Probably the best known government issuance in support of the bamboo industry in the country is Executive Order No. 879 (EO 879, 2010). The EO stipulated that the bamboo industry of the country shall be made a priority program of government. To provide over-all policy and program directions the Philippine Bamboo Industry Development Council (PBIDC) composed of several departments was created. To direct the preparation of the Philippine Bamboo Industry Development Plan (2010 to 2020) an Executive Committee was created. Furthermore, the Executive Committee was task to identify, prioritize and recommend initial strategic interventions, research directions and critical data needs while the Development Plan is being drawn up.

To provide specific interventions EO No. 879 directed the Department of Education (DepEd) to procure at least 25 per cent of its annual requirements of school desks and chairs of all public elementary and secondary schools nationwide made of bamboo. The annual allocation of DepEd for school furniture is Php 1 billion. This translates to Php 250 million for bamboo desks and chairs, which the bamboo industry can take advantage of.

To boost the potential supply of bamboo raw materials EO No 879 also directed the Department of Environment and Natural Resources through the Forest Management Bureau (FMB), the Mines and Geosciences Bureau (MGB) and the Laguna Lake Development Authority (LLDA) to use bamboo for at least 20 per cent of its annual reforestation projects and for the Ecosystems Research and Development Bureau (ERDB) to continue to generate bamboo production technologies for dissemination to farmers.

EO No. 26 established the National Greening Program (NGP) (EO 26, 2011). The NGP has targeted a total of 54,416 ha to be planted to bamboo nationwide. The total area of bamboo plantation established under the NGP as of the end of 2014 is 14,517 ha utilizing 3,562,788 planting materials (FMB 2016).³⁷ The ERDB and other research institutions particularly the State Universities and Colleges (SUCs) continue to develop and improve the technology in planting stock propagation, nursery and plantation establishment. These institutions are continuously transferring the technology to farmers and to corporations desiring to establish bamboo plantations.

The Department of Science and Technology (DOST) is mandated to conduct research through its agencies such as the Forest Products Research and Development Institute (FPRDI) and the Food and Nutrition Research Institute (FNRI) to generate new technologies on the processing of bamboo to reduce costs of production and develop new products and disseminate these to farmers and processors. DOST has also been instructed by EO No. 879 to allocate 20 per cent of its MSME assistance funds such as the SET-UP and TAPI Venture Capital to bamboo based industries. DOST through its Regional Offices has provided funds to micro and small bamboo enterprises to acquire technologies such as furnace type lumber dryer and charcoal and briquetting equipment.

³⁷ FMB. 2016. National Greening Program Coordinating Office

The provision of EO No. 879 which would have given the bamboo industry a boost is the requirement that DepEd procure 25 per cent public school desks and chairs made of bamboo. The Php 250 M appropriated for chairs annually translates to about 269,000 pieces of school furniture at a price of Php 930 an arm chair. However, furniture manufacturers have not been able to supply the requirements of DepEd because the cost of producing the arm chairs is much more than Php 930 a piece. This is brought about by the high cost of the raw material which constitutes about 50 per cent of the cost of production and the low volume capacity of machines used to manufacture the furniture.

In support to EO No. 879 President Aquino issued Memorandum Circular No. 30 (MC, 2012) issued on May 30, 2012. The MC directs the PBIDC and the DENR to harmonize the PBID program and the NGP and identify areas of cooperation and convergence.

- **Support to Research and Development on Bamboo**

Although not mentioned in the EO 879 the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) and the Philippine Council for Industries, Energy and Emerging Technologies Research and Development (PCIEERD) have been supporting research and development on bamboo. Appendix 5 shows the funding support provided by PCAARRD for bamboo research and development. The total funds provided by PCAARRD to bamboo research since 1998 amounted to Php 40,443,410.28.

State Universities and Colleges have been conducting research on bamboo production and processing utilizing their own funds. Prominent among these are the Mariano Marcos State University (MMSU) in Batac, Ilocos Norte, the Pampanga State Agricultural University (PSAU) in Magalang, Pampanga, the Mindanao State University (MSU) through Iligan Institute of Technology in Iligan City.

- **KAWAYAN Program of the Land Bank of the Philippines**

KAWAYAN stands for **K**alikasan Kabuhayan sa **W**astong Pama**YAN**an (LBP, 2015). It is a program of the Land Bank of the Philippines in support of the bamboo industry. The objectives of the KAWAYAN program are:

1. Provide credit assistance to various players in bamboo production and bamboo-based economic activities
2. Assist local bamboo players gain a big chunk of the multi-billion dollar industry
3. Help the government in making the country as the world's biggest bamboo producer
4. Increase farm productivity and household income and generate employment.
5. In bamboo, LBP aims to attain triple bottom line i.e. economic value, social and environmental importance

The eligible borrowers include the following:

- Cooperatives
- Federations
- Associations
- Non-government organizations
- Countryside financial institutions
- Small and medium enterprises
- Agri-business entities
- Local government units

The basic lending policies of the KAWAYAN program are shown in Table 4.1. It has wide range of types of loan from plantation development as well as bamboo processing. It also provides loans for the acquisition of fixed assets as well as for working capital. The program provides only 80 per cent of the project cost but for LGUs the loan should not be more than the net borrowing capacity of the LGU.

Table 4.1 - Basic lending policies

Type of Credit	Short term loan		Long Term Loan
Loan purpose	Working capital, relending, production	Rediscounting	Production/bamboo plantation development, fixed assets acquisition, permanent working capital
Loan term	One year	One year	Production loan - based on crop cycle, fixed assets acquisition based on projected cash flows and economic useful life of fixed assets, permanent working capital – 3 years
Interest rate	The program shall adopt the regular pricing structure for each identified client sector		
Mode of payment	Quarterly or semestral depending on the project's cash flow		
Maximum loanable amount	80% based on the commodity module for bamboo or technology protocols published by appropriate entity or based on the technology protocol agreed upon by the parties. For LGUs, not more than the net borrowing capacity.		
Collateral requirement	<ul style="list-style-type: none"> • Assignment of guarantee/insurance proceeds • Assignment of promissory notes plus underlying collaterals • Real estate mortgage • Chattel mortgage • Assignment of portion of the LGUs net income and IRA 		
Approving Authority	Approval of the loan shall follow the Loans Approving Group, consistent with the Bank's CASA.		

Source: LBP power point presentation

Another condition of the loan is that there should be an agreement between the bamboo growers and the anchor firm (the firm that is supposed to buy the products of the growers) on product quality standards/specifications as well as the pricing scheme, and delivery arrangements. The agreement should also include provisions on training on bamboo production and management of plantations to be conducted by the anchor firms. For LGU borrowers the loan should be approved by the *Sangunian* and there should be a plantation development plan.

The Land Bank of the Philippines has allocated Php 11.B for the program.

- **Tree Plantation Financing Program of the Development Bank of the Philippines (DBP)**

The Development Bank of the Philippines (DBP) has a plantation development program dubbed Tree Plantation Financing Program (TPFP) (DBP, undated) commonly called DBP Forest. TPFP is a credit assistance program for the expansion, harvesting, maintenance and protection of existing tree plantations with at least 4-year-old standing trees in at least 1% of the plantation area of qualified private and public lands. While the program is called tree plantation financing program bamboo plantation development is covered (Pagkanlungan, 2015).

The program aims to promote the development and maintenance of tree (bamboo) plantations and a planned approach in harvesting that will boost wood-based (bamboo-based) industries; assist communities improve their socio-economic conditions through an integrated tree (bamboo) planting program that may address local food sufficiency and health requirements, and arrest rapid deforestation and reduce the susceptibility of communities to natural disasters such as flooding and mudslides.

Eligible borrowers include:

- Industrial tree (bamboo) plantation companies
- Wood (bamboo) producers
- Integrated Forest Management Agreement (IFMA) holders accredited by the Philippine Wood Producers Association (PWPA)
- Socialized Integrated Forest Management Agreement (SIFMA) holders
- Private land owners
- LGUs
- Private schools
- People's Organization/cooperatives

The eligible loan purposes include:

- Expansion of tree (bamboo) plantation
- Maintenance and protection of existing plantations
- Harvesting of plantation
- Processing and post-harvest facilities equipment and related expenditures

The amount of loan that can be availed of in the program is 80% of the project cost for all borrowers except the LGUs which can borrow up to 90% of the project cost depending on fund source and borrowing capacity, which in the case of LGUs shall be based on the limitation set by the Local Government Code (LGC) and sub-limits on funding exposure that may be imposed by the Funders.

The equity requirement is 20% of the project cost for all borrowers except LGUs whose equity is 10% of the project cost. The interest rate will be based on prevailing rates and the interest payment due may be capitalized during the grace period. Repayment is for a maximum of 15 year inclusive of a grace period (on principal and interest payment not exceeding 5 years). The grace period may vary according to the gestation period of the species planted. There is also a grace period on capitalized interest payments.

The loan may be secured by any or combination of the following:

- Real estate mortgage other than plantation site
- Chattel mortgage
- Chattel mortgage of growing crops
- Assignment of tenurial instrument
- Assignment of insurance or guarantee coverage
- Assignment of supply contract/receivables
- Assignment of project income
- Assignment of Certified Emission Reduction(CER) credits
- Hold out on deposits
- For LGUs: Deed of Assignment of specified portion of IRA
- Other security assignments acceptable to DBP.

A staggered release of loan is applied in accordance with progress or accomplishments of the project, based on the program of implementation.

- **DTI Shared Service Facilities (SSF) Project**

A key strategy of government to achieve the goals of inclusive growth contained in the Social Contract of President Aquino (EO No. 43 Series of 2011) is the development and support of micro, small and medium enterprises (MSMEs). To pursue this goal government implemented a program called Shared Service Facilities Project (SFFP) (<http://www.dti.gov.ph/dti/index.php/programs-projects/ssf>). In 2013 the government appropriated Php 770 million to support SSF (DBM-DTI, 2014). The SSF project (SSF) aims to improve the competitiveness of MSMEs by providing them with machinery, equipment, tools, systems, skills and knowledge under a shared system.

SSF is a nationwide project implemented through partners or co-operators which could be juridical entity such as but not limited to non-government organizations, people's organizations, cooperatives, industry/trade/business associations, local government units (LGUs), state universities/colleges technical vocational schools and other similar government and training institutions (<http://www.dti.gov.ph/dti/index.php/programs-projects/ssf>). The beneficiaries of the project should be actual or potential users of the SFF facilities and should be predominantly cooperatives, associations or groups of MSMEs although individual entrepreneurs who may not be members of cooperatives, associations, corporations or organizations may also be beneficiaries of the project.

The SSF project provides a set of machineries, equipment, tools, systems, accessories and other items needed by an entrepreneur to improve his operations, increase his efficiency and make its operations more efficient and more productive and reducing cost of production thus making his operations more competitive. The co-operator provides the space for the machineries, secure, maintain, and manage them for the use of beneficiaries. After two years of successful operation the set of machineries is turned over to the co-operator (DBM-DTI, 2014). A Memorandum of Agreement (MOA) is entered into between DTI and the co-operator specifying the duties, roles and responsibilities of each party to the agreement.

In the bamboo SSF the operating set-up consists of a couple of Nodes and a Hub. The node is the primary processor. It produces slats for the hubs to convert to products such as engineered bamboo. The hub also produces products out of the engineered bamboo such as flooring, panels, builders' wood works as well as furniture.

The regional distribution of the SSF funds is shown in Table 4.2. Region 1 has the highest allocation with Php 91,508,000 while the lowest allocation is in NCR with only 12,670,000.

Table 4.2 – Regional distribution of the SFF funds

Regions	Amount (Php)	Total Budget (Php)
MOOE Central Office	70,000,000	70,000,000
Capital Outlay Regions		700,000,000
CAR	57,589,000	
NCR	12,670,000	
1	91,508,000	
2	48,202,000	
3	52,464,000	
4A	80,625,000	
4B	19,004,000	
5	34,554,000	
6	23,036,000	
7	36,623,000	
8	34,554,000	
9	46,071,000	
10	50,679,000	
11	34,553,000	
12	22,869,000	
Caraga	54,999,000	
Total		770,000,000

The SFF is for all MSMEs. Several SSF projects on bamboo have been implemented and on-going in various regions of the country. Table 4.3 summarizes the bamboo SSF projects in the various regions. As of December 31, 2014 there were 54 SSF funded projects for the production of bamboo slats for the nodes and engineered bamboo for the hubs, including bamboo crafts. The total investments amounted to Php 43,835,538 equivalent to 6.26% of the total SSF funds.

Table4.3 – Summary of bamboo SSF projects

Region	Number of projects	Type of projects	Type of co-operators	Type of machines provided	Project cost (Php)
1	8	Poles, slats, GDH ¹ , engineered bamboo	Cooperatives, associations, LGUS	Jointer, thickness planer, spindle moulder, circular saw, arm saw, bench drill, wide belt sander, dust collector, air compressor, grinder for planer knives, twin rip saw, laminating press, wood furnace, treating vat, carpentry tools	5,959,800
2	7	Handicrafts	Farmer associations and cooperatives	Compound miter saw, stationary bench drill press, wood hole saw, air compressor, electric hand drill and bits, angle disc grinder, pneumatic nail tucker, spray gun, dowel maker, pruning shears, bamboo splitter, stick making machine	665,056.25
CAR	2	GDH, charcoal and briquettes, slats	Cooperatives	Jointer planer, thickness planer, circular saw, band saw, grinder (hammer mill type), manual mixer, briquette dryer, modified drum kiln for charcoaling, briquettor, laminating table press	2,896,000

3	1	Bamboo slat processing	Association (persons with disabilities)	Pole cutter, twin rip saw, treatment vat, double head disc sander, dry kiln, laminating press with pneumatic cylinder	582,400
4A	8	Bamboo slats, builders woodworks, furniture, engineered bamboo, treatment and preservation,	Farmers' association, LGU, multi-purpose cooperative,	Bamboo pole cutter, jointer-planer, thickness planer, dust collector, single spindle moulder, circular saw, arm saw, band saw, bench drill, wide belt sander, air compressor with spray gun, sharpener, twin rip saw, furnace, laminating press	15,092,864
5	2	Bamboo products	LGU and vocational school	Pole cutter, air compressor with spray gun, pneumatic nailer, hand drill, hand splitter, rip saw, pole cutter, jointer planer, thickness planer, radial arm saw	1,510,000
7	1	Furniture, engineered bamboo products	NGO	Portable cut-off saw, table saw, jig saw, scroll saw, portable circular saw, power planer, hammer drill, plunge router, finishing sander, cmp miter saw, bench grinder, thickness planer, air compressor, steel pipe threader, drill press, band saw, pneumatic gauge shear, saw blade sharpener, angle sander, wheel sander, oxy-acetylene torch, electric welding machine	831,132
9	1	Pole and slat production	Association	-	745,932
10	15	Slats (Node), engineered bamboo (Hub),	Associations, foundations, upland farmers association, indigenous people's organization,	Pole cutter, twin rip saw, treatment vat, kiln dryer, jointer/planer, dust collector, laminating press, single spindle moulder, arm saw, band saw, bench drill, belt sander, air compressor, spray gun, sharpener, grinder for planer, transformer, circuit breaker, circular saw, mechanical clamps, belt sander	1,829,146.43
11	1	Bamboo crafts	Women's association	-	484,000
12	6	Slats, engineered bamboo	Cooperatives, women's association	Pole cutter, twin rip saw, thickness planer, compressors, aluminium treatment vats	3,187,200
13	2	Slats, construction materials, engineered bamboo	Association of differently abled persons	Jointer planer, thickness planer, single spindle moulder, bench drill, wide belt sander, air compressor, tenoner, circular saw, arm saw, band saw, pole cutter, twin rip saw, drum carbonizer/dryer, laminating press with pneumatic cylinder	2,815,000
Total	54				43,835,538

¹ GDH- gift, decors, housewares

Source: DTI, data as of December 31, 2014

- **One Town, One Product (OTOP) Project**

OTOP is a priority program of the Department of Trade and Industry to promote entrepreneurship by supporting about 3 million entrepreneurs and generate from 6-10 million employment. The local government executives take the lead in identifying products in their jurisdictions that have the potentials for promoting the objectives of the program which is to develop entrepreneurship and create jobs (<http://otopphilippines.org>). The program supports the identified micro, small and medium enterprises to manufacture, offer and market distinctive products or services through the use of local materials and local skills and talents.

The package of services that OTOP offers include:

1. Business counselling
2. Appropriate technologies
3. Skills and entrepreneurial training
4. Marketing, and
5. Product designs and development

OTOP assistance can be availed by linking with the nearest DTI Regional or Provincial Office (see www.dti.gov.ph) or through the website of OTOP (<http://otopphilippines.org>). Credit can be availed through the SME Unified Lending Opportunities for National Growth (SULONG).

The program has initially identified Abra as the province where OTOP projects can be established because of the existing bamboo processing enterprises in communities (Lapis and Gonzales, 2012) and the presence of bamboo resources as well as skilled labor. However, there are towns outside of Abra that have established bamboo-based OTOP projects. Table 4.4 shows the list of municipalities which have adopted bamboo products as OTOP projects. There are 40 such municipalities 8 of which are in Region 1 and 5 each in Region 4A and CAR. Five (5) municipalities with OTOP on bamboo are located in Abra. Abra is rich in bamboo resources and have highly skilled workers especially in the production of handicrafts.

Table 4.4 - Municipalities adopting bamboo as their OTOP

Regions	Provinces	Municipalities	Products
CAR	Abra	Bucay Lagangilang La Paz Pidigan Tayum	Bamboo Bamboo Bamboo Bamboo Bamboo
1	Ilocos Norte Ilocos Sur Pangasinan La Union	Nueva Era Burgos Cabugao Quirino Burgos San Carlos City Caba Sudipen	Bamboo/rattan handicraft Bamboocraft Bamboocraft Bamboocraft Bamboocraft Bamboo-based products Bamboo furniture Bamboo baskets
2	Isabela Cagayan	Sto. Tomas Piat	Bamboo furniture Bamboocraft
3	Bataan Tarlac	Dinalupihan Sta. Ignacia	Bamboo-based products Bamboo tiles, cornice
4A	Batangas Cavite Laguna Rizal	San Luis Maragondon Famy Magdalena Cardona	Bamboocraft Bamboo products Bamboo products Bamboo products Bamboo products

4B	Oriental Mindoro	Gloria	Bamboo based novelties
5	Camarines Sur Masbate	Minalabac Naga City Buhi Baleno	Bamboo handicrafts Bamboo handicrafts Bamboocrafts Bamboo furniture
6	Ilo-ilo Antique	Pavia Maasin Barboza	Bamboo furniture Bamboo Bamboocraft
7	Bohol Cebu	Catigbian Puro	Bamboo based products Bamboocraft
8	Leyte	Leyte	Coco-bamboocraft
9	Zamboanga Sur Zamboanga Norte	R Magsaysay Leon Postigo	Bamboo sawali Bamboocraft
10	Camiguin Misamis Occidental Misamis Oriental	Guinsilban Tanguib City Opol Villanueva	Bamboocraft Bamboo furniture Bamboocraft Bamboocraft
11	Davao City	Talomo	Bamboocraft

Source: DTI. 2015. OTOP Report

The OTOP project could be made a vehicle to make the municipality a tourist destination. The Municipal LGU can sponsor a festival during its town fiesta featuring local costumes and custom featuring bamboo, hold competition in sports such as bamboo pole climbing (*palo sebo*). If the municipality has a river it can have a bamboo raft race, and can also hold bamboo shoot cooking and eating contest, and can also hold a concert at night featuring bands using bamboo instruments. There can also be stalls and booths selling locally made bamboo products. The affair can be advertised on radio and TV stations to attract visitors. Arrangements can be made with radio and TV stations to feature in their programs of the town festival.

- **The National Greening Program of the Department of Natural Resources**

On February 24, 2011 President Aquino issued EO No. 26 creating the National Greening Program (EO 26, 2011). The Program is a vehicle for government to pursue its objectives of poverty reduction, food security, biodiversity conservation, and climate change mitigation and adaptation. It is the intent of the NGP to plant 15 billion trees in 1.5 million hectares. In the implementation of the NGP other agencies of government including the private sector were given roles and responsibilities.

In the NGP road map bamboo is one of the commodities for plantation development. The target area for development is 54,416 hectares. Table 4.5 shows the accomplishments of the NGP with respect to bamboo plantation development.

Table 4.5 - NGP accomplishments on bamboo plantation development

Region	2011		2012		2013		2014		Total	
	Area ¹	PM ²	Area	PM	Area	PM	Area	PM	Area	PM
CAR	34	12,710	98	48,780	677	135,560	103	24,000	911	221,050
Others							12		12	
R 01			4	2,210	528	145,570	192	38,200	724	186,180
R 02	100	4,000		34,000	5	2,400	7	3,500	112	43,900
R 03	176	112,891	1,242	248,412	2,442	490,273	691	143,540	4,551	995,116
R 04A	95	50,500	116	58,000	430	215,143	1,226	245,300	1,867	568,940
R 04B		500			13	6,615	50	10,000	63	17,115
R 05	1	2,560					1,630	326,237	1,631	328,797
R 06				2,465	74	15,076	120	24,040	194	41,581
R 07	23	11,500	1	5,120	867	186,446	840	194,848	1,731	397,114
R 08				100			790	158,016	790	158,116
R 09					145	72,250			145	72,250
R 10				26,220	286	143,029	529	105,800	815	275,049
R 11				1,284	81	40,500			81	41,784
R 12	142	15,276		6,400			534	119,417	676	141,093
R 13		100		20,900			213	53,700	213	74,700
Total	571	210,073	1,461	453,891	5,548	1,452,862	6,937	1,445,998	14,517	3,562,788

¹Area in hectares; ²PM = planting materials

Source: National Greening Program, Forest Management Bureau, DENR

As of December 31, 2014 the NGP has developed 14,517 ha of bamboo plantation, which is 27% of the target. It is expected that additional plantation areas will be developed. It should be noted that 3,562,788 planting materials were used in the 14,517 ha of plantation or an average of 245 planting materials per ha which is higher than the recommended 204 planting materials per ha. At an average price of Php 12 per planting material the total cost so far for this item is Php 42.75 million, which presumably was infused into the local economy. This is excluding the cost of the preparation of the plantation area and plantation maintenance. Production of planting materials as well as preparation of the planting site and actual planting plus maintenance of the plantation (fertilization and weeding) would have generated temporary jobs for upland farmers.

Chapter 5

SWOT ANALYSIS OF THE PHILIPPINE BAMBOO INDUSTRY

SWOT analysis of individual companies was first introduced in the 1960s by Albert Humphrey using data from Fortune's 500 companies (Silva, 2013). He used the technique to analyse the strength (S), weaknesses (W), opportunities open to the various companies (O) and the threats or risks (T) that the companies may be facing. Strength and weaknesses are internal to the company while opportunities and threat are factors that are external to the companies. The technique was used as a tool for various purposes. It is a way of understanding how the company can improve its operations by defining its strengths which it can put to good advantage and understanding its weaknesses so that it can take steps to reduce them. It is a tool for planning. By analysing external factors that have impacts on the company such as opportunities it can position itself to take advantage of these opportunities. The company can plan to avoid or minimize the threats that it is facing or will surely face in its operation.

The viability of a company can be greatly improved by analysing together the company's weaknesses and the impending threats that it is facing. By doing so, the company can identify the risks. On the other hand an analysis of the strengths and opportunities open to the company will direct the actions it will take to improve its performance (Markgraft, 2015).

SWOT analysis can be applied to the Philippine bamboo industry to identify the various strengths and weaknesses internal to the industry so that the strengths can be further enhanced or improved and utilized to great advantage while actions can be taken to reduce or eliminate the weaknesses. There are a myriad opportunities that are open to the bamboo industry players that they can take advantage of. There are at the same time many threats that are impacting on the industry which the industry players can take actions to reduce or eliminate.

5.1 Strengths

Bamboo grows almost everywhere in the country. It is a renewable resource and has high regenerative capacity. Culms mature in 3 to 4 years and can be harvested in a short period of time unlike wood. There is also no need to replant because only the mature culms are harvested and these are renewed every year through the production of shoots. It has myriad of uses spanning all aspects of the life of the Filipino.

The Filipino is very artistic. For this reason Philippine furniture and handicraft designs are very competitive in the world markets. In addition Filipino workers are very skilled and they can turn the furniture and handicraft designs into living work of art well sought-after in foreign countries as well as by local hotel owners. The endless imagination of the Filipino has turned bamboo into a medium of art (carved bamboo butts). Innovative furniture manufacturers now accentuate their products with bamboo carvings.

Filipino craftsmen and artisans can be found throughout the country. The artisan skills of the Filipino are handed down through generations. In addition furniture manufacturers train their workers in carving not only in wood but in bamboo as well. Bamboo carving is more difficult than wood because of its straight grains it easily chips.

Although currently there are only about 8 to 10 species that have found commercial use there are many more species found in the country. Research work is being done to determine their properties

and suitable uses. Many of these species have profitable uses in landscaping, home décor and as ornamental plants.

Although undocumented there are many micro and small enterprises making different bamboo products. These products find use in homes and this market is keeping the industry alive and thriving.

Bamboo can sequester carbon higher than trees can and its root structure is suitable for erosion control. It is also suitable for rehabilitating degraded areas such as mined-out areas because of its ability to absorb heavy metals.

Table 5.1 Strengths and weaknesses of the Philippine bamboo industry

Strengths	Weaknesses
<ol style="list-style-type: none"> 1. Bamboo grows in various habitat in the Philippines 2. It is a renewable resource and has high regenerative ability. 3. It has short gestation period. Only mature culms are harvested and not the entire clump, therefore when managed well there is no need for replanting unlike most timber species. 4. It has many and varied uses, in almost all aspects of the life of the Filipino, including food and nutrient supplement 5. Excellent material for world-class furniture and handicrafts due to its versatility and workability 6. It has very high strength properties because of its cylindrical shape and highly suitable for construction purposes 7. Bamboo as medium for art has stimulated the creativity and imagination of the Filipino artisan 8. Presence of skilled workers 9. Its carbon sequestration capability is higher than wood 10. It has high capability to control erosion and to rehabilitate degraded areas 	<ol style="list-style-type: none"> 1. Inadequate supply to meet the requirements of various bamboo-based industries 2. It deteriorates easily, prone to the attacks of destroying organisms: fungi, beetles and termites and marine organisms when used in marine environment 3. Its cylindrical shape while it is a strength is also a weakness because it needs to be processed for applications where wide materials are needed 4. High cost of production of bamboo products in the country including high labor cost 5. Lack of investors in plantation development as well as in industry development 6. Lack of bamboo development program 7. Lack of industry associations to promote the bamboo industry 8. Machineries used are not suited for bamboo, processing equipment are generally imported.

5.2 Weaknesses

There is a dearth of information on the bamboo industry in the Philippines. For one there is no accurate information of the supply of raw materials. Other aspects of the industry where there is very little information is on number of micro and small enterprises engaged in the manufacture and processing of bamboo, employment, local trade and sales and contribution to the gross domestic product (GDP). Thinking that there is sufficient supply of raw materials many investors ventured into bamboo processing only to find out that there is not enough supply.

A major weakness of the bamboo industry in the Philippines is the inadequate supply of raw materials to meet the requirements of bamboo-based industries. Many factories of engineered bamboo have stopped producing it because of insufficient supply. Many furniture exporters are hesitant to accept orders because of their fear that they may not be able to meet the order because of the problem in the supply of raw culms. Many investors without their own plantations are hesitant to engage in bamboo processing.

Bamboo deteriorates easily. It is prone to the attacks of various organisms such as beetles, fungi, termites and marine organisms. While it's cylindrical shape gives the round pole strength it is also a weakness because it has to be processed into wider boards to produce panels and other products.



Labor cost in the country is high. There is also lack of investors in the establishment of bamboo plantations as well as processing industries. There is also limited number of industry associations to promote the bamboo industry in the country.

While some manufacturers produce high quality engineered bamboo the majority of products are of inferior quality. This makes it difficult to enter into the mainstream construction industry and it leads to low investor confidence. There is need to improve the quality of engineered bamboo as well as traditional furniture and handicraft products.

There is no national program on the bamboo industry. Bamboo projects are fragmented and uncoordinated and therefore the activities are not directed to specific purposes and outcomes. There is need for an institution to coordinate and manage all these projects.

In other countries manufacturing bamboo products which compete with our products in foreign markets provide incentives and support to their industries. In our case there is need for incentives such as tax holidays or rent-free use of public lands for bamboo plantations or insurance coverage of plantations against destructive typhoons and floods.

Many of the machines used by local bamboo processors are not suitable for bamboo since these are basically wood processing machines re-modelled only for bamboo. Generally the productivity of these machines is low and therefore the cost of production is high. For this reason investors with sufficient capital have been importing equipment from China. It is incumbent that the country should invest in the design and fabrication of high capacity processing equipment for bamboo.

5.3 Opportunities

The issuance of EO 879 creating the Philippine Bamboo Industry Development Council (PBIDC) and later the issuance of MC 30 supporting the establishment of a bamboo industry development program provide bases for concerted efforts in industry development. The mandate of DepEd to procure 25% of its desks and chairs made of bamboo creates a big market for furniture manufacturers.

The Land Bank of the Philippines (LBP) and the Development Bank of the Philippines (DBP) have allocated funds for supporting bamboo plantation and processing establishment. There are also government program open to the industry: the Shared Service Facility (SSF) project of DTI, the Micro, Small and Medium Enterprise Technology Program (SET-UP) and the Venture Financing program of DOST are available to bamboo entrepreneurs for procuring technologies to improve their operations.

A number of non-government organizations such as the Philippine Bamboo Foundation, Inc. and Filbamboo are conducting dialogues with LGUs and private organization including corporations on the importance of bamboo as plantation crop for environmental purposes and as raw material for industry. Some organizations are also conducting training on bamboo propagation, nursery and plantation establishment as well as in processing exemplified by Carolina Bamboo Garden in Antipolo, Rizal. Likewise the ERDB and FPRDI are conducting training on bamboo propagation and on utilization, respectively.

There are research institutions in the country that are capable and have been generating technologies and processes for the bamboo industry. The ERDB, the UPLB College of Forestry and Natural Resources (UPLB CFNR) and state universities and colleges (SUCs) have established the protocols for macro-propagation of different species bamboo and the FPRDI and also SUCs have developed processes on the utilization of bamboo as well as equipment for bamboo processing.

The decline of wood resources globally and in the home front has created opportunities for bamboo to replace wood in many uses especially in construction. The large global market allows the Philippines

to produce quality products especially furniture and handicrafts and increase their share in the global markets.

LGUs have started to realize the importance of bamboo in the local economy, creating jobs and employment for local residents. Many have established bamboo development councils and formulated development programs. Ilocos Sur has established a bamboo corridor consisting of the 6 northernmost municipalities of the province with the objectives of creating jobs, increasing income of bamboo farmers and improving the environment through the planting of bamboo.

Bamboo has many attributes that makes it a good instrument for improving the environment and mitigate the adverse effects of climate changes. Its root system has the ability to hold soil intact and prevent soil erosion, high ability to absorb CO₂ from the atmosphere and it is also effective in absorbing heavy metals from the soil especially in mined out areas.

The ASEAN economic integration may be viewed as an opportunity. While competing products will enter the country at low or zero tariff, the products of the Philippines will in turn also enter the market of other ASEAN countries with the same conditions. The entry of products from competing countries will create a situation where local manufacturers should endeavour to improve the quality of their products. Competition brings out the best among competitors.

The Philippines has improved its position as a tourist destination. A strong tourism industry generally improves the market of local products among foreign visitors as well as local tourists. This is expected to improve sales of handicrafts and articles of art made of bamboo.

Table 5.2 Opportunities and threats

Opportunities	Threats
<ol style="list-style-type: none"> 1. Establishment of the Philippine Bamboo Industries Development Council (PBIDC) as promulgated under EO No. 879 and supported by MC No. 30 2. Initiatives in the legislative branch of government to develop the bamboo industry 3. Advocacies of non-government organizations on bamboo development 4. Decline in the wood resources worldwide and locally that provides opportunities for bamboo to replace wood in many uses 5. Technologies such as nursery and plantation establishment, drying and preservative treatment of bamboo expand its uses or strengthens it uses in old applications 6. Development by the research sector of new processes and new products such as engineered bamboo, bamboo pellets, bamboo beer and water, etc. 7. Worldwide value of bamboo business is close US12billion, the Philippines can work for a sizeable share of this market 8. ASEAN integration will promote innovation and efficiency in local bamboo industry in its bid to become competitive 9. The Land Bank of the Philippines and the Development Bank of the Philippines have allocated funds to support development of bamboo plantations and processing industries 10. A few companies are implementing big ticket bamboo projects. 	<ol style="list-style-type: none"> 1. Bamboo products coming from China and neighboring countries at very low prices 2. Most bamboo processing machines are imported as there are no local fabricators of high production machines 3. Bamboo industry workers enticed to work in other countries 4. Government policies are not supportive to the development of the bamboo industry 5. There are no incentives to invest in bamboo plantation development or in pioneering industries 6. There is not enough support for its development from government or from the private sector 7. No specifications for bamboo construction materials resulting in the non-use of bamboo in high-level constructions 8. Many importing countries are now requiring certification of product quality as well as certification that the raw materials came from a sustainable resource



A few companies are now in the process of implementing big ticket projects both in plantation establishment and in bamboo processing. Some large corporations have adopted bamboo plantation development as corporate social responsibility projects.

5.4 Threats

While the ASEAN Free Trade Agreement can be viewed as creating opportunities for the local bamboo industry it also constitutes a threat. At this point in time the low to zero tariffs is disadvantageous to Philippine products given the current quality of local products. The market of high quality furniture and handicrafts is not the ASEAN but European, US and middle-east markets.

Bamboo products coming from China are flooding local markets and can compete effectively against local products because of low prices.

Government policies are not supportive of the industry. Some of these policies are dis-incentives in the establishment of bamboo plantations. Likewise there are no product specifications and this is preventing the use of bamboo in high-level construction.

As stated earlier the country has highly skilled workers. This has not been missed by competing countries and they have started to recruit them to work in foreign countries. Higher pay has lured many local workers to go and work in other countries.

Many foreign markets especially in Europe have started to require exporters to submit certificate of product quality as tested by accredited testing laboratories. They also require certificates that the raw materials came from sustainable sources and not from illegal sources. While this is important in ascertaining that illegal raw materials do not enter into the production system it is a threat because the Philippines still does not have system of certification. It is important that the country establishes this system.

Chapter 6

PROFITABILITY ANALYSIS

Plantation establishment

The multi-sector linkages of the bamboo industry open opportunities for investment and livelihood generation across its value chain. Unlike commercial crops such as coffee and cacao, which are processed only for food, bamboo supplies the food, construction, agriculture, fisheries, handicrafts, and furniture sectors and can supply new sectors with high potential such as the pulp and paper, and biofuel sectors. Aside from a ready market, a mandatory condition that will propel the growth of these sectors and feed their requirement for poles is plantation establishment.

A crucial factor in deciding whether to invest in the processing of higher value bamboo products is the sustainability in the supply of quality culms. This is already an acknowledged barrier that has to be addressed and encouraging the private sector to engage in bamboo plantation development is seen as part of the solution. At present, bamboo plantation establishment is off to a slow start. Naturally growing clumps in private lots and open fields are still the major sources of culms.

The lack of technical know-how in developing a bamboo plantation is no longer a barrier because protocols for its management as well as its financial viability have already been established. Based on the recommended bamboo plantation management PCAARRD (2007) for *kawayan tinik*, the investment needed to develop one hectare is Php 123,000.00. This covers the expenses for equipment and tools and bamboo propagules amounting to Php 18,250.00. The bulk of the initial investment is allotted for working capital (Php 98,400.00) which is needed to pay off labor and buy fertilizers for the plantation's maintenance during the 1st to the 4th year – a period of waiting for the culms to mature and a period of zero sales (Annex 6-1). The balance of Php 6,250 is for land preparation of the plantation site and for replanting.

A well-managed plantation and the application of proper harvesting techniques can yield culms that are straight, with minimal blemish which can thus be sold at a premium. Assuming a farmgate price of Php 90.00 per culm for quality *k. tinik* and a cashflow period of 15 years, the resulting FIRR is 20% (Table 6.1). This is a relatively fair return considering that a small, typical cacao farm has return rates, ranging from 19% to 22%. At Php 65.00 per pole, FIRR goes down to 16%, still higher than a coffee farm, which can yield an IRR of 8% if planted to Arabica and an IRR of 31% if planted to Robusta. Net incomes are also higher for bamboo plantations, ranging from Php 35,000/ha/yr to more than Php 100,000.00/ha/yr (Table 6.2).

Table 6.1 Financial Indicators for a 1 ha. *k. tinik* bamboo plantation

FINANCIAL INDICATORS		
Price per culm	At Php 65.00/culm	At 90.00 per culm
FIRR	16%	20%
NPV	Php 225,000.00	Php 385,173.00
ROI	46%	70%
Average Net Income	Php 35,000.00/ha	Php 100,000.00

Upstream Opportunities

Whether farmers or investors will be enticed to go into bamboo plantation development depends not only on the expected returns to their investment but also on what they perceive to be the present state and future of the upstream industries. These are after all, the markets for their culms. Aside from the traditional markets previously discussed in Chapter 3, new opportunities that will enhance the viability of bamboo plantations are engineered bamboo, bamboo charcoal and light distillate production.

Table 6.2- Summary of financial indicators for alternative investment options.

Investment Options	Investment	NPV (Php)	FIRR (%)	ROI (% per year)	Payback Period (years)	Net Profit Php/year
Bamboo plantation development ^a	Php 123,000.00/ha.	385,173.00 (15 yr period)	20	70	8	86,891.00
Ornamentals ^b	Php 24,210.00	21,466.00	38	8 – 51	2.8	12,560.00
Charcoal & distillate ^c	Php 223,000.00	688,080.00	82	65	2.4	140,204.00
Engineered bamboo planks ^d	Php 7.5 million	14,000,000.00	49	43	5.25	3,400,000.00
Bamboo shoot production	Php 230,000-232,000.00	-	-	-	-	Php 156,000 – 1 M (gross profit)
Coffee ^e						
Typical farm	Php 36,500 – 50,900/ha		8 – 31			Php 23,455.00 – Php 35,790.00 per ha
Modern farm	Php 81,900 – 135,000/ ha		36 – 53			
Cacao ^f	Php 79,000.00 – Php 400,000.00/ ha		19 -22		8 -14 years	Php 25,000.00 – 73,000.00/ha

^aUpdated from, "Profitability Analysis: Bamboo shoot and pole production," Philippine Council for Agriculture, Forestry and Natural Resources Research and Development 2007.

^b Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) Department of Science and Technology 2012

^c Investment Primer on Bamboo Charcoal and Light Distillate Production, FPRDI, 2014

^d Business Plan on the Production of Engineered Bamboo Floor Planks, FPRDI, 2014

^e Towards a Roadmap/Masterplan for the Philippine Coffee Industry (International Benchmarking and Strategic Industry Analysis), 2012

^f Cacao Roadmap, Department of Agriculture, 2012

Bamboo charcoal is highly suitable for producing activated carbon which has many industrial uses. The distillate or "bamboo vinegar" that is collected during carbonization can be sold in its raw form as soil conditioner or skin balm. The bamboo charcoaling kiln has a loading capacity of 90 kg and costs Php 180,000.00. Based on a Php 40.00 per kg selling price for the bamboo charcoal and an Php 80.00 per liter selling price for the distillate, the FIRR is estimated to be 82% and ROI of 65%.

Cultivation of ornamental bamboos is suited for community-based livelihood projects. A start-up scale of 20 plants will require an initial investment of Php 24,000.00 which is easily within reach of small communities. Maximum net profit of Php 12,560.00 per year can be realized starting on the 7th year. The cultivation of ornamental bamboos is financially viable as indicated by an FIRR of 38% and an ROI that ranges from 8% to 51% per year.

Comparison with Coffee and Cacao Plantation Establishment

Coffee – Two species of coffee are being grown commercially in the country: robusta and arabica and the types are typical and modern. The pay back period for the typical robusta is 6.3 years while the typical arabica is 4.9 years. For the modern type robusta the pay back period is 4.3 years while the modern arabica is 4.1 years.



The financial internal rate of return (FIRR) of the two species of coffee are: typical robusta is 8% while the modern robusta is 36%. The typical Arabica has an FIRR of 31% while the modern arabica has an FIRR of 53 per cent.

Cacao – For cacao two situations were analyzed: low cost farming and high cost corporate farming. The low cost farming has a pay back period of 14 year while it is only 8 years for the corporate farming. With respect to internal rate of return (IRR) at farm gate price, the low cost farming has an IRR of only 2.8 while the corporate farming has an IRR of 21.8 per cent. At export parity price, the low cost farming has an IRR of 15.2% while the corporate farming has an IRR of 30.6 per cent.

Annex 6-1

Bamboo Plantation Establishment, 1 hectare

Updated from the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development publication, "Profitability Analysis Bamboo shoot and pole production," 2007.

Bamboo Plantation Establishment (Cont'd)

Assumptions

Yield per ha			
- bamboo culms		1,050	culms
- bamboo shoots		840	piece
Propagules per ha		230	piece
Bamboo clumps per ha		204	clumps
Fertilizer requirement		0.3	kg/clump
		63	kg/ha
Labor requirement			
- land preparation		15	mandays
- planting/ replanting		10	mandays
- fertilizer application		2	mandays
- maintenance (seeding, cleaning, thinning, watering)		48	mandays
- harvesting		48	mandays
No. of years before first harvest		4	
Total Investment	Php	122,906.00	
Loan (70%)	Php	86,034.20	
Equity (30%)	Php	36,871.80	
Selling price of mature culms	Php	90.00	per culm
Cost of bamboo propagule	Php	50.00	per piece
Wage rate	Php	250.00	per manday
Land rental	Php	10,000.00	per year
Working capital	Php	98,406.00	
- Covers capital requirement for fertilizers,			
Wages, for fertilizer application and			
maintenance, land rental and			
depreciation for the first four			
non-earning years			

Investment Cost	
Tools/ Equipment	4,500.00
<i>weighing scale</i>	
<i>shovel</i>	
<i>rake</i>	
<i>grass shears</i>	
<i>water hose</i>	
Propagules	13,750.00
Preparatory activities	6,250.00
<i>Land preparation cost</i>	3,750.00
<i>Planting/ Replanting cost</i>	2,500.00
Working capital	98,406.00
TOTAL INVESTMENT	122,906.00

SUMMARY OF FINANCIAL INDICATORS

NPV	Php 385,173.00
IRR	20.10%
ROI	70%
Payback	8 yrs 1 mo
Average net profit before tax	Php 86,891.00 per ha per year

Bamboo Plantation Establishment (Cont'd)

Annual Production Cost Estimate											
YEAR	0	1	2	3	4	5	6	7	8	9	10
Fertilizer		1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764
Labor											
Fertilizer application		500	500	500	500	500	500	500	500	500	500
Maintenance		12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
							-	-	-	-	-
Overhead											
Lease		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Allowance for tools repair/ replacement			450	450	450	450	450	450	450	450	450
OPERATING COST		24,264	24,714								
Financial costs						7,743	6,449	5,039	3,502	1,826	
Depreciation		1,060	1,060	1,060	1,060	1,060					
TOTAL PRODUCTION COST		25,324	25,774	25,774	25,774	33,517	31,163	29,753	28,216	26,540	24,714

Bamboo Plantation Establishment (Cont')

	86,034	Equity	36,872
Period	5		
Interest rate	9%		
Payment	22,119		

Amortization Schedule

Year	Principal	Interest	Balance
1	14,376	7,743	71,659
2	15,669	6,449	55,989
3	17,080	5,039	38,909
4	18,617	3,502	20,292
5	20,292	1,826	0

Bamboo Plantation Establishment (Cont'd)

Working Capital Requirement

YEAR		1	2	3	4
	TOTALS				
Land lease	40,000.00	10,000.00	10,000.00	10,000.00	10,000.00
Fertilizer	7,056.00	1,764.00	1,764.00	1,764.00	1,764.00
Labor					
- fertilizer application	2,000.00	500.00	500.00	500.00	500.00
- maintenance (seeding, cleaning, thinning, watering)	48,000.00	12,000.00	12,000.00	12,000.00	12,000.00
Allowance for tools repair/ replacement	1,350.00		450.00	450.00	450.00
	-				
TOTAL	98,406.00	24,264.00	24,714.00	24,714.00	24,714.00

Bamboo Plantation Establishment (Cont'd)

Discounted Cashflow Year	0	1	2	3	4	5	6	7	8	9	10
TOTAL CASH INFLOW		0	0	0	0	77,250	103,000	128,750	128,750	128,750	128,750
1. Inflow operation											
Sales revenue		0	0	0	0	77,250	103,000	128,750	128,750	128,750	128,750
TOTAL CASH OUTFLOW	122,906	24,264	24,714	24,714	24,714	24,714	24,714	24,714	24,714	24,714	24,714
2. Increase in fixed assets											
Fixed investments	18,250										
Pre-production expenditures	6,250										
3. Increase in net working capital			0	0							
4. Operating costs		24,264	24,714	24,714	24,714	24,714	24,714	24,714	24,714	24,714	24,714
NET CASHFLOW	-122,906	-24,264	-24,714	-24,714	-24,714	52,536	78,286	104,036	104,036	104,036	104,036
CUMULATIVE NET CASHFLOW	-122,906	147,170	171,884	196,598	221,312	-168,776	-90,490	13,546	117,582	221,618	325,654
NET PRESENT VALUE	385,173										
INTERNAL RATE OF RETURN	20.10%										

Bamboo Plantation Establishment (Cont'd)
Projected Income Statement

Year	0	1	2	3	4	5	6	7	8	9	10
Revenue from sales											
Bamboo poles		-	-	-	-	59,400	79,200	99,000	99,000	99,000	99,000
Bamboo shoots		-	-	-	-	17,850	23,800	29,750	29,750	29,750	29,750
Gross sales		-	-	-	-	77,250	103,000	128,750	128,750	128,750	128,750
Less: Operating Costs											
Fertilizer		1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764	1,764
Labor		12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Total Operating Costs		14,264	14,264	14,264	14,264	14,264	14,264	14,264	14,264	14,264	14,264
Gross Income		(14,264)	(14,264)	(14,264)	(14,264)	62,986	88,736	114,486	114,486	114,486	114,486
Less: Overhead expenses											
Land rental		10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Depreciation		1,060	1,060	1,060	1,060	1,060					
Repair and maintenance		-	450	450	450	450	450	450	450	450	450
Total Overhead		11,060	11,510	11,510	11,510	11,510	10,450	10,450	10,450	10,450	10,450
Net Profit Before Interest		(25,324)	(25,774)	(25,774)	(25,774)	51,476	78,286	104,036	104,036	104,036	104,036
Less: Interest on loan						7,743	6,449	5,039	3,502	1,826	
Net Profit before tax		(25,324)	(25,774)	(25,774)	(25,774)	43,733	71,837	98,997	100,534	102,210	104,036

Annex 6-2

Production of Engineered bamboo Floor Planks

ASSUMPTIONS

- | | | |
|----------------------------|---|--|
| 1. Product | : | Engineered bamboo floor planks, 920 mm x 90 mm
x 15 mm |
| 2. Selling Price | : | Php 190.00 per pc |
| 3. Target market | : | new residential construction,
9% increase from 2014 to 2015, 1 st qrtr |
| 4. Production | : | 8,000 pcs per month
96,000 pcs per year
9,600 sq m, this is <1% share of residential floor
area in 2015 |
| 5. Bamboo pole requirement | : | 1,000 poles per week
48,000 poles per year |
| 6. Price of bamboo poles | : | Php 70.00 per pole |
| 7. Financing | : | loan is 70% of total initial investment
Interest rate, 15%
Discount factor, 10% |

Summary of Financial Indicators

NPV		Php 14 million
IRR		49%
ROI		43%
Payback	1 st qrter, 5 th year	
Average net profit		Php 3.4 million per year

Production of Engineered bamboo Floor Planks (Cont'd)

TABLE A Comparative Construction Statistics		
Second Quarter, 2015 and 2014		
(Details may not add up to total due to rounding)		
Type of Construction	Second Quarter 2015 (April - June)	Second Quarter 2014 (April - June)
TOTAL		
Number	32,974	32,729
Floor Area (sq.m.)	7,046,908	6,212,733
Value (PHP '000)	79,015,280	69,905,942
Residential		
Number	24,543	23,817
Floor Area (sq.m.)	3,946,007	3,613,923
Value (PHP '000)	36,731,063	34,518,511
Non-Residential		
Number	3,956	3,567
Floor Area (sq.m.)	2,881,054	2,384,367
Value (PHP '000)	34,744,239	27,500,794
Addition		
Number	1,298	1,653
Floor Area (sq.m.)	219,847	214,443
Value (PHP '000)	1,960,280	1,855,368
Alteration and Repair		
Number	3,177	3,692
Value (PHP '000)	5,579,696	6,031,267

Production of Engineered bamboo Floor Planks (Cont'd)

Initial Investment

COST ITEMS		Php
Equipment		2,980,000.00
Vehicles		1,500,000.00
Furniture and Fixture		100,000.00
TOTAL FIXED INVESTMENT		4,580,000.00
Pre-operating expense		1,374,800.00
Location/admin expense	128,000.00	
Advertising	1,246,800.00	
Working capital		1,298,237.00
TOTAL START-UP COST		7,253,037.00

Annual Production Cost

	0	1	2	3	4	5	6	7	8
Production program		50%	70%	100%	100%	100%	100%	100%	100%
Raw materials									
bamboo		840,000	2,352,000	3,360,000	3,360,000	3,360,000	3,360,000	3,360,000	3,360,000
glue		48,000	67,200	96,000	96,000	96,000	96,000	96,000	96,000
finishing		312,000	624,000	624,000	624,000	624,000	624,000	624,000	624,000
PU		672,000	940,800	1,344,000	1,344,000	1,344,000	1,344,000	1,344,000	1,344,000
Labor, direct		330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000
Electricity, equipment		30,000	42,000	60,000	60,000	60,000	60,000	60,000	60,000
COGS		2,232,000	4,356,000	5,814,000	5,814,000	5,814,000	5,814,000	5,814,000	5,814,000
Administrative overhead		1,581,500	1,754,000	1,754,000	1,754,000	1,754,000	1,754,000	1,754,000	1,754,000
Salary expenses		690,000	690,000	690,000	690,000	690,000	690,000	690,000	690,000
Benefits		82,500	255,000	255,000	255,000	255,000	255,000	255,000	255,000
Allowances		240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
supplies		40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
utilitites		55,000	55,000	55,000	55,000	55,000	55,000	55,000	55,000
insurance		18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Lease		360,000	360,000	360,000	360,000	360,000	360,000	360,000	360,000
Repair and maintenance		96,000	96,000	96,000	96,000	96,000	96,000	96,000	96,000
Labor for installation of flooring		288,000	403,200	576,000	576,000	576,000	576,000	576,000	576,000
Financial costs		761,569	706,089	642,286	642,286	642,286	642,286	642,286	642,286
Depreciation		23,142	23,142	23,142	23,142	23,142	23,142	23,142	23,142
TOTAL Operating Expenses		3,110,211	3,342,430	3,451,428	3,451,428	3,451,428	3,451,428	3,451,428	3,451,428
Selling and distribution		110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Distribution		110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
Marketing		1,621,853	2,045,837	2,658,053	2,658,053	2,658,053	2,658,053	2,658,053	2,658,053
Advertising		617,333	617,333	617,333	617,333	617,333	617,333	617,333	617,333
Packaging		793,320	1,110,648	1,586,640	1,586,640	1,586,640	1,586,640	1,586,640	1,586,640
Commissions		211,200	317,856	454,080	454,080	454,080	454,080	454,080	454,080



TOTAL	7,074,064	9,854,267	12,033,481	12,033,481	12,033,481	12,033,481	12,033,481	12,033,481
Unit cost	147.38	146.64	125.35	125.35	125.35	125.35	125.35	125.35
Average cost, Php per plank	129.68							

Production of

bamboo Floor Planks (Cont'd)

Engineered

Production of Engineered bamboo Floor Planks (Cont'd)

CASHFLOW	0	1	2	3	4	5	6	7	8
TOTAL CASH INFLOW	5,077,126	10,805,013	15,323,723	21,432,012	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029
Inflow funds									
Total equity	0								
Total loan	5,077,126								
Increase in accounts payable		389,184	173,952	96,983					
Inflow operation									
Sales revenue		10,415,829	15,149,771	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029
TOTAL CASH OUTFLOW	5,954,800	9,593,546	12,653,239	16,166,915	15,755,033	15,755,033	15,755,033	15,755,033	15,755,033
Increase in fixed assets									
Fixed investment	4,580,000								
Pre-production expenditures	1,374,800								
Increase in current assets		1,003,137	543,338	411,882	0				
Operating costs		4,557,500	6,969,200	8,600,000	8,600,000	8,600,000	8,600,000	8,600,000	8,600,000
Marketing costs		1,731,853	2,155,837	2,768,053	2,768,053	2,768,053	2,768,053	2,768,053	2,768,053
Income tax paid		1,169,618	1,853,426	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542
Interest paid		761,569	706,089	642,286	568,913	484,535	387,499	275,908	147,579
Loan repayments		369,869	425,349	489,152	562,525	646,903	743,939	855,530	983,859
SURPLUS (DEFICIT)	-877,674	1,211,468	2,670,483	5,265,097	5,579,996	5,579,996	5,579,996	5,579,996	5,579,996
CUMULATIVE CASH BALANCE	-877,674	333,794	3,004,277	8,269,374	13,849,371	19,429,367	25,009,363	30,589,359	36,169,355

Production of Engineered bamboo Floor Planks (Cont'd)

DISCOUNTED CASHFLOW	0	1	2	3	4	5	6	7	8
TOTAL CASH INFLOW		10,415,829	15,149,771	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029
Inflow operation									
Sales revenue		10,415,829	15,149,771	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029
TOTAL CASH OUTFLOW	5,954,800	8,072,923	11,347,850	14,938,494	14,623,595	14,623,595	14,623,595	14,623,595	14,623,595
Increase in fixed assets									
Fixed investments	4,580,000								
Pre-production expenditures	1,374,800								
Increase in net working capital		613,952	369,386	314,899	0	0	0	0	0
Operating costs		4,557,500	6,969,200	8,600,000	8,600,000	8,600,000	8,600,000	8,600,000	8,600,000
Marketing costs		1,731,853	2,155,837	2,768,053	2,768,053	2,768,053	2,768,053	2,768,053	2,768,053
Corporate tax paid		1,169,618	1,853,426	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542
NET CASHFLOW	-5,954,800	2,342,906	3,801,921	6,396,535	6,711,434	6,711,434	6,711,434	6,711,434	6,711,434
CUMULATIVE NET CASHFLOW	-5,954,800	-3,611,894	190,027	6,586,562	13,297,996	20,009,431	26,720,865	33,432,299	40,143,733
NET PRESENT VALUE	20,941,131								
INTERNAL RATE OF RETURN	68.59%								

Production of Engineered bamboo Floor Planks (Cont'd)

PROJECTED NET INCOME	1	2	3	4	5	6	7	8
Total income								
Sales revenue	10,415,829	15,149,771	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029	21,335,029
Less: variable costs	3,194,520	5,857,704	8,100,720	8,100,720	8,100,720	8,100,720	8,100,720	8,100,720
VARIABLE MARGIN	7,221,309	9,292,067	13,234,309	13,234,309	13,234,309	13,234,309	13,234,309	13,234,309
Less: fixed costs	3,117,975	3,290,475	3,290,475	3,290,475	3,290,475	3,290,475	3,290,475	3,290,475
OPERATIONAL MARGIN	4,103,334	6,001,592	9,943,834	9,943,834	9,943,834	9,943,834	9,943,834	9,943,834
Less: cost of finance	761,569	706,089	642,286	642,286	642,286	642,286	642,286	642,286
GROSS PROFIT	3,341,765	5,295,504	9,301,548	9,301,548	9,301,548	9,301,548	9,301,548	9,301,548
TAXABLE PROFIT	3,341,765	5,295,504	9,301,548	9,301,548	9,301,548	9,301,548	9,301,548	9,301,548
Income (corporate)								
tax	1,169,618	1,853,426	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542	3,255,542
NET PROFIT	2,172,148	3,442,077	6,046,006	6,046,006	6,046,006	6,046,006	6,046,006	6,046,006
ROI, average	63.3%							

Annex 6-3

Bamboo Charcoal and Light Distillate Production

Assumptions

Production per load			
bamboo charcoal		40	kg
distillate		28	li
No. of loads per month		5	loads
Bamboo poles required		90	kg/load
Contract labor	Php	1000.00	per load
Selling price			
bamboo charcoal		45	
light distillate		80	
Amount of loan (70%)	Php	156,030.00	

Summary of Financial Indicators

NPV	Php 688,080.00
FIRR	82%
ROI	65%
Payback	2 yrs, 5 mos
Average net profit	Php 140,204.00

Bamboo Charcoal and Light Distillate Production (Cont'd)

Investment Cost

Fixed Investment		
Building	Php	200,000.00
Equipment		180,000.00
TOTAL FIXED INVESTMENT	Php	180,000.00
2. Pre-operating capital		20,000.00
3. Working capital		22,900.00
TOTAL INVESTMENT	Php	222,900.00

Bamboo Charcoal and Light Distillate Production (Cont'd)

Annual Production Cost Estimate											
PERIOD											
YEAR	0	1	2	3	4	5	6	7	8	9	10
Production program		50%	80%	100%	100%	100%	100%	100%	100%	100%	100%
Bamboo poles		13,500	21,600	27,000	27,000	27,000	27,000	27,000	27,000	27,000	27,000
Repair and maintenance		18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Labor, direct		30,000	48,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
Factory overhead		0	0	0	0	0	0	0	0	0	0
OPERATING COST		61,500	87,600	105,000							
Administrative overhead		0	0	0	0	0	0	0	0	0	0
Financial costs		14,043	11,696	9,139	6,351	3,312					
Depreciation		38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000	38,000
TOTAL PRODUCTION COST		113,543	137,296	152,139	149,351	146,312	143,000	143,000	143,000	143,000	143,000
Packaging		16,200	25,920	32,400	32,400	32,400	32,400	32,400	32,400	32,400	32,400
Marketing overhead		30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
TOTAL COST OF GOOD SOLD		159,743	193,216	214,539	211,751	208,712	205,400	205,400	205,400	205,400	205,400

Bamboo Charcoal and Light Distillate Production (Cont'd)

Loan amount	156,030	Equity	66,870
Period	5		
Interest rate	9%		
Payment	40,114		

Amortization Schedule

Year	Principal	Interest	Balance
1	26,071	14,043	129,959
2	28,418	11,696	101,541
3	30,975	9,139	70,565
4	33,763	6,351	36,802
5	36,802	3,312	0

Bamboo Charcoal and Light Distillate Production (Cont'd)

Discounted Cashflow											
Year	0	1	2	3	4	5	6	7	8	9	10
Production capacity		50%	80%	100%	100%	100%	100%	100%	100%	100%	100%
TOTAL CASH INFLOW		294,000	326,400	348,000	348,000	348,000	348,000	348,000	348,000	348,000	348,000
1. Inflow operation											
Sales revenue		294,000	326,400	348,000	348,000	348,000	348,000	348,000	348,000	348,000	348,000
TOTAL CASH OUTFLOW	200,000	130,600	143,520	167,400	167,400	167,400	167,400	167,400	167,400	167,400	167,400
2. Increase in fixed assets											
Fixed investments	180,000										
Pre-production expenditures	20,000										
3. Increase in net working capital		22,900									
4. Operating costs		61,500	87,600	105,000	105,000	105,000	105,000	105,000	105,000	105,000	105,000
5. Marketing costs		46,200	55,920	62,400	62,400	62,400	62,400	62,400	62,400	62,400	62,400
6. Corporate tax paid		0	0	0	0	0	0	0	0	0	0
NET CASHFLOW	-200,000	163,400	182,880	180,600	180,600	180,600	180,600	180,600	180,600	180,600	180,600
CUMULATIVE NET CASHFLOW	-200,000	-36,600	146,280	326,880	507,480	688,080	868,680	1,049,280	1,229,880	1,410,480	1,591,080
NET PRESENT VALUE	688,080										
INTERNAL RATE OF RETURN	82.21%										

Annex 6-4

Ornamental Bamboo Backyard Production

20 mother plants

Source: Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) Department of Science and Technology 2012

Initial Investment Cost

Capital investment

Mother planting stocks, 20 pcs at Php 600.00/pc	Php 12,000.00
Shovel, 1 pc	200.00

Working capital

Repair (10% of depreciating assets)*	10.00
Utilities, water*	600.00
Management cost*	6,000.00
Materials*	
- Coconut coir, 40 bags, Php 20.00 per bag	800.00
- Potting plastic bags, 40 pcs, Php 15.00/bag	600.00
Labor	
- Planting stock procurement, 20 plants, Php 50.00/plant**	1,000.00
- Outplanting mother plants, 4 mandays, Php 250.00/md**	1,000.00
- Offsetting/potting culm yields, 8mandays, Php250.00/md**	2,000.00
<i>TOTAL WORKING CAPITAL and START UP COSTS</i>	Php 12,010.00

TOTAL INITIAL INVESTMENT	Php 24,210.00
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* 1st cycle, months 1-6

** 1st year

Cost of materials and labor, Yrs 2-10

Materials*	Php
- Coconut coir, 120 bags, Php 20.00 per bag	2,400.00
- Potting plastic bags, 120 pcs, Php 15.00/bag	1,800.00
Labor	
- Planting stock procurement, 20 plants, Php 50.00/plant**	0
- Outplanting mother plants, 4 mandays, Php 250.00/md**	0
- Offsetting/potting culm yields, 24 mandays, Php250.00/md**	6,000.00

Ornamental Bamboo Backyard Production (cont'd)

Projected Income Statement, before tax										
	1	2	3	4	5	6	7	8	9	10
Income from sales	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Gross Sales	24,000									
Less: Production Cost										
Materials										
- Coconut coir dust /garden soil	1,600	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
- Potting plastic bags	22,020	23,420	23,420	23,420	23,420	23,420	23,420	23,420	23,420	23,420
Farm Labor										
- Planting Stock Procurement	1,000									
- Outplanting mother plants	1,000									
- Offsetting/ potting culm yields	4,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Total Production Cost	8,800	10,200								
Gross Income from sales	15,200	25,800								
Less: overhead expenses										
- Repair of equipment and facilities	20	20	20	20	20	20	20	20	20	20
- Utilities expense	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200
- Management cost	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000	12,000
- Depreciation	20	20	20	20	20	20	20	20	20	20
Total overhead expense	13,240									
Net profit (before interest)	1,960	12,560								
Less: interest expense		3,220	2,779	2,254	1,629	885				
Net profit (before tax)	1,960	9,340	9,781	10,306	10,931	11,675	12,560	12,560	12,560	12,560

Ornamental Bamboo Backyard Production (cont'd)

Projected Cashflow, before financing and tax

	0	1	2	3	4	5	6	7	8	9	10
Inflows											
Income from sales		24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000	24,000
Total cash inflow		24,000									
Outflows											
Cashflow from investment activities	24,210										
Production costs		8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800	8,800
Overhead expenses		13,220	13,220	13,220	13,220	13,220	13,220	13,220	13,220	13,220	13,220
Total outflow	24,210	22,020	23,420	23,420	23,420	23,420	23,420	23,420	23,420	23,420	23,420
Net cashflow	-24,210	1,980	12,580	12,580	12,580	12,580	12,580	12,580	12,580	12,580	12,580
NPV	21,466										
FIRR	38%										
Payback	2.8 yrs										

Annex 6-5

Coffee Farm Cash Flows by Variety, Philippines

ITEM	Robusta		Arabica	
	Typical	Modern	Typical*	Modern
Planting density (trees/ha)	850	1,667	800	1,250
Total Investment/Establishment Cost	50,918	81,928	36,520	135,225
Period (Year/s)	1	1	1	1-2
Average maintenance costs				
Materials	21,314	22,572	597	28,144
Labor	20,342	31,733	21,581	19,875
Other costs	6,906	8,839	6,444	16,613
Average Cash Outflow	48,562	63,144	28,623	64,631
Average Yield (kg green beans)	722	1,289	493	1,144
Period (Years)	2-10	2-10	2-10	3-10
Average price (per kg green bean)	80	80	100	200
Average Cash Inflow	57,778	103,111	49,306	228,750
Average Net Cash Flow	9,216	39,967	20,683	164,119
Average Net Cash Flow including return to family labor	23,455	-	35,790	-
Payback period	6.3 years	4.3 years	4.9 years	4.1 years
Financial Internal Rate of Return (FIRR)	8 percent	36 percent	31 percent	53 percent

Source: Towards a Roadmap/Masterplan for the Philippine Coffee Industry, (International Benchmarking and Strategic Industry Analysis), 2012

Annex 6-6

Economics of Cacao Production

Parameters/ Reference	Ave. Farm	CIP-RPOT	NGP-RPOT	NGP- Low cost	High-cost Corporate
Reference	World average	Top 10 average		World average	World highest
Reference Country	All producers	Ivory Coast	Ghana	Indonesia	Guatemala
Reference Yield, kg/ha	470	610	437	411	2,670
Technical					
First flowering, year (yr)	3	3	3	4	2.5
Productive period, yr	20	30	30	30	30
Planting Density, original, tree/ha	1,000	700	1,000	1,100	2,500
Ave yield per tree, kg/tree	1.5	1.1	0.7	0.6	1.4
Ave. productive tree/ha	346	541	734	808	1,930
Average yield, kg/ha	510	560	467	430	2,667
Peak yield, kg/ha	1,120	720	577	522	3,130
Farmer Family					Per ha
Farm size, ha	0.9	1	3	5	1
Production, ave., kg/yr	459	561	467	430	2,670
Farmgate price, PHP /kg	65	75	75	65	75
Ave. cash inflow per family , PHP /yr	19,850	25,305	41,955	73,250	
Labor devoted, man-days (md)/yr	20	40	123	210	82
Financial/Economic					
Ave. establishment cost , PHP /ha		79,625	81,900	113,080	400,000
Ave. production cost, PHP /ha/yr	15,000	28,832	33,520	31,930	110,436
Estimated total production, kg/ha		7,300	6,260	5,157	34,670
Amortization of development cost, PHP /kg	11.00	10.90	13.00	21.73	11.53
Ave. production cost, direct, PHP /kg	32.89	45.20	57.80	43.09	31.26
Ave. total production cost, PHP /kg	43.89	56.10	70.70	64.82	42.79
Payback period, yr		9	8	14	8
IRR at current farmgate price, %		18.6	19.3	2.8	21.8
IRR at export parity price, %		28.9	31.2	15.2	30.6
IRR at import parity price, %		33.0	36.0	19.0	34.3

Source : Cacao Roadmap, Department of Agriculture 2012

Chapter 7

STRATEGIES AND TIMELINES

This Chapter aims to identify the various strategies that will be undertaken by the bamboo industry with the support of government and non-government organizations to achieve the vision, goals and objectives of the industry. It also tries to identify specific activities in the short (2016-2020), medium (2021-2030) and in the long term (beyond 2030) as well as in 2031 to 2035. The duties and responsibilities of various stakeholders are likewise identified.

Table 7.6 shows the summary of strategies and plan of action to achieve the vision, goals and objectives of the bamboo industry of the Philippines.

Micro or large bamboo enterprises have a set of constraints in their operations. In the assessment of the status of the bamboo industry these constraints were identified. These include inadequate raw materials, or need for new technologies, or policies or markets for their products or a combination of these constraints if not all of them. A thorough evaluation of these constraints led to the identification of the strategies needed by government, the industry and various stakeholders to address to make the industry competitive, locally and internationally, and to satisfy its function of becoming the vehicle for inclusive growth as well as an instrument for environmental rehabilitation and for mitigating and adapting to climate change.

The strategies identified for the development of the bamboo industry include the following:

1. Establishment of a reliable institution to shepherd the industry;
2. Establishment of supportive policies;
3. Conduct of inventory of raw material supply, survey of enterprises engaged in bamboo processing including employment in these enterprises, machineries they use, and their contribution to the economy and establishment of a system of managing data and information
4. Development of a sustainable supply of quality raw materials;;
5. Steady input of relevant and cost effective production technologies and new products;
6. Development of high capacity machines and equipment;
7. Training of highly skilled manpower;
8. Establishment of rural based enterprises; and
9. Development of reliable local and international markets.

Data/Information and Management

One constraint in the development of the bamboo industry in the Philippines is the lack of data and information. Investors who would like to invest in the industry are hesitant because of the dearth of information on bamboo, most especially on the data on raw material supply and market. Most of the data on bamboo resources are dated and need up-dating. Many who have ventured into the processing of bamboo products soon found themselves with inadequate raw material supply. Many manufacturers of export handicrafts and furniture are hesitant to even participate in foreign trade fairs because they may not be able to deliver orders due to inadequate raw material supply³⁸.

One reason for the dearth of information on bamboo is the fact that for a long time bamboo has not been given enough official attention it being considered officially as a minor forest product. While it has many uses it has always been under the shadow of wood and wood products. The main reason for

³⁸ Bituin, M. 2015. Furniture manufacturer and exporter. Personal communication. October 21, 2015.

the insufficient/inaccurate data on the bamboo industry in the country is because transactions (harvest, transport, processing and sale of bamboo products) on bamboo seldom become an official transaction. As a result there are no official records of these transactions. A farmer cuts a few culms of bamboo for his own use or for sale and this is not recorded. A micro/small processor of bamboo buys a few culms to produce cages and tepees for fighting cocks as well as bamboo slats and sells these to buyers without the benefit of official receipts and these are not recorded.

Records of bamboo processor can be found in the municipal treasurer's office for those who apply for Mayor's Permit to operate but these are few. Likewise, some records can be found in the Provincial Offices of DTI for bamboo processors who apply for DTI's permit to operate, but these are also few. The Community Environment and Natural Resources Office (CENRO) of the DENR has records of those who seek to have a Certificate of Verification for transport purposes for bamboo culms but these are also few. The statistics of the DENR on bamboo culms produced come from the records of the CENRO and these are greatly underestimated. The reported production of bamboo by DENR in 2013 was only 1,427,985 (FMB, 2013).

Resource inventory - A comprehensive and systematic inventory of bamboo resources especially in bamboo-rich provinces and an equally intensive inventory of bamboo processors and equipment should be conducted to have a reliable data base upon which decisions on investments can be made. The inventory of bamboo processors should include information on raw material requirements (species and volume), prices, employment, markets and other relevant information. When policy makers come to realize that bamboo has a large contribution to the economy in terms of employment, export value and contribution to the gross domestic product (GDP) they may look more kindly to bamboo investors and issue policies supportive to the industry and industry players. The proposed inventory method and estimate of costs of the inventory are shown in Appendix 6.

The results of the inventory of bamboo resources and processors or enterprises and equipment should become the base for a data management system (DMS) for the bamboo industry. The DMS should be managed by a responsible agency or organization. A strengthened Secretariat of the PBIDC could be mandated to take on the responsibility of managing the data. Managing the data would include updating information and providing the information to industry stakeholders.

Plantation Development

Some of the new firms that have ventured in the manufacture of engineered bamboo have closed operation mainly because of insufficiency of raw material supply. While previous surveys reported about 48,000 ha of bamboo resources of the country these areas contain all kinds of species. However, the bamboo processing industries utilize only a few species and this reduces the amount of raw materials available to the industries. In addition, the bamboo clumps found in forest lands are inaccessible making the cost of bringing the culms to manufacturers excessively high.

Most of the current sources of raw materials for industrial use come from clumps in private lands. While they are many these are dispersed and this makes it difficult to consolidate and supply the firms needing the raw materials.

The major solution to this major problem of insufficiency of supply of raw materials is the establishment of bamboo plantations in appropriate locations. Major considerations in planning the establishment of plantations include the following:

1. Market for the bamboo, i.e. industry to be supplied which determines the species to be planted, location of industry which determines the economic distance of the plantation, size or area of plantation (sufficient to supply the requirements of the firm with consideration for expansion of operation)

2. Sources of planting materials, i.e. planting materials could be bought from nurseries or they can be produced by the plantation developer by establishing a nursery.
3. Availability of area for plantation development, for large plantation establishment the areas are basically forest areas but in such cases these would be located at a distance from the factories.

There are a few government programs aimed at improving the raw materials supply situation. The Land Bank of the Philippines (LBP) has allocated PhP 11billion to support stakeholders establish bamboo plantations under its KAWAYAN program (LBP 2015). Likewise the Development Bank of the Philippines has established a PhP 2 billion window where stakeholders who would like to establish bamboo plantations can access capital for development (DBP 2015). The National Greening Program (NGP) of the Department of Environment and Natural Resources (DENR) has targeted 54,416 ha for bamboo plantation establishment (Aquino, 2015) although the basic consideration of the NGP is for rehabilitation of denuded areas and not for commercial purposes. There are other initiatives of the private sector in establishing bamboo plantations.

Bamboo plantation development should be private sector-led. Where areas for development in the uplands are limited the private sector can enter into agreement with forestland tenure holders such as the Community-based Forest Management Agreement People's Organizations (CBFMA-POs) who have over 1.5 million ha allocated to them, and the Indigenous People's (IPs) who have tenure to over 4 million ha of forestlands. Holders of Integrated Forest Management Agreements (IFMA) are allowed to use bamboo for plantation development. These bamboo plantation developers should be provided with fiscal incentives so that they will invest. Furthermore, policies of government should promote rather than constrain private investments in plantation development.

Management of Existing Bamboo Clumps

Currently the major sources of bamboo culms are clumps located in farmers' fields or in backyards in private lands. Most if not all of these clumps are unmanaged and a substantial amount of the culms are of low quality, e.g. crooked, undersized (smaller diameter because of restricted space for growth because the culms are too close to each other). They are also not fertilized. Furthermore, during harvesting a substantial portion, particularly the lower part of the culm, especially *kawayan tinik* is left behind which is a waste of raw materials because the higher quality portion of the culm is not harvested.

A program for training of farmers on proper management of clumps could be a strategy for substantially increasing the volume of high quality raw materials available for the industry. This is also a strategy in increasing the income of farmers in pursuit to President Aquino's social contract of inclusive growth.

The Philippine Bamboo Foundation, Inc. (PBFi) and the Ecosystems Research and Development Bureau (ERDB) of the Department of Environment and Natural Resources (DENR) have been providing training to farmers on the management of clumps.

Research and Products Development

The back bone of a successful industry is the amount of new technologies or products infused into that industry. These new technologies which include processes and procedures and the new products are generated by the research and development sector. So it is also in the bamboo industry.

The research institutions which have been conducting research and development on bamboo planting materials and product processing include the Ecosystems Research and Development Bureau (ERDB) of the Department Environment and Natural Resources (DENR), the UPLB College of Forestry and

Natural Resources (UPLB CFNR), the Forest Products Research and Development Institute (FPRDI) of the Department of Science and Technology (DOST), the Fiber Development Authority (FIDA) of the Department of Agriculture (DA), state colleges and universities. The Philippine Council for Agriculture, Aquatic, Environment and Natural Resources Research and Development (PCAARRD) and the Philippine Council for Industry, Energy and Emerging Technologies Research and Development (PCIEERD) have been providing financial assistance for bamboo research and development.

The identification of research direction was basically the needs of the industry to move forward, either those that promote cost reduction or those that provide new products or uses of bamboo could be the basis for establishing an industry in the rural areas. The following are possible areas for research and development.

Tissue culture for production of planting materials – The traditional methods of producing bamboo planting stocks are culm cutting, branch cutting and use of rhizomes. These processes are slow since the number of planting stocks produced in a given period is few, costly and uses culms that could have been utilized for other purposes. One method of producing planting stocks is through tissue culture. Tissue culture has been used to produce planting materials in crops like bananas and abaca. Tissue culture of bamboo has become the standard procedure for planting stock production in India, Indonesia and Vietnam.

Tissue culture of bamboo has been tried in the Philippines as early as the 1990s at the ERDB and at the Institute of Plant Breeding (IPB) of the UPLB. Three species were studied at ERDB namely: *Gigantochloa levis* (Blanco) Merr. (*bolo*), *Bambusa philippinensis* (Gamble) McClure (*laak*) and *G. atter* (Hassk) Kurz. (*kayali*) in an attempt to establish the protocol for the tissue culture of these species. Only *G. levis* (*bolo*) produced plantlets. The plantlets were not out-planted (Calinawan and Chicano, 1995).

The studies at the IPB were more successful. Plantlets of *G. levis* and *Bambusa bambos* (L) Voos (*India bamboo*) have been induced from nodes using growth hormones (Zamora and Gruezo, 1997). Plantlets of *Dendrocalamus latiflorus* Munro (*Machiku*) have also been regenerated from soft tissues from the internodes of young shoots (Zamora and Gruezo, 1988) while plantlets were regenerated from *D. strictus* (Roxb) Nees (*solid bamboo*) using embryoids from excised embryos (Zamora and Gruezo, 1990). Tissue cultured *D. strictus* had a survival rate of 95% and 100% when out-planted 1989 to 1990 in slightly rolling and flat lands in Bataan and Zambales, respectively. These have grown into mature clumps.

There were no follow-up studies on tissue culture since then. Furthermore the species studied were not the highly commercial species. To reduce the cost of planting stock propagation, produce them at a faster rate, there is need to develop the protocol for tissue culture of highly commercial Philippine bamboo species, namely *kawayan tinik*, *Giant bamboo*, *bulo*, *bayog*, *laak*, *buho*, *kawayan killing* and *kayali*.

Management of bamboo for shoot production - Bamboo shoots are a delicacy throughout the country. They are a common item seen in markets in the rural areas during the rainy season. A survey conducted to determine the species whose shoots are used for food indicated that 7 species are the predominant shoots eaten. These include: *kawayan tinik*, *Giant bamboo*, *bayog*, *kawayan kiling*, *kayali*, *bulo*, and *laak* (Caasi-Lit et al, 2010).

The extraction of shoots is unregulated because there is no information on the amount of shoots that can be collected and shoots that should be left behind to maintain the health of the clumps. This unregulated collection of shoots has been identified as one of the major causes of the degeneration of clumps that lead to the depletion of bamboo culms adversely affecting the supply of bamboo in the country (Virtucio and Roxas, 2003).

This situation has caused some local government units (LGUs) to ban the collection of bamboo shoots. The provincial government of Pangasinan has passed an ordinance on May 3, 1996 banning and penalizing the collection and sale of bamboo shoots in public and private properties (Virtucio and Roxas, 2003). This drastic move may be avoided if only proper management of the clumps is practiced. In fact it has been shown by an initial study of Virtucio and Roxas (2003) that many of the uncollected shoots that appear late in the shoot emergence period die anyway.

While shoot production can be combined with culm production in a given clump with proper management the amount of shoots that can be collected is often not sufficient to support a bamboo shoot processing factory. If the Philippines wants to embark in the production shoots for food and for canning purposes management of bamboo basically for shoot production should be studied thoroughly. Thailand³⁹ and other countries that have established bamboo shoot canning factories and exporting the product have gone into the establishment of bamboo plantations for shoot production. In these operations bamboo culms are the auxiliary products.

Engineered bamboo products – Studies conducted at the Forest Products Research and Development Institute (FPRDI) to compare locally produced and imported engineered bamboo (engineered bamboo) showed that some locally produced engineered bamboo have higher bending strength and stiffness. Furthermore, engineered bamboo produced from *kawayan tinik* and *Giant bamboo* has higher hardness properties (Alipon et al, 2011). This means that quality-wise properly produced local engineered bamboo can compete with imported ones.

However, in the FPRDI study it was also shown that the quality of engineered bamboo produced by various manufacturers is highly variable. This is one of the reasons why locally produced engineered bamboo is not widely used. There is need therefore to standardize the production of engineered bamboo in terms of the following:

1. Age of bamboo by species most suitable for engineered bamboo production;
2. Processing to increase recovery of materials (reduce wastes);
3. Moisture content range of the bamboo materials for glue application;
4. Optimum amount of glue applied for various species (*k. tinik* or *G. bamboo*), type of raw material (slats, crushed or veneer), treated or untreated materials, types of glue and various types of products;
5. Level of pressure applied and duration of gluing to attain highest possible bond strength; and
6. Lathe settings for production of bamboo veneer for engineered bamboo manufacture as they affect the optimum amount of glue applied, to economize on glue, and to attain the highest possible bond strength

Industrial uses of climbing bamboos and lesser used species – Escobin *et al* (2005) listed 16 climbing bamboo found in the Philippines and described 13 of them. There are 3 genera, *Cyrtochloa* (7 species), *Cephalostachyum* (1 species) and *Dinnochloa* (8 species) in the Philippines. Fourteen of these species are endemic to the Philippines and the other two are native to the Philippines and Borneo. Most of the species have limited distribution. *D. oblonga* S. Dransfield, *D. palawensis* (Gamble) S. Dransfield, and *D. robusta* S. Dransfield sp. nov. are found only in Palawan (Natividad, 2010) while *Cyrtochloa puser* (Gamble) S. Dransfield is found mostly in Abra, Ilocos and Cordillera provinces (Lapis and Gonzales, 2012).

Most if not all of the climbing bamboos have small diameter. *C. puser* (puser) has a diameter ranging from 1 to 4 cm (Lapis and Gonzales, 2012). Some species have solid culms while others have hollow culms. Only a few of the climbing bamboos have found uses as components of furniture, handicrafts or parts of ladies' apparel such as handles of handbags. Puser is the raw material of a thriving

³⁹ Tesoro, F. O. 2001. Personal knowledge

handicraft industry in La Paz, Abra. The community is being assisted by the In-Hand Abra Foundation (Lapis and Gozales 2012). The other species used in the production of hats, mats and baskets in Mindoro and Bukidnon provinces is *C. mindorensis* S. Dransf. sp. nov.

According to Virtucio (2008) there are 2,187,288 clumps of climbing bamboos in the country. This number of clumps could provide about 10 M culms annually that could be used as raw materials of handicraft and furniture manufacture.

One of the reasons why climbing bamboos are not widely used is the lack of technical information on these species. Studies on the properties of a few climbing bamboos have been done at the FPRDI. There is a need to widen these studies to include other species of climbing bamboos as well as the lesser used erect species as this will increase the available raw materials of the bamboo industry.

Development of bamboo pole jointing system for structural application – The cylindrical shape of bamboo and its hollow center make it difficult to connect or join one pole to another. This difficulty has been constraining the use of bamboo in round form for structural purposes. An improved and reliable system of connecting poles would certainly increase the uses of bamboo poles. FPRDI is experimenting on a system of connection using metal plates. More studies should be done in this area.

Wastes utilization – Wastes are generated in the course of processing bamboo. During harvesting alone the tops and branches are left behind as wastes. Bamboo leaves are also part of the harvesting wastes. Processing wastes come in the form of trimmings and shavings as well as saw dusts. These wastes increase the cost of the bamboo raw material. Development of products from these wastes would greatly reduce the cost of the raw material as well as reduce cost of waste disposal.

Products from Pyroligneous Liquid - Bamboo is a good source of high grade charcoal when the proper procedure and method are applied. Bamboo charcoal has been used as raw material for activated carbon. In Japan a process for collecting light distillate or pyroligneous liquid (PLL) generated during carbonization had been incorporated in the charcoaling process (Toba, 2000). In Japan the pyroligneous liquid is called bamboo vinegar since it contains a high amount of acetic acid. Japan produces around 160,000 liters of bamboo vinegar annually.

PLL has many uses which include: treatment of allergies and sore throat, as antiseptic, anti-fungi and as bathroom deodorizer (Bisana, 2010). It has also been used as air freshener and deodorizer for pig pens and chicken poultry houses. Laboratory study on the effects of PLL on stain fungi showed encouraging results.

Using a special type of kiln Bisana (2010) was able to generate 313 ml/kg and 238 ml/kg of PLL from *kawayan tinik* and *botong*, respectively. Chemical analysis of the PLL yielded the following (Table 7.1):

Table 7.1 - Chemical composition of pyroligneous liquid from bamboo

Chemical compounds	Kawayan tinik		Botong	
	Top (ppm)	Bottom (ppm)	Top (ppm)	Bottom (ppm)
Acetic acid	26.014	32.662	26.132	32.581
Methanol	39	43.5	39	43
N-propanol	6.5	6.5	7	7
Isoamyl acetate	4.7	4.1	4.6	4.3
Isopropyl alcohol	0.9	0.8	0.9	0.9

The various potential uses of PLL provide opportunities that can be explored by studying further the properties of the liquid and developing chemical products from it such as fungicide, disinfectant, insecticide or preservative, organic fertilizer, and bath soap with fungicidal properties.

Pulp and paper – It is often said that the amount of paper used by a country manifests the level of literacy and of the economic growth of that country. In the past several years the advent of computer and the drive for paper-less business activities have people predicting that this would greatly reduce the consumption of paper that even the increase in population would not be able to off-set. However, the predicted decline in the use of paper did not take place. Table 7.2 shows the increase in the consumption of paper in the country from 2001 to 2010, from 1.45 million tons to 1.834 million tons. It was however estimated that the consumption would have decreased to 1.643 million tons in 2011⁴⁰.

Wood had been the main source of pulp for paper production in the country by the Paper Industries Corporation of the Philippines (PICOP) until its closure in 2010. There are several fibrous materials that could be the raw materials for pulp and paper production. Abaca with its long fibers produces high quality pulp for the production of high quality paper. Another source of long fibers suitable for paper production is bamboo. It is a major raw material for paper production in India. The Bataan Pulp and Paper Mills located in Samal, Bataan was the first and only paper mill in the Philippines that used bamboo as raw materials since 1956 (<http://wikimapia.org/4026191/Bataan-2020-Inc-Samal-Plant-Facility>. September 19, 2015). However, it was forced to close operation when its bamboo plantation flowered and died. One big paper company, Kimberly Clark, is planning to use bamboo as raw material (Manda, 2015).

Although fiber length is not the only criterion for determining suitability of a species for pulp and paper production it is a good indicator. Six bamboo species were tested for anatomical properties (Table 7.3). All the 6 species have fiber length longer than the three industrial tree plantation species from Caraga Region (Alipon et al, 2015). *Falcata* [*Paraserianthes falcataria* (L) Nielsen], in addition to dipterocarp species was the species used by PICOP. The added advantage of bamboo is that there is no need to replant because only culms are harvested from a clump, unlike wood plantations that need replanting once the plantation is harvested.

Table 7.2 - Paper Industry in the Philippines: Current state and background

	2001	2010	2011 Estimate	Historical trend % p.a.
Number of paper mills	43	27	24	
Industry capacity, '000 tons	1,580	1,297	1,100	-3%
Production	1,056	1,038	950	-1%
Imports	533	961	823	+5.4%
Exports	139	165	130	-2.8%
Consumption	1,450	1,834	1,643	+2.2%
Paper and board per capita consumption	16	20	19	+2%

Source: Proposed Roadmap for the Pulp and Paper Industry

The procedures for producing pulp and paper from wood have all been established, except mechanical pulping for the production of newsprint⁴¹. There is a need to adapt these procedures for the pulping of bamboo. However, there are properties of bamboo that need further in-depth study for pulp and paper making such as high silica content particularly in the rind and this needs a procedure to reduce if not remove the silica entirely.

⁴⁰ Proposed Roadmap for the Pulp and Paper Industry.

⁴¹ Torres, A. 2015. Research Specialist. Forest Products Research and Development Institute. October 20, 2015. Personal communication.

Textile products from bamboo –Textiles can be produced from viscose rayon and viscous rayon fiber is produced by treating dissolving pulp with aqueous sodium hydroxide and carbon disulphide

(<file:///D:/Bamboo%20Road%20Map/Viscose%20rayon%20-%20the%20oldest%20man%20made%20ofiber%20-%20versatile%20fiber%20yarn.html>).

China has long been producing textile products from bamboo fibers. In fact it is exporting these products e.g. towels, t-shirts, scarps, socks, sweaters, etc. (Manda, 2015). The research needed is the production of viscous rayon and in producing yarn from the rayon. At the moment no research on this area is being undertaken in the Philippines.

Table 7.3 - Fiber dimension of some Philippines bamboos and wood species

Species	Fiber length, mm	Fiber width, mm	Cell wall thickness, mm
Bamboos			
Kawayan tinik	1.95	0.018	0.007
Giant bamboo	3.78	0.019	0.007
Bulo	1.80	0.027	0.006
Kawayan killing	2.33	0.017	0.004
Bayog	2.16	0.014	0.004
Buho	2.42	0.014	0.006
Industrial Tree Plantation Species ¹			
Falcata [<i>Paraserianthes falcataria</i> (L) Nielsen]	1.112		0.003
Mangium (<i>Acacia mangium</i> Willd.)	1.020		0.003
Yemane (<i>Gmelina arborea</i> Roxb.)	1.149		0.004

Source: Tamolang, F. N. et al. 1957. Fiber dimension of certain Philippine broadleaved woods and bamboos as cited in FPRDI Monograph on Production and Utilization of Philippine bamboos, February 2007.

¹Source: Alipon, M. A., P. A. Alcachupas, E. O. Bondad, M. DR. Ramos, M. M. Dionglay, and E. D. Villanueva. 2015. Wood properties and quality evaluation of industrial tree plantation species (ITPS) in Caraga. Forest Products Research and Development Institute. DOST. (unpublished)

Food, feeds and medicinal products from bamboo shoots –The earliest written record about the benefits of eating bamboo shoots was in the Tang Dynasty (618 AD to 918 AD). The Ming Dynasty (1368 AD – 1644 AD) likewise stated the medicinal benefits. In Japan, bamboo shoots are considered as the “King of Forest Vegetables”⁴² Bamboo shoots are rich in nutrients, minerals and vitamins. It contains dietary fibers (9%), carbohydrates (2%), protein (5%) and calories (1%). Among the minerals bamboo shoots contain are: potassium (15%), manganese (13%), copper (9%) and zinc (7%). Among the vitamins found in bamboo shoots are: vitamin B6 (12%), thiamine (10%), vitamin C (7%) and vitamin E (5%). Bamboo shoots have other health benefits such as: aids in weight loss, reduces risks of cancer, strengthens the immune system, anti-inflammatory properties, improves cardio vascular health, effective against respiratory diseases, and beneficial in controlling cholesterol levels(<http://www.organicfacts.net/health-benefits/other/health-benefits-of-bambooshoots.html>).

With rich nutrients, minerals and vitamins found in bamboo shoots it provides good opportunities for developing “nutraceuticals”. Bamboo shoots have excellent anti-microbial qualities and can be extracted to make capsules and tablets. In India the silicious components found in the shoots are

⁴²<http://www.organicfacts.net/health-benefits/other/health-benefits-of-bamboo-shoots.html> cited by Puzalan, D. Bamboo Food and Beverages, Power Point Presentation, DOST-FPRDI Technology Forum on Bamboo, July 28, 2015. SMX Convention Center

called *banslochan*; in Indo-Persian and Tibetan medicine, it is called *tabashir* or *tawashir*; in English it is called "*bamboo manna*". Shoots of *B.arundinacia*[(Retz.) Willd.]/ *B. bambos* [(L.) Voss]are used in the treatment of diarrhea, thread worm and cough; shoots and dried pith of *D. strictus*[(Roxb.) Nees]contain silicious matter and have tonic and astringent action(Choudbury,et al 2012).

Each region or even province has its own favourite way preparing bamboo shoot dishes. In the Ilocos provinces it is "*dinengdeng*" with *saluyot* (*Corchorus olitorious* L), in the Central Luzon provinces it is "*ginisa*" with chicken bits, "*ginataan*" (or with coconut) and "*adobong labong*". Pickled bamboo shoots are the favourite in other regions such as the Southern Luzon region but "*ginataan*" is also a delicacy. "*Ginatan*" and "*ginisa*" are particularly liked also in the Visaya provinces and in Mindanao (Caasi-Lit et al, 2010).

More sophisticated dishes have been prepared with bamboo shoots. Punzalan (2015) describes several dishes with bamboo shoot ingredients such as the *bambutido*, bamboo seafood pancit, crispy bamboo *pusitos*. Preparations for snacks include: *bambu suman*, sliced bambu and banana, *bambu lumpia* and others.

Other preparation using bamboo shoots that can be explored is producing dried bamboo powder which could be used in the production of instant bamboo soup, extender for wheat flour for production of bread and cakes. Canned bamboo shoots found in groceries around the country are imported. Producing it locally for domestic consumption and for export is a good possibility

Phytochemicals for bamboo preservatives - The greatest objection to the use of bamboo as a construction material is its susceptibility to deterioration by various agencies such as fungi, powder post beetles, termites and marine organisms. Under exposed conditions especially when in contact with the soil it would last only for a few years. Studies in India showed that the service life of bamboo posts buried in the ground was 1-2 years, while those used indoors lasted for 2-5 years, depending on the severity of attack of deterioration agents (Liese, 1959; Purushotham., 1963). In Pakistan, the natural durability of bamboo was found to average 1-3 years under severe conditions of exposure and 4-7 years or longer when used indoors (Liese, 1968). When used indoors under favorable conditions, bamboo has been known to last beyond 10-15 years. Under marine environment, bamboo can last only for about 6 months.

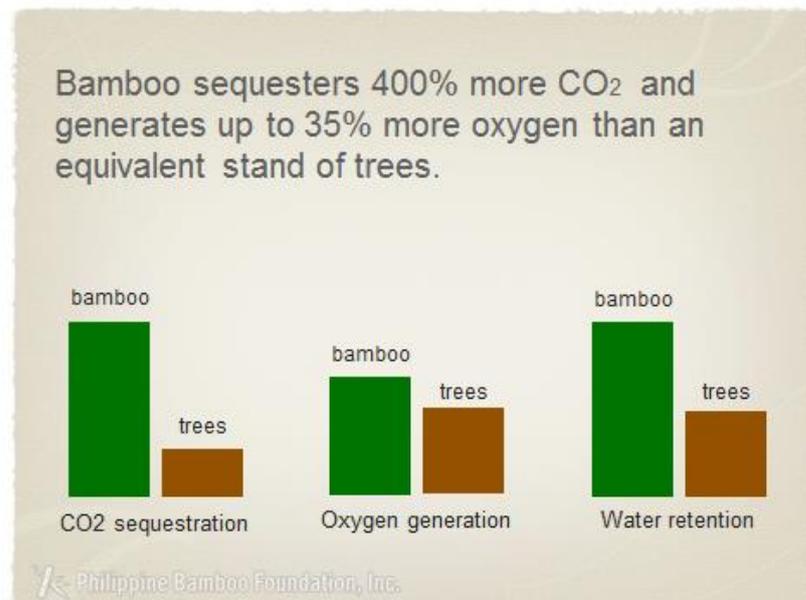
Bamboo is made up mostly of cellulose and it contains large amounts of starch. Cellulose is food to fungi and insects such as termites, while starch is consumed by molds, staining and decay fungi, and beetles. Molds, staining and decay fungi require moisture to be able to attack organic materials such as bamboo. Bamboo contains high amounts of water especially right after harvesting. To make bamboo less susceptible to the attacks of deteriorating organisms, it is necessary to reduce moisture content to about 15 to 18%. Attacks from these organisms can also be reduced by reducing the starch content of bamboo. Against termites and decay organisms it is often not enough to reduce the moisture content since drywood termites can attack cellulosic materials with moisture content as low as 10 per cent. Preservative treatment or the impregnation of toxic chemicals is more effective than just reducing the moisture content of the material.

Preservatives are mostly inorganic and they have lasting negative environment and health effects. A more sustainable type of preservatives is one that comes from plants or phytochemicals. There is very little research done on this area and it needs more attention. At the moment an exploratory research on the preservative properties of a few species including bamboo is being done at the FPRDI. More studies should be done on phytochemicals for preservatives.

Bamboo and the environment – The root system of bamboo has the ability to hold soil and prevent it from being eroded which makes it a good plant species for rehabilitating degraded watersheds. Engineering measures such as wattling, sodding and bench-brush layers using bamboo

have been found effective in reducing soil loss at the surface mine waste dumps at Sto. Nino Mines in Benguet (Costales et al, 1989). *Kawayan tinik* has been studied for its ability to remediate degraded soils by absorbing heavy metals and has been found to be very effective (Tangan and Tomin, 2009).

On climate change, bamboo has been reported to have higher ability to sequester carbon than trees. Manda (2015) reported that bamboo stands can sequester 400% more carbon and can generate 35% more oxygen than an equivalent stand of trees. Bamboo has also higher ability to retain water than trees (Manda, 2015) (Figure 8.1). Umali *et al* (2015) studied the biomass and carbon sequestration of 4 bamboo species namely: *Kawayan tinik*, *Giant bamboo*, *bulo* and *buho*.



Source: Manda, E. 2015. Bamboo: A Promising Agro-industrial Commodity. Power Point Presentation

Figure 7.1. Comparative environmental traits of bamboo and trees

The results are shown in Table 7.4 and 7.5. *Giant bamboo* has the highest biomass content (51.1 kg) while *buho* has the lowest (3.8 kg). The carbon content (in percent) of the four species is more or less the same, ranging from 39.8% (*buho*) to 44.3% (*G. bamboo*). The percentage CO₂ sequestered in the various parts of the bamboo (culm, leaves and branches) ranged from 35.3% (leaves of *buho*) to 46.7% (culm of *G. bamboo*).

Table 7.4 - Biomass and carbon content of four commercial bamboo species

Attributes	Giant Bamboo	Kawayan tinik	Bolo	Buho
Number of sample poles	62	61	60	60
Green biomass (kg)				
Mean	111.8	51.9	42.1	7.9
Range	29.3 -242.5	7.3 – 113.5	13.5-76.3	1.5 – 16.7
Dry biomass (kg)				
Mean	51.1	23.6	19.1	3.8
Range	13.56-118.03	3.06 – 44.02	5.4 – 37.4	0.8 -8.9
Carbon content (%)				
Mean	44.3	43.7	43.2	39.8
Range	33.9 -51.1	26.0 – 47.1	34.3 - 48.1	30.2 - 46.2

Source: Umali, P. A., F. Ociones and N. L. Lantican. 2015. Biomass and Carbon Sequestration of Four Economically Important Bamboo Species in the Philippines Terminal Report ERDB March 2015

Table 7.5 - Carbon sequestration in various parts of four commercial bamboo species

Bamboo species	Total Carbon Sequestered (%)			
	Oven dry	Pole	Leaves	Branches
Giant bamboo	44.3	46.7	40.8	45.5
Kawayan tinik	43.6	44.4	41.4	45.1
Bulo	43.2	46.1	39.9	43.6
Buho	39.8	44.6	35.3	39.5

Source: Umali, P. A., F. Ociones and N. L. Lantican. 2015. Biomass and Carbon Sequestration of Four Economically Important Bamboo Species in the Philippines Terminal Report ERDB March 2015

Two Australian soil scientists, Leigh Sullivan and Jeffrey Parr, from Southern Cross University discovered what they call “plant stones” in the soil beneath decaying bamboo leaves (Peacock, 2008). These are tiny capsules of carbon ‘just like a glass jar that has the carbon inside it and that gets deposited into the soil, it’s very stable, and stays there for thousands of years,” the scientists claimed. This only shows the tremendous role bamboos are playing in mitigating climate change. While there have been studies on the role of bamboo in environmental stabilization and in carbon dioxide sequestration these have been basically on four commercial species.

More studies should be undertaken to document the role of bamboo in preventing/minimizing soil erosion, rehabilitation of degraded watersheds, up-take of heavy metals, carbon sequestration and studies on plant stones.

Vigorous transfer of bamboo technologies

While there are still several areas in bamboo production and utilization that needs to be researched there are already existing technologies that have to be transferred to the industry. These include the established protocol on culm and branch cutting propagation, post-harvest prophylactic treatment against fungi and beetle attack, high pressure sap displacement treatment, furnace type dryer, bamboo veneer lathe, bamboo flattening machine, charcoaling and briquetting technologies and production of pyrolygneous liquid. There are also engineered bamboo processing machines already developed that should be transferred to the processing sector.

Equipment Design and Fabrication

One constraint in the development of the bamboo industry in the country is the inadequacy of high quality locally manufactured bamboo processing equipment. It is not because of lack of efforts to do so but because of the lack of a concerted program to design and fabricate these types of machineries. The Mariano Marcos State University (MMSU) in Batac, Ilocos Norte has designed and fabricated

machines for splitting bamboo poles, surfacing the materials and producing bamboo tiles. Likewise, the Cottage Industries and Technology Center (CITC) has developed similar machines. FPRDI has designed and fabricated a bamboo flattening machine, and a pelletizer. It has been producing machines for charcoaling and briquetting. A pilot equipment for producing high quality charcoal and pyroligneous liquid has been constructed at FPRDI. Earlier it has caused the reverse-engineering of a bamboo veneer lathe⁴³ done by a company in Sta. Rosa City. A basic instrument needed when working with wood and bamboo is a moisture meter. FPRDI has patented a moisture meter and has been supplying the wood and bamboo industries this needed instrument.

A machine shop in Antipolo, Rizal, the Aurelio Woodcraft and Trading has been fabricating and supplying wood and bamboo processing equipment. It has supplied the wood and bamboo processing equipment of the Guevent Investments Development Corporation, Inc. (GIDCI) in Taytay, Palawan⁴⁴. But these shops are few. Large processors of bamboo products still have to import their machines either from Taiwan or from China. CS First Green Agri-industrial Development Corporation has just imported a complete set of equipment for the production of engineered bamboo worth US\$ 1 million from China (Uy, 2015)⁴⁵.

A program to design and fabricate quality bamboo processing equipment should be established with the combined efforts of the private industry and government. The Metals Industries Research and Development Center (MIRDC) of the DOST can assist in the design and in producing prototype machines. Machine fabricators should be provided with incentives such as tax holidays, tax free importation of equipment and materials, to encourage investors to venture into machine design and development. Technical Education and Skills Development Authority (TESDA) should include bamboo machines design and fabrication in its training curricula.

Orienting Policies in Support of Bamboo Industries

A critical factor in the success of an industry in the country is the presence of policies in support of the industry. Among the primary policy issues that must be addressed by government is the fact that bamboo is classified as a forest product. Presidential Decree No. 705, issued in 1975, otherwise known as the “Revised Forestry Code of the Philippines” defined forest products, thus **“Forest product means, timber, pulpwood, firewood, bark, tree top, resin, gum, wood, oil, honey beeswax, nipa, rattan, or other forest growth such as grass, shrub, and flowering plant, the associated water, fish, game, scenic, historical, recreational and geologic resources in forest lands.”** While the Code did not specifically mention bamboo in its enumeration of products such as resins, gums, nipa, rattan, and beeswax it mentions **“grass, shrubs, and flowering plants and geologic resources IN FOREST LANDS” (capitalization supplied)**. A result of this minor forest products classification is that there has been very little support provided for the development of bamboo-based industries. There has never been a policy issuance by the DENR on bamboo unlike that of rattan where DENR Administrative Order No. 1989-04 (DENR, 1989) was issued defining the licensing, disposal and replenishment of rattan resources.

Lately, however, the issuance of EO No. 879 has given a push for the bamboo industry and the mandate of the Department of Education to procure 25% of its public school desks and chairs made of bamboo has provided opportunities for furniture producers (EO 879, 2010). Likewise Memorandum Circular No. 30 issued on May 30, 2012 by President Aquino gave the industry an added boost (MC 30, 2012). Under the National Greening Program (NGP) of the DENR which was established by EO No. 26

⁴³ Roberto Natividad June 26, 2015, personal communication

⁴⁴ Belen, I. 2015. Proprietor of Aurelio Woodcraft and Trading. Personal communication. October 2, 2015.

⁴⁵ Uy, L. 2015. General Manager of CSFAIDC. Personal communication. September 9, 2015.

(EO 26, 2011) issued on February 24, 2011, the program allocated 54,416 ha for bamboo plantation development⁴⁶.

Among the issues that must be given priority attention are the following:

Agency responsible for the development of the bamboo industry – EO No. 879 established the Philippine Bamboo Industry Development Council (PBIDC). It named the Secretary of the Department of Trade and Industry (DTI) as its Chair with membership from various departments, the League of Municipalities and representatives from non-government organizations and private industry organizations. An executive committee was also created to be headed by the DTI Undersecretary for Regional Operations and Development Group (RODG) and likewise a Secretariat, the Bamboo Technical Working Group (TWG) to assist the Executive Committee. The members of the TWG are to be designated by the PBIDC. The Secretariat is to be headed by the Director of the Cottage Industry Technology Center (CITC). The Secretariat is supposed to “identify the gaps in the bamboo industry supply-value chain and determine the most appropriate activities to address this gap”.

The members of the TWG are representatives designated by members of the PBIDC and as such they have primary duties and obligations in their mother agencies in which case they have limited time they can devote to the TWG. The Director of the Cottage Industries Training Center (CITC) has been designated as head of the head of the TWG. Recently, however, the CITC has been abolished as part of the government rationalization.

There are two options of strengthening the institution managing the bamboo industry development: a) one is to establish a new agency mandated to implement the program to develop the bamboo industry or, 2) strengthen the PBIDC Secretariat by providing it permanent personnel and providing it with a regular annual budget through the General Appropriations Act that is sufficient for it to implement its functions.

Strengthening the Secretariat is a more viable option. On August 12, 2015 a Senate Hearing was conducted on 3 senate bills, S. B. No. 300 (Villar, 2013), S. B. No. 915 (Trillanes, 2013) and S. B. No. 1666 (Estrada, 2013) under the Committee on Natural Resources and chaired by Senator Chiz Escudero. The first two bills are very similar and they proposed the creation of a Bamboo and Rattan Center. The third bill proposed the creation of national bamboo and rattan development program. Senator Escudero made it clear during the Senate Hearing that he is opposed to the creation of a new agency but amenable to a bamboo industry development program. A more viable option therefore would be to strengthen the PBIDC Secretariat and this could be sponsored by Senator Bam Aquino in the Senate and an advocate of bamboo in the House of Representatives. A draft bill to strengthen the Secretariat is shown in Appendix 7.

A strengthened PBIDC Secretariat would be tasked to manage the DMS for bamboo in the country.

Establish standards for bamboo planting stock from culm and branch cuttings – One of the main reasons for the rather low survival rates of out-planted bamboo propagules is that the planting materials are not yet ready for out-planting. This is because there are no established standards for bamboo planting materials. Establishing standards for planting materials will result in longer stay of the propagules in the nursery improving their capability to survive when out-planted in the field. However it also increases the price of the planting materials. However, the reduction in mortality and the improvement of the quality of the planting materials will result in higher quality culms and reduction in the cost of processed bamboo products.

⁴⁶Aquino, M. T. 2015. Chief of the NGP Secretariat. Personal communication. July 2015.

Standards for bamboo planting materials should be established, adopted and implemented by the stakeholders. ERDB, UPLB CFNR, State Colleges and Universities, bamboo gardens and nurseries producing planting materials can collaborate to formulate standards for bamboo planting materials.

Establish grading system for bamboo culms/poles – There is no grading system for culms in the country. Prices of bamboo culms for the different species in different regions in the country vary over significant levels. The price of *kawayan tinik* culm may vary from Php 50 to over Php 200. This may have been affected by the supply and demand factor and the labor cost as well as the value attached to bamboo. However on the side of processors they demand a minimum set of quality for their raw materials. The presence of an approved set of standards for the quality of bamboo culms will make procurement prices for processors more stable and predictable.

A draft set of standards for culms for different species have been developed and submitted to the Bureau of Product Standards. However, the proposed standards have not been approved.

Establish specifications for bamboo construction materials and have it adopted in the National Structural Code of the Philippines – The National Structural Code of the Philippines sets the specifications of various construction materials (NSCP, 2001). These are for buildings, towers, and other vertical structures. There are specifications for Structural Concrete, for Structural Steel, for Wood and for Masonry. However, there is none for structural bamboo. Unless the National Structural Code of the Philippines adopts specifications for structural bamboo, it cannot be accepted as a structural material for buildings, towers and other vertical structures.

The first step towards this direction is to establish standards for engineered bamboo. A proposed standards of engineered bamboo is shown in Appendix 8. From there, specifications for minimum quality, design and construction requirements, durability against deteriorating organisms such as beetles, fungi and termites, structural bamboo supporting masonry and concrete, wall framing, floor framing and tiles, exterior wall coverings, interior panelling and sheathing, must be developed and adopted into the National Structural Code of the Philippines. There is therefore a need to develop the specifications and work for its adoption and implementation.

FPRDI can study the mechanical properties of engineered bamboo planks and establish the design specification for the use of these planks in vertical constructions: for columns, beams and trusses. FPRDI can work with the Association of Structural Engineers of the Philippines (ASEP) and the Philippine Institute of Civil Engineers and architects in preparing the specifications for structural bamboo products.

Adopt incentives for establishing bamboo plantations and processing operations – Although bamboo has been used in various applications from construction to furniture to handicrafts to farm and house implements, the bamboo industries can be looked at as in its nascent stage. They need the guidance, assistance and support that government and large corporations can provide. The government can provide some incentives that it has been providing to pioneering industries. The incentives may include the following:

1. Rent-free government lands for bamboo plantation establishment;
2. Tax holidays for plantation development as well as bamboo processing operations;
3. Tax free importation of machineries for bamboo processing (while local machines are being designed and fabricated) as well as other raw materials for production of bamboo products;
4. Low interest loans for bamboo plantation establishment and processing operations (LBP KAWAYAN Program and the DBP bamboo plantation program);
5. Coverage of bamboo plantations under the Philippine Crop Insurance Corporation at low premium; and
6. Unrestricted export of bamboo culms and products at low or zero tariff.

Government can assist plantation development investors identify and allocate suitable forestland areas for bamboo plantation development.

Streamline policies on harvest, transport and sale of bamboo culms and products – As a forest product bamboo is covered by policies of the DENR on the harvest, transport and sale of forest products. Section 4 of DENR AO No. 07 Series of 1994 requires that the transport/shipment of non-timber forest products shall be accompanied or covered by the original Certificate of Non-Timber Forest Products Origin (CNFPO) (DAO 07, 1994). Section 10.5 states that the transport of logs, timber, lumber and other forest products coming from planted trees or non-timber forest products coming from private lands shall be accompanied by a Certificate of Verification (CoV) issued by the CENRO.

The CoV can be issued only if an inventory or inspection of the non-timber forest products had been conducted to verify if the said forest products originated from private lands. This implies that the bamboo clumps or plantations of farmers have to be inspected by the CENRO. In a dialogue between bamboo producers and bamboo processors in Laguna convened by the DTI, many of the farmers complained that it takes time before the CENRO can actually make the inventory and that the CENRO office is quite far and that filing the application for the CoV costs them unnecessary expenses.

A system for registering bamboo clumps and plantations in private lands should be established and implemented to get rid of the need to obtain a Certificate of Verification and instead a Certificate of Ownership (COO) is issued to the owner of the clumps or plantations which should be sufficient as document for the transport of the bamboo culms.

System for Product Certification– In the last decade western markets have been requiring product certification. This refers to processes intended to determine if a product meets minimum standards, similar to quality assurance (<https://en.m.wikipedia.org/wiki/Certification>). In the context of forest products, product certification is a means of providing traceability of the raw materials used in the manufacture of the products. This is basically targeting economies where illegal harvesting is a problem (<https://en.wikipedia.org/wiki/Traceability>).

Full traceability provides:

1. mechanism to comply with local and international policies and regulations and
2. reduce the risk of illegal or non-compliant materials entering the supply chain.

In the context of satisfying foreign markets it is to the advantage of exportable products from bamboo that the country develops, adopts and implements a system of certification.

Social Impact Projects

The Philippine Bamboo Industry Development Roadmap should be designed to promote inclusive growth. This means that the stakeholders that retains the least benefits be provided opportunities to have a larger share of the benefits from the industry. The Social Impacts Projects are aimed to provide these opportunities for inclusive growth.

Establish bamboo-based community enterprises in rural areas – The participation of farmers who own a few clumps of bamboo in their fields or backyards is merely to supply a few culms in the supply chain. When the culms they supply to the chain are aggregated they are actually supplying the greater bulk of the raw materials of the industry. Yet their individual share in the benefits of the industry hardly provides them sufficient income to support their families. The farmers should be given the opportunity to become entrepreneurs themselves.

There are many technologies that have been developed that could be the basis for establishing enterprises in the rural areas where the bamboo farmers are the entrepreneurs themselves. This includes the production of high quality bamboo charcoal, charcoal briquettes, production of some products from bamboo pyrolytic liquid, production of slats for manufacturers of engineered bamboo, bamboo chips for biomass energy, production of barbecue sticks, coffee stirrers, etc.

Actually, the DTI has already begun the process through its Shared Service Facilities Program or SSF program. The program involves what are called Nodes and Hubs. The Nodes undertake primary processing of the bamboo poles by producing bamboo slats. The slats are provided to the Hubs which manufacture them into engineered bamboos for the production of products such as desks, chairs, panels or bamboo lumber. The community can team-up with a furniture exporter to provide semi-processed raw materials such as slats cut to the desired length and width and thickness and treated. The community enterprise can also produce furniture parts for exporters.

There are other government agencies that could provide similar assistance to bamboo farmers. In fact EO No. 879 mandates the Department of Science and Technology (DOST) to provide assistance to bamboo processing through its Small and Medium Enterprises Technology Upgrading Program or SET-UP and its Venture Capital Program under the Technology Application and Promotions Institute.

The DTI program One Town One Product (or OTOP) is another vehicle for community based enterprise development in bamboo rich municipalities. The bamboo products could be the basis for transforming the municipality into a tourism destination. An annual bamboo festival featuring the bamboo products as well as contests and competition that are bamboo-based such as bamboo shoot eating contests, cooking contests using bamboo shoots can be held to generate interests of tourists in visiting the municipality. A concert could also be held with participating bands using instruments made of bamboo.

Gender in the bamboo industries – In Vietnam about 60% of all employees in the bamboo and rattan handicrafts industries are women (Marsh and Smith, undated). Bamboo shoots production is generally male dominated with only about 31% women. In processing it is even between men and women.

The actual number of men and women in the various segments of the bamboo industry in the Philippines is not known. However, through observations women dominate the weaving segments while there are more men doing harvesting and mechanical processing of bamboo. In furniture manufacture women do most of the finishing operations such as patching, sanding and lacquer or varnish application.

To improve the participation of women in various aspects of the bamboo industry there should be a program for training of women in areas where they are traditionally employed and also in areas where men are traditionally employed.

Human resource development (training of labor and up to middle level personnel) – For the industry to provide the highest standards of quality of products from planting stock production, nursery operation, plantation development and management, harvesting and post-harvest operations to processing there is need to train workers in the industry. A training needs analysis should be conducted to establish the training needs of various sectors of the industry.

Currently there are several organizations providing training in various aspects of the industry. In order that the level of learning that trainees obtain is the same there is a need to standardize training modules. The Technical Education and Skills Development Authority (TESDA) must standardize these modules through the formulation of Training Regulations (TR). Training service providers should also be accredited by TESDA.

The Philippine Bamboo Foundation, Inc. in coordination with TESDA is in the process of preparing TR for the approval of TESDA. The TR is on planting stock production, nursery establishment and management and plantation development and management. A TR on bamboo processing will also be formulated.

Promote bamboo in art and architecture – Bamboo has been a part of the culture of the Filipino. Probably the most famous bamboo musical instrument is the Bamboo Organ in Las Pinas City. Other musical instruments have been manufactured such as the bamboo ukulele and flutes. Musical groups such as the Pangkat Kawayan and Kawayan 7 have instruments all made of bamboo. Bamboo has also been made into amplifier for cellphones.

Lately, bamboo has become the medium for carving. With the decline of wood species used in carving, bamboo was introduced to the carvers in Baguio and in Paete, Laguna through the efforts of the Philippine Bamboo Foundation, Inc. (PBFI) President Ed Manda. A bamboo carving contest was sponsored by the PBFI in Asin, Baguio with National Artist Ben Cabrera as chair of the panel of judges. Exquisite works of arts have been produced during that carving contest⁴⁷.

Bamboo as medium for carving has also been introduced to carvers in Paete, Laguna. The material has been accepted by carvers in this town. The carvings in Baguio have ethnic inclinations while those in Paete have religious bent.

Betis Wood Craft of Betis, Pampanga owned and operated by Ms. Myrna Bituin is a producer of high quality furniture. The company is exporting furniture products to the US, EU countries and lately to the Middle East. Betis Wood Craft has incorporated carved bamboo parts in its furniture products with great acceptance from its importers⁴⁸.

One the most famous architectural work done is the Cathedral designed and built by Simon Velez of Columbia (Manda, 2015). The Cathedral was built entirely of bamboo. Other architectural works using bamboo as the main construction material are the Madrid Barajas International Airport in Madrid, Spain; the Parking Garage of the Leipzig Zoo in Germany; the PANACA Theme Park in Costa Rica; the Green School in Bali, Indonesia and many others. Pilipino architects should be encouraged to include bamboo in their architectural designs of edifices and structures. A strong advocate of bamboo in architecture is Architect Bing Encarnacion Tan.

Establish local bamboo industry development programs– Section 7 of EO No. 879 mandates the League of Municipalities of the Philippines to provide coordinative support in partnership with the LGUs for the development of the bamboo industry. The Local Government Units can provide policy and material support for this activity. The Provincial LGU can establish provincial bamboo industry development programs.

A first step toward this end would be the establishment of local bamboo industry development councils (PrBIDC). The PrBIDC can encourage the establishment of the PrBIDC in the provinces by the strengthened Secretariat. The Province of Ilocos Sur has already created the Bamboo Industry Development Council of Ilocos Sur on July 28, 2015. It is the objectives of the Council to promote bamboo industries in the province to provide sustainable livelihood to reduce poverty and to use bamboo to help mitigate global warming. Ilocos Sur has already established a bamboo corridor made up of the 5 northern most municipalities of the province. Vice Governor Deogracias Victor Savellano is a strong advocate of bamboo in the province of Ilocos Sur. There are other provinces that have established bamboo industry development councils.

⁴⁷ Manda, E. 2015. Personal communication

⁴⁸ Bituin, M. 2015. Personal communication.

A possible component of the PrBID program is the establishment of the “bagsakan center” for bamboo poles and products as a strategy for marketing bamboo thus promoting the growth of the industry in the provinces which would redound to the economic benefits of stakeholders.

Market Promotions

In Malaysia there is the Malaysian Timber Industry Board (MTIB). It is a government agency under the Ministry of Plantation Industries and Commodities established in 1973 by an Act of Parliament. The main objective of the MTIB is to initiate development of the various sectors of the timber industry and provide technical, marketing and other forms of assistance to ensure their continued growth within a rapidly industrialising Malaysian economy.

(http://www.mtib.gov.my/index.php?option=com_content&view=article&id=69).

Specifically the functions of the MTIB include the following:

1. To further enhance industrialisation and upgrading of the timber industry with emphasis on value-added processing.
2. To promote and improve the markets and marketing of timber products.
3. To facilitate and strengthen the development of SMEs.
4. To develop and promote standard in quality timber products.
5. To foster orderliness in timber trade.
6. To promote and improve the trade in, and markets for timber, and
7. To assist the timber industries in the marketing of timber;

Support local marketing organizations - The MTIB looks like a good model for promoting and marketing forest products including bamboo products. At the domestic front there is a similar organization assisting industries market their products. The Export Marketing Bureau (EMB) of the DTI although its mandate covers all export products it can provide assistance to bamboo exporters such as information on export procedures and documentation. It also provides business matching between foreign buyers and local exporters. The EMB provides consulting services on market and product opportunities and regulations (EMB, 2015). The programs of the EMB include the following:

1. Philippine Export Competitiveness Program (PECP) – Seminars, information sessions, and activities that give exporters an insight on productivity, innovation and updates on export trade.
2. Doing Business in Free Trade Areas (DBFTA) and Doing Business with the EU using GSP – Information campaign on benefits of the Philippine Free Trade Agreements (FTAs) covering market opportunities, preferential tariffs, rules of origin and customs procedures.
3. Regional Interactive Platform for Philippine Exporters (RIPPLES) – Extends strategic firm level interventions to participating companies to make companies export-ready or to enhance their export capacity and competitiveness.
4. Halal Export Industry Development and Promotion Program – EMB assists Philippine Halal certifiers obtain recognition from various Islamic markets and facilitate SMEs to be halal certified to be able export accepted Halal certified products.

The EMB can enhance its assistance to the bamboo exporters by designing program specifically for the bamboo exporters.

Another organization, an NGO that is assisting exporters is the Philippine Exporters Confederation, Inc. or PHILEXPORT. It is the umbrella organization of Philippine exporters accredited under the Export Development Act (EDA) of 1994. It is a non-stock, non-profit private organization born out of the unification in August 1992 of the Philippine Exporters Foundation and the Confederation of Philippine Exporters(<http://www.philexport.ph/about-philexport>).

It is the function of PhilExport to assist Philippine industries become compliant with standards, regulations and other requirements through related services, learn about the latest policies, trade and market developments and trends through seminars, workshops and information materials, assist industries get connected with international buyers, and assist industries become more competitive by creating their own e-commerce websites.

The government, PhilExport and the industries themselves must continue to work together to promote industries including those using bamboo as raw material, continue to hold trade fairs especially the furniture and handicraft industries, and mount trade missions to promote local industries.

Appendix 9 is a list of outlets and dealers of furniture and housewares as well as handicrafts. Although these firms handle products other than bamboo they serve a very important function of marketing bamboo products thus promoting the bamboo industry.

Establish “bagsakan” centers in communities – A major problem of micro and small bamboo enterprises is market for their products. The common marketing strategy of these enterprises is to display their products at the roadside hoping that motorists will notice their display and buy their products. This is also a problem of bamboo pole producers. Unless they have established buyers owners of bamboo clumps have difficulty selling their products.

A possible alternative to roadside marketing is the establishment by LGUs of “bagsakan centers” where micro, small enterprises and owners of bamboo poles can market their products.

Establish linkages at the provincial level between bamboo pole farmers and processors through the auspices of the DTI and other relevant NGAs – Often buyers and sellers of certain commodities are not connected. This defines the bamboo industry situation in Laguna and many other provinces. In a recent workshop on bamboo convened by the Provincial Office of the Department of Trade and Industry (DTI) where both bamboo culm producers and bamboo processors were invited, the culm producers were complaining that they have the culms but no buyers. On the other hand processors were similarly complaining that they cannot buy culms because there were none to be bought.

This situation accentuates the need to establish linkages between the bamboo pole farmers and processors through the auspices of the DTI provincial office and other relevant National Government Agencies.

Establish an Association of Engineered bamboo Producers – One reason why the construction industry is not incorporating engineered bamboo in their design of buildings particularly in the finishing components such as floors, panels and fixtures is the inadequate information on the product. This stems from the inability of the engineered bamboo component of the bamboo industry to articulate the attributes and properties of engineered bamboo as well as the added social (inclusive growth) and environmental (reduction of soil loss and climate change as well as water conservation) benefits derived from using bamboo products. There is no organization that articulates these benefits. The furniture component of the bamboo industry has the Chamber of Furniture Industries of the Philippines (CFIP) that takes the cudgel for promoting the furniture industry as well as addressing other issues affecting it. A new organization, the Philippine Federation of Furnishings Association (PhilFFA) encompasses producers of furniture and handicrafts as well other types of furnishings.

An organized engineered bamboo industry could also address other issues such as inclusion of engineered bamboo in the National Structural Code of the Philippines, raw material supply (bamboo and adhesives), skills development as well as machineries and product quality standardization. An association of engineered bamboo manufacturers and producers which could include raw materials

suppliers could well be the needed vehicle to propel the engineered bamboo component of the industry to greater heights.

Table 7.6 - Strategies and plan of action

Strategies/programs	2016-2020	2021-2030	2031-2050
Resources information	<ul style="list-style-type: none"> • Inventory and mapping of bamboo resources especially in resource-rich provinces • Inventory of bamboo enterprises • Establishment of data management system including mandating agency responsible for managing data/information on bamboo resources • Inventory of existing bamboo processing equipment, local and imported 	<ul style="list-style-type: none"> • Management of data and information 	<ul style="list-style-type: none"> • Management of data and information
Resources development	<ul style="list-style-type: none"> • Assessment of plantation requirements of industry • Plantation establishment and maintenance of plantations • Enhancement of existing bamboo clumps 	<ul style="list-style-type: none"> • Plantation establishment and maintenance of plantations • Enhancement of existing bamboo clumps 	<ul style="list-style-type: none"> • Plantation establishment and maintenance of plantations • Enhancement of existing bamboo clumps
Research and products development			
<ul style="list-style-type: none"> • Planting material production 	a) Tissue culture on the propagation of commercial bamboo species	a. Commercial production of tissue cultured planting materials	a. Commercial production of tissue cultured planting materials
<ul style="list-style-type: none"> • Management of bamboo for shoot production 	a. Mgnt of existing clumps for shoots and culms b. Mgnt of plnttion for shoot production	a) Disseminate results and train farmers b) Disseminate results, establish bamboo shoots plantations	a) Continue to train farmers b) Continue to manage plantation for shoot production
<ul style="list-style-type: none"> • Engineered bamboo production 	a) Effect of age on properties b) Increase recovery c) Range of MC for glue application d. Amount of glue application e. Level of pressure and duration of pressure f. Lathe settings for veneer production	a. Standardize process of engineered bamboo production b. Disseminate research results to end-users	a. Apply standards
<ul style="list-style-type: none"> • Industrial uses of climbing bamboos and lesser used species 	a. Physical, mechanical and chemical properties of bamboo b. Disseminate results	a. Continue research b. Disseminate results c. Commercialize technologies	a. Continue research b. Disseminate results c. Commercialize technologies
	a. Jointing system for pole to pole jointing and	a. Continue research on jointing system	a. Continue research on jointing system

<ul style="list-style-type: none"> • Development of pole jointing system for structural purposes 	<ul style="list-style-type: none"> bamboo to other materials b. Pilot test results 	<ul style="list-style-type: none"> b. Disseminate results to end-users 	<ul style="list-style-type: none"> b. Disseminate results to end-users
<ul style="list-style-type: none"> • Wastes utilization 	<ul style="list-style-type: none"> a. Modification of processes to reduce wastes b. Study uses of wastes such as chips and pellets for energy, leaves for feeds c. Charcoal and briquettes production from wastes 	<ul style="list-style-type: none"> a. Commercialize results b. Continue research on reducing wastes and products from wastes 	<ul style="list-style-type: none"> a. Commercialize results b. Continue research on reducing wastes and products from wastes
<ul style="list-style-type: none"> • Products from pyroligneous liquid 	<ul style="list-style-type: none"> a) Fungicide, disinfectant, air freshener, organic fertilizer b) Deodorant, bath soap with fungicide 	<ul style="list-style-type: none"> a. Commercialize results b. Continue research on new products from PPL 	<ul style="list-style-type: none"> a. Commercialize results b. Continue research on new products from PLL
<ul style="list-style-type: none"> • Pulp and paper production 	<ul style="list-style-type: none"> a. Pulping properties of different bamboo species with special attention on removal of silica and cutin 	<ul style="list-style-type: none"> a. Pilot test processes of pulping and paper making b. Continue research c. Establish pulp and paper mills 	<ul style="list-style-type: none"> a. Pilot test processes of pulping and paper making b. Continue research c. Establish pulp and paper mills
<ul style="list-style-type: none"> • Textiles from bamboo 	<ul style="list-style-type: none"> a. Research on viscous rayon and textile production from bamboo pulp 	<ul style="list-style-type: none"> a. Establish textile factories b. Continue research on various bamboo species 	<ul style="list-style-type: none"> a. Operate textile factories b. Continue research on various bamboo species
<ul style="list-style-type: none"> • Food/feeds and medicinal products from bamboo shoots 	<ul style="list-style-type: none"> a. Develop new food products from shoots b. Establish process for canned bamboo shoots c. Develop “nutraceuticals” from bamboo shoots d. Develop feed products from bamboo leaves 	<ul style="list-style-type: none"> a. Commercialize new food products b. Continue development of new food products c. Establish canning factories d. Commercialize “nutraceuticals” e. Commercialize feed products 	<ul style="list-style-type: none"> a. Continue to commercialize new food products b. Continue to develop new food products c. Operate new canning factories d. Continue to commercialize “nutraceuticals” e. Continue to commercialize feeds from leaves of bamboo
<ul style="list-style-type: none"> • Preservatives from bamboo light distillate (pyroligneous liquid) 	<ul style="list-style-type: none"> a. Develop preservative from light distillate from bamboo charcoaling 	<ul style="list-style-type: none"> a. Commercialization of new preservative b. Continue research preservative from light distillate 	<ul style="list-style-type: none"> a. Commercialization of new preservative b. Continue research
<ul style="list-style-type: none"> • Environmental stabilization through bamboo 	<ul style="list-style-type: none"> a. Reduction/prevention of soil erosion b. Rehabilitation of degraded watersheds c. Heavy metals absorption d. Climate change mitigation and adaptation e. Discovering “plant stones” in bamboo litter 	<ul style="list-style-type: none"> a. Transfer of technologies to end users b. Continue studies on role of bamboo in environment and climate change 	<ul style="list-style-type: none"> a. Transfer of technologies to end users b. Continue studies on role of bamboo in environment and climate change

<ul style="list-style-type: none"> • Vigorous transfer of existing and new bamboo technologies 	<p>a. Incorporate transfer of existing and new bamboo technologies in national bamboo industry development program</p>	<p>a. Vigorous transfer of bamboo technologies</p>	<p>a. Continue vigorous transfer of bamboo technologies</p>
<p>Equipment Design and Fabrication</p>	<ul style="list-style-type: none"> • Assist designers of bamboo processing equipment • Assist local fabricators of bamboo processing equipment • Promote use of locally fabricated bamboo processing equipment 	<ul style="list-style-type: none"> • Continue to assist designers of bamboo processing equipment • Continue to assist local fabricators of bamboo processing equipment • Continue to promote locally fabricated equipment 	<ul style="list-style-type: none"> • Continue to assist designers of bamboo processing equipment • Continue to assist local fabricators of bamboo processing equipment • Continue to promote locally fabricated equipment
<p>Policy development</p>	<ul style="list-style-type: none"> • Establish an agency responsible for the development of the bamboo industry <ul style="list-style-type: none"> a. A separate agency under DTI or b. Strengthen the PBIDC secretariat with added mandates and personnel and appropriate budget • Establish standards for bamboo planting stock from culm and branch cuttings • Establish grading system for bamboo poles • Establish specifications for bamboo construction materials and have it included in the National Structural Code of the Philippines • Legislate incentives for establishing bamboo plantations and processing operations • Streamline policies on harvest, transport and sale of bamboo poles and products • Require Land Bank of the Philippines and the Development Bank of the Philippines to establish bamboo development assistance to investors and processors • DOST and DTI to provide assistance to bamboo entrepreneurs through 	<ul style="list-style-type: none"> • PBIDC strengthened with additional mandates, personnel and budget • Implement standards for planting stocks from culm and branch cuttings • Implement grading system for bamboo poles • Implement specifications for bamboo construction materials as specified in the National Structural Code of the Philippines • Implement incentives for establishing bamboo plantations and processing operations • Implement new policies on harvest, transport and sale of bamboo poles and products • Vigorous implementation of the LBP and DBP present assistance to the bamboo industry, extend program when necessary • Vigorous assistance from DOST and DTI to bamboo processors • Establishment of provincial bamboo 	<ul style="list-style-type: none"> • Provide support to the strengthened PBIDC • Revise standards if needed, continue to implement standards • Revise grading rules if needed, implement • Implement specifications on bamboo construction materials as prescribed in the NSCP • Continue to implement incentives, re-define them if needed • Implement new policies, revise if needed • Require LBP and DBP to replenish funds to support the bamboo industry, and implement the program • Require DOST and DTI to continue to support the bamboo industry • Provincial governments to continue to

	<p>existing department programs</p> <ul style="list-style-type: none"> • Amend EO No. 879 to require all Provincial LGUs to establish Provincial Bamboo Industry Development Councils (PrBIDC) • Product certification 	<p>industry development programs</p> <ul style="list-style-type: none"> • Implement product certification • Craft and implement policies to encourage carbon credit trading for bamboo plantation establishments 	<p>implement bamboo industry development programs</p> <ul style="list-style-type: none"> • Continue to implement product certification
Social impact projects	<ul style="list-style-type: none"> • Establish bamboo-based community enterprises in rural areas • Promote use of bamboo in art and architecture • Promote women in the bamboo industry, provide appropriate training to women • Human resource development (training of labor including women in the industry) 	<ul style="list-style-type: none"> • Implement bamboo-based community enterprises in bamboo-rich rural areas • Establish programs to promote use of bamboo in art and architecture • Continue to train women in various aspects of the industry • Implement TESDA approved/certified Training Regulations by accredited trainers 	<ul style="list-style-type: none"> • Continue to implement bamboo-based community enterprises in rural areas • Continue to promote use of bamboo in art and architecture • Continue training of women in the industry • Continue to implement TR and revise it if needed
Market promotions	<ul style="list-style-type: none"> • Hold trade fairs for bamboo products • Mount foreign trade missions to promote bamboo products • Establish “bagsakan” for bamboo poles and bamboo products in rural areas • Establish linkages at the provincial level between bamboo pole farmers and processors through the auspices of the DTI and other relevant NGAs • Establish an association of engineered bamboo producers 	<ul style="list-style-type: none"> • Continue to hold trade fairs in various regions • Assist exporters to join foreign trade fairs and also mount trade missions • Continue to operate “bagsakan” in the rural areas • Assist the established linkage to work for the farmers and the processors • Association promotes use of engineered bamboo 	<ul style="list-style-type: none"> • Continue to hold trade fairs in various regions • Assist exporters to join foreign trade fairs and also mount trade missions • Continue to operate “bagsakan” in the rural areas • Assist the established linkage to work for the farmers and the processors • Association continues promotion of engineered bamboo

Chapter 8

A GREENING PROGRAM

The Philippine Bamboo Industry Development Roadmap: A Greening Program

The worsening climate worldwide brought about by climate change requires that government and private sector programs adopt project components that mitigate the sources of climate change. Foremost of these is the increase of carbon dioxide (CO₂) in the atmosphere. The increase in green house gases (GHG) comes from many sources such as vehicle emissions, decimation of forests, land transformation and pollution. The implementation of the Philippine Bamboo Industry Development Roadmap (PBIDRM) is in fact a greening program.

Plantation development

Bamboo absorbs CO₂ from the atmosphere, water and nutrients from the soil and with the energy from the sun produces through the process of photosynthesis carbohydrates for its food. The carbohydrates are used in the building of cell elements and tissues such as fibers. These elements contain carbon and for as long as the bamboo is alive or is produced into products that do not deteriorate, the carbon remains sequestered in the bamboo material.

The PBIDRM proposes the establishment of a total of 69,300 ha (Table 3.39) of bamboo plantations. These would be made up of an average of 204 clumps or a total of 14,137,200 clumps. Lanting et al (2013) estimated that a mature clump would have an average of 34 culms. The total culms in the 69,300 ha would be 480,664,800. The average oven dry weight of *kawayan tinik* is about 25 kg. Taking this as the average value of all the species to be planted the total dry weight of bamboo in the 69,300 ha of plantations would be 12,016,620,000 kg.

In the study of Umali et al (2015) the percentage of carbon sequestered by *kawayan tinik* is 43.6. The percentage sequestered carbon for *giant bamboo* and *bolo* is very similar, 44.3 and 43.2, respectively. For *boho* it was 39.8 percent. The average percentage of carbon sequestered by the 4 species is 42.825 per cent. Using this value of 42.825 per cent, the amount of carbon that will be sequestered by the 69,300 ha of bamboo plantations that are anticipated to be established by the program would be 516,714,660,000 kg or 516.714 million tons. For as long as the bamboo plantations will be managed well and that the number of culms will be maintained the 517 million tons of carbon will remain sequestered in the plantations. This value is only for the standing culms in the 69,300 ha and does not include the carbon sequestered in the tissues of the culms that are annually harvested.

The NGP plantations – Although it is not patently a part of the PBIDRM the planting of bamboo in more than 14,000 ha under the National Greening Program of DENR is a contribution to the greening of the country using bamboo. The plantations developed under the NGP are not for commercial purposes and they were planted as part of the rehabilitation of degraded watersheds, usually in inaccessible areas. As such they would not probably be prey to poaching and illegal harvest. Being so, the carbon sequestered by the bamboo in the plantations will help in the mitigation of emission of CO₂ in the atmosphere.

The bamboo plantations will also reduce soil erosion. The root system of bamboo is so structured that it can hold on the soil tightly, effectively preventing the loss of soil especially during heavy rainfall and flooding. Bamboo likewise absorbs high amount of moisture. The study of Umali et al (2015) cited that the fresh moisture content of *kawayan tinik* can reach as high as 450 per cent, meaning that the weight of water present in the culm is 4.5 times the oven dry weight of the culm especially the younger culms. The ability of bamboo to absorb and store water in its cell cavities and fibers allows it to survive longer



during times of low precipitation. This makes bamboo a good species for the rehabilitation of degraded lands such as mined out areas. Bamboo is also effective in absorbing heavy metals in mining areas.

Waste utilization

One strategy in reducing the cost of manufacture of bamboo products is the minimization of wastes and the utilization of wastes. Any reduction in the use of raw materials redounds to the conservation of the resource. Any culm of bamboo that remains standing because of wastes minimization is a bamboo that continues to absorb CO₂ from the atmosphere and also continues to retain the carbon in its tissues.

The use of wastes as raw materials for the production of other bamboo products such as charcoal and charcoal briquettes also constitutes a resource conservation initiative. It also saves the waste materials from possible burning and the emission of carbon into the atmosphere.

Bio-fuel

The use of bamboo chips and possibly pellets to replace fossil fuel in running boilers for the generation of electricity is a major contribution to reducing the emission of GHG into the atmosphere. Although bamboo also emits carbon to the atmosphere when it is burned as fuel to run boilers, this is lower than carbon emissions of fossil fuel such as coal or bunker oil.

Bamboo in construction, furniture and handicrafts

The production of cement and steel requires large amounts of fossil fuel thereby increasing the emission of GHG into the atmosphere. Some components of construction can be replaced with bamboo products such as panels, floor tiles, columns and beams. Plastic tables and chairs as well as fixtures could also be replaced with bamboo products. The production of plastics and products made of plastics also generates GHG that are emitted into the atmosphere. As non-degradable material, these add to the pollution load of the environment.

Many cities and municipalities in the country have passed resolutions and ordinances banning the use of plastics. These plastic products include tooth picks, food containers, bags, and packaging materials. Many of these products can be replaced with bamboo. Bamboo has long been used for tooth picks. Bamboo veneer has been made into food receptacles and plastic coffee stirrers have been replaced with wood and bamboo.

Healthy environment

Probably the greatest environmental contribution of bamboo is in improving and maintaining the health of people. Bamboo like other plants emits oxygen while it absorbs carbon dioxide. Bamboo plantation enhances the scene with its green color and it is said that green is very pleasing and relaxing to the eyes. It reduces stress that can cause depression and is detrimental to health.

Chapter 9

RECOMMENDATIONS

9.1 Implementation Plan

The success of the bamboo industry development road map rests on a number of factors. Among these are discussed below and they also constitute the preliminary activities in the implementation of the strategies for the development of the bamboo industry in the Philippines.

1. **Strengthening of the PBIDC Secretariat** – The first order of business is to strengthen the PBIDC Secretariat by expanding its mandate, increasing its personnel and providing it sufficient budget. This can be done through an amendment of EO 879 or through the enactment of a law. Concurrent with this, initiatives to amend EO 879 should be made.
2. **Bamboo industry development program** – A parallel activity is the formulation of a bamboo industry development program with the participation of and approval of all stakeholders.
3. **Inventory of bamboo resources, bamboo enterprises, bamboo processing equipment, and economic attributes of the industry** – Bamboo is a plentiful resource that grows throughout the country. If one travels across the country one would be able to observe clumps upon clumps of bamboo. The problem is that there are no reliable statistics of how much there are in a given locality. Many who have ventured into the bamboo industry soon found themselves running out of raw materials. The reason for the dearth of reliable information is that most transactions of micro and small enterprises seldom if ever enter into record books. These transactions are never official and sans receipts.

There are also no records of the number and sizes of micro and small bamboo processing enterprises. Many do not register their operations either with the DTI or with the local government offices. For this reason there is no official record of the value of domestic trade of bamboo and bamboo products. The economic planners do not know how much the industry is contributing to the economy (the GDP), how many persons are employed and the level of skills of the workers. Government cannot therefore collect taxes from these operations.

A very important activity is to conduct a nation-wide inventory of bamboo resources both in public and private lands and geo-tag these resources, inventory of bamboo-based enterprises as well as those participating in its transport and sales, and determine economic attributes of these enterprises.

4. **Realign policies in support of the bamboo industry** – The strengthened Secretariat should work with concerned government offices to achieve the following policies:
 - 4.1 grant tenure to would-be plantation developers in forestlands such as IFMA, SIFMA and other types of tenure;
 - 4.2 adopt clear policies on harvesting, transport and export of bamboo raw materials raised in government and private land;
 - 4.3 establish other modes of verification of ownership and sources of raw materials from private land and eliminate the securing of Certificate of Verification (CoV) from the CENRO;
 - 4.4 provide incentives to investors with fiscal and non-fiscal incentives such as:
 - 4.4.1 rent-free use of forestlands for bamboo plantation establishment;

- 4.4.2 classify plantation development and bamboo processing as pioneering industries and enjoy the benefits of such classification such as tax holidays;
- 4.4.3 tax free importation of machineries/equipment and other materials for bamboo plantation establishment and processing;
- 4.4.4 coverage of bamboo plantations and processing plants under the Philippine Crop Insurance Corporation, and
- 4.4.5 unlimited export of raw bamboo materials.

5. **Establishment of bamboo plantations** – Bamboo plantation establishment should be private sector-led and not the responsibility of government. The responsibility of government is to set the environment for the private sector to engage in plantation development and putting up of processing factories. While the policies are being put in place, and the institution to manage the growth and development of the bamboo industry is being established, advocacy for bamboo plantation establishment and development should be continued and intensified.

The Roadmap has projected that there is need to establish 69,300 ha of plantations of bamboo of different species. Before the first propagule is planted in the ground there are several activities that need to be done:

- 5.1 A critical aspect in the development of plantation is the availability of suitable sites that are accessible and productive. For large plantations the best option would be government lands and negotiations for the lease of these areas have to be made. Another option is that there are tenure holders of government land such as the Community-Based Forest Management Agreement (CBFMA) people's organizations. Plantation developers may form a partnership with these tenure holders. Another group that could provide areas for plantation development are the Indigenous People (IPs) who have titles to their ancestral domains or have tenure to their ancestral land claims. Again an agreement can be negotiated with them.
- 5.2 In most instances the parties that will establish plantations are those who have processing plants and want to assure themselves of a continuous supply of raw materials. Many enterprises are establishing plantations while in the process of establishing their processing operations. For these companies the first step is to determine their immediate requirements for culms and project additional requirements for growth. They then would have to locate areas, most probably government lands that are accessible to their factories and work for permits to use the land. The Secretariat can play a facilitative role in obtaining these permits.
- 5.3 If the plantation developers do not produce their own planting materials they assure themselves of reliable sources of propagules. If they produce their own planting materials they should ascertain that their workers have the expertise or experience in macro-propagation and in managing nurseries. If their workers need capacity building they must link with service providers for the training of their personnel.
- 5.4 Likewise it is necessary that plantations have to be managed well to produce good stock of raw materials. Workers of plantations should have necessary skills to do this, if not, training of personnel should be arranged.
- 5.5 To ensure the production of planting stock of uniform characteristics tissue culture protocols should be developed by the research community and at least three tissue culture laboratories established, one each in Luzon, Visayas and Mindanao.

6. **Management of existing bamboo clumps** – This strategy is basically training of farmers who own a few clumps in their backyards or fields and members of CBFM POs who have bamboo clumps in their areas. The PBFI, the UPLB College of Forestry and Natural Resources, the ERDB, the MMSU, the PASU and other private organizations have been conducting training of bamboo farmers. They should continue to do so but there is need for training funds. This has to be sourced out.

To standardize these training the Training Regulations submitted to TESDA by the PBFI should be reviewed soonest and approved and disseminated to training providers. There is also a need to accredit training providers by TESDA.

7. **Research and Development** - The first order of business here is to plan and **prepare a national research agenda** participated in by all sectors of the industry from the farmers/plantation owners/developers to processors and market promoters. The current program of PCAARRD would be a good starting point including the research programs of other institutions such as the ERDB, UPLB CFNR, SUCs, FIDA, FPRDI and other research institutions. This should be spearheaded by the PBIDC Secretariat. The Research Agenda should be an integral part of the Bamboo Industry Development Program.

Once the program has been formulated and adopted by the bamboo industry funds for its implementation should be sourced out. Research agencies have their own in-house funds for research but of course that is always not enough. PCAARRD and to a certain extent PCIEERD provide research funds on bamboo production and utilization. Foreign funding should also be tapped for the implementation of research such as the ADB, ACIAR, USAID, World Bank, UNIDO, ILO, FAO, INBAR and others.

A good approach would be to have the program legislated on a 5-year period and have it funded by Congress.

8. **Equipment design and fabrication** – The process where the capacity of the equipment and the quality of processed product is crucial is the manufacture of engineered bamboo. Engineered bamboo has many uses and applications: furniture, construction, handicraft, car bodies and other novelty uses. The approach is to determine the step in the process where the productivity of the equipment is the bottle neck. A few of these that can be immediately identified are in thickness planing and squaring of the side of the slats and in assembly and pressing. Hot press is very crucial because using cold-setting glue in the absence of a hot press takes hours or overnight pressing and this considerably lowers the capacity of the factory. There may be other crucial steps in the process of engineered bamboo manufacture where the machine has to be upgraded in capacity.

The technology for building a hot press is not complicated and it can be locally produced. FPRDI was able to commission a company to reverse-engineer a lathe for bamboo veneer production. So it can be done with a hot press or a thickness surfacer or jointer.

MIRDC of the DOST can be commissioned along with a private fabricator to design and produce a prototype machine, pilot-test it in an engineered bamboo factory to straighten out kinks and then fabricate it for the industry. Since this is a product development for an industry this could be funded by DOST through PCAARRD or PCIEERD with the financial assistance of foundations interested in bamboo production like the PETRON Foundation which is the corporate social responsibility (CSR) arm of the company.

Design and prototyping of machineries should be part of the training portfolio of TESDA and the bamboo industry sector should be responsible for preparing the Training Regulations (TR) in cooperation with TESDA. It should also be included in the curricula in industrial engineering courses.

9. **Orienting policies in support of bamboo industries** – The major policies with respect to strengthening the PBIDC Secretariat and on the issue of Certificate of Validation as transport document for raw bamboo culms have been discussed above. The policies discussed below pertain to product standards, and product certification.

9.1 *Standards on planting materials from culms and branches* – Propagators, nurseries, plantation developers and research institutions should work together to formulate a set of standards for planting materials from culms and branches. The greatest assurance that the standard is implemented is when plantation developers will not buy or accept propagules that do not satisfy these standards. The industry should be able to formulate the standards and accepted by the stakeholder particularly buyers of propagules within two years upon implementation of the bamboo industry development program.

9.2 *Grading system for bamboo culms/poles* – One reason why processors have difficulty getting raw materials is the absence of a grading system for culms and poles. Many culms/poles offered for sale are crooked, of different sizes and often immature. A grading system would also set the range of prices for different grades, premium would be given to mature, straight and defect free culms/poles. This would set premium prices for culms coming from well managed clumps and higher returns for farmers who manage their clumps.

The draft grading system for bamboo poles submitted to the Bureau of Product Standards (BPS) should be reviewed by bamboo industry stakeholders both from government and industry and resubmitted for review and approval of the BPS. This should be done within two years after implementation of the Bamboo Industry Development Program.

9.3 *Inclusion of bamboo construction materials in the National Structural Code of the Philippines* – The biggest potential market of engineered bamboo is the construction industry. It is not yet accepted as a structural material because of the absence of design specifications for engineered bamboo structural components. The FPRDI should provide the mechanical and physical properties of engineered bamboo planks and round poles of different bamboo species at various moisture contents for the design of specifications for various applications in vertical components of buildings. It should also provide specifications on preservative treatment loading for protection against destroying organisms such as termites, decay fungi and beetles.

FPRDI should work with the Association of Structural Engineers of the Philippines (ASEP) in formulating the design specifications with the collaboration of the Philippine Institute of Civil Engineers (PICE), the United Architects of the Philippines (UAP) and the Chamber of Real Estates and Builders Association (CREBA). A sponsor of a bill for the inclusion of engineered bamboo in the National Structural Code of the Philippines should be identified in Congress. This should be completed within 3-4 years upon the implementation of the bamboo industry development program.

9.3 *System for product certification* – The Philippines should already adopt a system for product certification for bamboo. This is to ascertain that raw materials came only from legal sources. A certification process would also promote the acceptance of bamboo products by importing countries.

The focal agency for establishment of a system of certification is the DENR. However, the procedure can be formulated by another agency such as the Forestry Development Center (FDC) of the UPLB College of Forestry and Natural Resources in collaboration with FMB of the DENR and the FPRDI and the ERDB.

The system of certification should be in place within 5 years after the start of the bamboo industry development program.

10. **Social impact projects** – The social impact projects are designed to achieve inclusive growth through the bamboo industry.

10.1 *Community-based bamboo enterprises in the rural areas* – Several bamboo rich communities will be selected to be part of the project on the establishment of bamboo-based enterprises. Priority will be given to the communities that are recipients of equipment under the Shared Service Facilities of DTI. For communities that are not part of the SSF project of DTI necessary equipment and facilities for the enterprise will be provided. The type of enterprise to be developed will depend upon resources present, market and resident skills of potential workers of the enterprises. Where skills are deficient workers will be trained in various aspects in the processes of the enterprises.

For those who are not part of the SSF project of DTI other enterprises such as bamboo charcoal, pyroligneous liquid and briquette production will be established. The better quality lump charcoal can be sold as is and the lower grade charcoal can be manufactured into briquettes. The pyroligneous liquid can be sold as such or could be manufactured into easy-to-process chemical products such as anti-bacterial soap.

Funds can be sourced from DOST SET-UP program and Venture Financing program, PCAARRD, LGUs and foreign funding.

10.2 *Gender and Persons with Physical Challenges in the bamboo industry* - The main scope of this component is the upgrading of skills of women and persons with disabilities (PWDs) in the bamboo industry so that they can hold on to their jobs or get promoted to higher paying jobs, provide new skills where they did not have such skills so that they can compete in higher paying jobs, or get promoted to supervisory positions.

The training of women and PWDs should be part of the overall manpower development program of the industry. The training of women and PWDs in the larger corporations will be conducted by the corporations at their own expense. For the other companies the budget for such training will be sourced out from the bamboo industry development program or sourced out from local and international funding agencies.

- 10.3 *Human resources development* – The training of women and PWDs in the industry is a component of the overall upgrading of the skills and knowledge of workers in the industry. The scope of the training will be from production of planting materials through processing and unto marketing and product promotions.

What is important here is that the training modules as well as training service providers should be accredited by TESDA in order that the knowledge imparted to trainees and the skills developed would be uniform. The first step is to identify the training needs of workers in the various aspects of bamboo culm production to processing and unto marketing and products promotion. Training modules (Training Regulations) should then be prepared and approved by TESDA. Service providers should also be accredited by TESDA.

Again large corporations train their own workers and new ones undergo apprenticeship prior to regular employment. Where corporations outsource component parts of their products, workers in the smaller companies are trained by the larger corporations, sort of big-brother-small-brother set up.

While the primary responsibility for the training of manpower is with the enterprises themselves many could not afford to provide such training and rely basically government-funded training. Budget for the training of workers in companies that cannot afford to provide their own training should be sourced out within and outside of the industry.

- 10.4 *Promote use of bamboo in arts and architecture* – The strategy is to train wood carvers in carving of bamboo. The bigger furniture manufacturers train their own people in bamboo carving. Independent wood carvers will be trained to shift to bamboo so that they can continue to have a livelihood and the arts of the people is preserved and remain intact through these carving.

In architecture the use bamboo in the design of structures should be encouraged by making bamboo as part of the curriculum of architectural colleges.

- 10.5 *Establish local bamboo industry development programs* – The approach to this strategy is advocacy. Private and government agencies can collaborate to encourage LGUs to establish local bamboo industry development councils and for the established councils to formulate development programs. The strengthened Secretariat can coordinate seminars in provinces and municipalities especially those that have rich bamboo resources.

11. Market promotions – A crucial component in promoting the bamboo industry is the presence of sustainable markets. It would be difficult to persuade investors if there are no markets of the products that they intend to produce. The industry development program should have an effective strategy for promoting bamboo products locally and internationally.

- 11.1 *Trade fairs* – This is one of the activities promoted by the Bureau of Domestic Trade Promotions (BDTP). This is done at the national and regional levels. It provides local bamboo producers to display their products and buyers can put orders for the products. There are other government agencies that hold trade fairs. The DOST celebrates the annual National Science and Technology Week, usually in the third week of July. Clients of the SET-UP program display their products in part to sell but more to make potential customers aware of their products and the quality of those

products. DOST Regional offices also hold annual trade fairs for similar purposes. One main reason for these trade fairs is to introduce students to what science and innovation can do in the production of goods.

Furniture and handicraft manufacturers hold annual trade fairs usually in Metro Manila and one in Cebu and in Pampanga. Foreign buyers attend these trade fairs with the intention of making orders. DTI, DOST and the industry organizations should continue to hold trade fairs.

- 11.2 *Trade missions* - Exporters of high quality furniture and handicrafts mount their own trade missions. This is possible for manufacturers who can afford the expenses and they are rewarded with substantial orders which would justify the expenses for these trade missions.

In competing countries such as Vietnam, trade missions are supported by their government. The Philippine government should also support trade missions.

- 11.3 *Bagsakan centers*- A crucial component in the bamboo industry in the rural areas is the presence of a sustainable and reliable markets. Many of these micro and small enterprises rely on traditional way of marketing their products by displaying them by the road side for potential buyers to see. Some manufacturers resort to itinerant vending to sell their bamboo products. A more organized strategy for promoting their products would be the establishment of “bagsakan centers” established by LGUs in cooperation with national agencies such as the DTI or the DOST.

- 11.4 *Establish linkages among stakeholder for the promotion of bamboo products* In a workshop held in Calauan, Laguna organized by Laguna DTI among suppliers of raw materials and processors of bamboo products, the bamboo suppliers were saying that they have the bamboo culms but do not have buyers. On the other hand the processors were saying that they want to buy bamboo culms but there is none to buy. This highlights the need to link the suppliers and the buyers. The PBIDC and the DTI should establish a program to link these two parties together for a better bamboo industry.

- 11.5 *Establish an association of engineered bamboo manufacturers* – One reason why the construction industry is hesitant to use engineered bamboo is because of their unfamiliarity with the product. An industry association of producers of engineered bamboo would be the vehicle for a concerted initiative to promote the product to the construction and other related industries.

The strengthened Secretariat of the PBIDC can spearhead the formation of this association which should have membership from both the engineered bamboo producers and users of the product.

9.2 Cost of Implementing the Plan

The total cost of implementing the Philippine Bamboo Industry Roadmap is Php26,335,009,800 over a twenty year period from 2016 to 2035. The details of the implementation costs are shown in Table 9.1. The bases in the estimate/calculation of some of the costs are shown as legends of Table 9.1.

It is interesting to note that there are investors who have invested quite large sums of money in bamboo plantation development as well as bamboo processing. The Bamboo Technology and

Development Park Corporation (BTDP) is already in the process of implementing its plan to develop 15,000 of bamboo plantation. It plans to establish a pulp and paper mill, a textile mill as well as a processing mill for the manufacture of engineered bamboo. The corporation has budgeted Php 15 billion for the entire project.

Another big ticket project is the CS 1st Green Agri-industrial Corporation which intends to develop about 25,000 of bamboo plantation in 8 municipalities in Pangasinan. Currently the corporation is establishing a nursery for the production of planting materials for an initial 250 ha of bamboo plantation. The engineered bamboo processing equipment at a price of US\$ 1 million that it ordered from China arrived in October 2015 and will be installed in its factory in Aguilar, Pangasinan. The corporation has budget Php 6 billion for the entire project.

The Land Bank of the Philippines (LBP) has allocated Php 11 billion for bamboo plantation development and for the establishment of processing operations. On the other hand the Development Bank of the Philippines (DBP) has allocated Php 2 billion for forest plantation including bamboo as the plantation crop. The Guevent Investment Development Corporation (GIDC) has established 10 ha of *kawayan tinik* and 4 ha of *giant bamboo* plantations in Taytay, Palawan. It is also in the process of establishing a processing mill for engineered bamboo. It is estimated that the plantations and the processing mill cost the corporation Php 16 million.

Petron Corporation plans to establish a 300 ha bamboo plantation in Bataan at a cost of Php 10 million.

The total planned investments in the bamboo industry of planned and on-going projects is estimated at Php 34.076 billion which is much higher than the estimated cost of Roadmap implementation of Php 26.335 billion.

Part of the cost of implementation will come from the appropriations of the concerned agencies. For example part of the cost of implementing bamboo research will come from the research funds of research institutions such as FPRDI and ERDB as well as State Universities and Colleges (SUCs). PCAARRD and PCIEERD will most likely continue to fund researches on bamboo. On manpower development the larger companies will train their own workers. It may be necessary to generate funds for the training of farmers in macro propagation of planting materials as well as management of their existing bamboo clumps.

The sustained implementation of the Roadmap needs the strengthening of the Secretariat of the Council which will oversee the said implementation.

Table 9.1 - Implementation Plan (Estimates of cost)

Strategy	Activity	2016-2020	2021-2025	2025-2030	2031-2035	Total
Institutional development	<ul style="list-style-type: none"> Amendment of EO 879 Additional manpower & budget 					
Resource survey	<ul style="list-style-type: none"> Survey of plantations & existing clumps Survey of enterprises Data management 	15,597,000 3,697,000	5,000,000	5,000,000	5,000,000	Php 15,597,000 Php 3,697,000 Php 15,000,000
Resource development	Plantation establishment <ul style="list-style-type: none"> Culm production Shoot production 	16,300 (ha) P2,003,367,800 50 (ha) Php 5,900,000	21,000 ha P2,581,026,000 75 ha Php 8,850,000	21,000 ha P2,581,026,000 150 ha Php 17,700,000	11,000 ha P 1,351,966,000 200 ha Php 23,600,000	69,300 ha P 8,517,385,800 475 ha Php 56,050,000

	<ul style="list-style-type: none"> • Training on management of existing clumps, 1,000 trainees/year @ Php 4,000/pax • Establishment of tissue culture laboratory, 4, 2 in Luzon, 1@ in Visayas & Mindanao 	Php 20,000,000	Php 20,000,000	Php 20,000,000	Php 20,000,000	Php 80,000,000
		Php 40,000,000	Php 5,000,000	Php 5,000,000	Php 5,000,000	Php 55,000,000
Research & products development	Amount for direct research undertaken by agencies, SUCs @ Php 100 M/year	P500,000,000	P500,000,000	P500,000,000	P500,000,000	P2,000,000,000
Design & fabrication of equipment & machines		P25,000,000	P25,000,000	P25,000,000	P25,000,000	P100,000,000
Policy development & advocacy	<ul style="list-style-type: none"> • Policy development • Advocacy @ Php 5 M/year 	P25,000,000	P25,000,000	P25,000,000	P25,000,000	P100,000,000
Social impact projects	<ul style="list-style-type: none"> • Community-based enterprises, 1,000 communities @ Php 10 M each • Promote bamboo in arts and architecture (included in Advocacy) • Promote women in industry (included in manpower development) • Manpower development <ol style="list-style-type: none"> 1. Propagation , nursery, plantation 4,070 trainees/@ Php 4,000/pax¹ 2. Processing, various aspects, 20,000 pax @ Php 4,000/pax² 3. Bamboo carving, 2,000 trainees @ Php 4,000/pax 	P2,500,000,000	P2,500,000,000	P2,500,000,000	P2,500,000,000	P10,000,000,000
		1170 pax P4,680,000	1,425 pax P5,700,000	1,400 pax P5,600,000	75 pa P300,000	4,070 pax P16,280,000
		2,000 pax P8,000,000	6,000 pax P24,000,000	6,000 pax P24,000,000	6,000 pax P24,000,000	20,000 pax P80,000,000
		500 pax P2,000,000	500 pax P2,000,000	500 pax P2,000,000	500 pax P2,000,000	2,000 pax P8,000,000

Strategy	Activity	2016-2020	2021-2025	2025-2030	2031-2035	Total
Marketing and promotions	<ul style="list-style-type: none"> • Trade fairs Industry DTI 					

	DOST, Php 400k/R/yr 16 R + NSTW • Trade missions • Pagsakan centers, 1,000, @ Php 5M • Media promotions	P62,000,000 P5,000,000 100 centers P500,000,000 P5,000,000	P62,000,000 P5,000,000 300 centers P1,500,000,000 P5,000,000	P62,000,000 P5,000,000 300 centers P1,500,000,000 P5,000,000	P62,000,000 P5,000,000 300 centers P1,500,000,000 P5,000,000	P248,000,000 P20,000,000 1,000 centers P5,000,000,000 P20,000,000
Total Cost						P 26,335,009,800
Investments						(Php)
	LBP					11,000,000,000
	DBP (part of it)					2,000,000,000
	CS1st Green Agri-industrial					6,000,000,000
	DENR-DND					50,000,000
	Petron Corp					10,000,000
	Guevent Investment Development Corp					16,000,000
	Bamboo Technology & Development Park					15,000,000,000
Total Investment						Php34,076,000,000

¹75 nurseries to be established, 15 personnel/nursery; 3 personnel/ha of plantation management;

²1,000 processing plants, 20 trainees/plant

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ACRONYMS

AFTA	ASEAN Free Trade Agreement
ASEAN	Association of South East Asian Nations
ASEP	Association of Structural Engineers of the Philippines
BAC	Berris Agricultural Corporation
BDTP	Bureau of Domestic Trade Promotions
BOI	Board of Investments
CAR	Cordillera Administrative Region
CER	Certified Emission Reduction
CITC	Cottage Industry Technology Center
CoV	Certificates of Verification
CBFMA	Community Based Forest Management Agreement
CENRO	Community Environment and Natural Resources Offices [DENR]
CFIP	Chamber of Furniture Industry of the Philippines
CNIS	Comprehensive National Industrial Strategy
CREBA	Chamber of Real Estates and Builders Association
CSFGADI	CS First Green Agri-Industrial Development, Inc.
DBP	Development Bank of the Philippines
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DND	Department of National Defense
DMS	Data Management System
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
EIFSI	Euro Integrated Farms & Supply, Inc.
EMB	Export Marketing Bureau [Department of Trade and Industry]
EO	Executive Order
ERDB	Ecosystems Research and Development Bureau [Department of Environment and Natural Resources]

ERDS	Ecosystems Research and Development Service [DENR]
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FIRA	Furniture Industry Research Association
FRA	Forest Resources Assessment
FDC	Forestry Development Center [UPLB College of Forestry and Natural Resources]
FPRDI-DOST	Forest Products Research and Development Institute [Department of Science and Technology]
FMB	Forest Management Bureau [Department of Environment and Natural Resources]
GHG	Green House Gases
GIDCI	Guevara Investment and Development Corporation, Inc.
GWh	Giga Watt hour
IFMA	Integrated Forest Management Agreement
IFMP	Integrated Forest Management Program
IKM	Ilo-ilo Kawayan Marketing
INBAR	International Network for Bamboo and Rattan
ISO	International Standards Organization
ISTA	International Safe Transit Association
IIT	Iligan Institute Technology [MSU]
KAWAYAN	K Alikasan Kabuhayan sa W Astong Pama YAN an [Land Bank of the Philippines]
kWH	kilo Watt Hour
LBNP	Lubao Bamboo Nature Park
LBP	Land Bank of the Philippines
LGC	Local Government Code
LGU	Local Government Unit
LLDA	Laguna Lake Development Authority
LTO	License to Operate [FDA]
MFBEA	Mindanao Farmers and Banana Exporters Association
MC	Memorandum Circular
MIRDC	Metals Industry Research and Development Center [Department of Science and Technology]
MMSU	Mariano Marcos State University

MOA	Memorandum of Agreement
MSME	Micro Small and Medium Enterprises
MSU	Mindanao State University
MTIB	Malaysian Timber Industry Board
MW	Mega Watt
NCR	National Capital Region
NFTC	National Furniture Testing Center
NGP	National Greening Program
NSCP	National Structural Code of the Philippines
OTOP	One Town One Product
OWL	Other Wooded Lands
PASu	Protected Area Supervisor
PASU	Pampanga Agricultural State University
PBIDC	Philippine Bamboo Industry Development Council
PCAARRD	Philippine Council for Agriculture, Aquatic, Natural Resources Research and Development [DOST]
PCIEERD	Philippine Council for Industries, Energy and Emerging Technologies Research and Development [DOST]
PDP	Philippine Development Plan
PECP	Philippine Export Competitiveness Program
PENRO	Provincial Environment and Natural Resources Offices [DENR]
PHILEXPORT	Philippine Exporters Confederation, Inc.
PhilFFA	Philippine Federation of Furnishings Association
PICE	Philippine Institute of Civil Engineers
PICOP	Paper Industries Corporation of the Philippines
PIDS	Philippine Institute of Development Studies
PNRI	Philippine Nuclear Research Institute [DOST]
PNS	Philippine National Standards
PWD	Persons with Disability
PWPA	Philippine Wood Producers Association
RA	Republic Act

RIPPLES	Regional Interactive Platform for Philippine Exporters
RODG	Regional Operations and Development Group
SAFRADAP-MPC	San Francisco Association of Differently Abled Persons Multi-purpose Cooperative
SET-UP	Small and Medium Enterprise Technology Upgrading Program [DOST]
SIFMA	Socialized Integrated Forest Management Agreement
SPAI	Strategic Partners & Alliances, Inc.
SSF	Shared Service Facilities
SUCs	State Universities and Colleges
SWOT	Strength, Weaknesses, Opportunities and Threats
TAPI	Technology and Promotions Institute [DOST]
TESDA	Technical Education and Skills Development Authority
TPFP	Tree Plantation Financing Program [DBP]
TR	Training Regulations [TESDA]
TWG	Technical Working Group
UAP	United Architects of the Philippines

Appendices

Appendix 1

Bamboo Furniture Production in Misamis Occidental

By Carolyn Marie C. Garcia, Rico J. Cabangon,
Pedrito Q. Lontok and Monina Cheska L. Castro

The project “Technology Transfer of the Kiln Dryer, Preservation and Finishing Facilities in Region X” aims to introduce technologies that will eventually lead to the development of a competitive bamboo industry in the province. To provide a perspective for project implementors, an initial appraisal of the bamboo industry in the province was conducted with the assistance of the DTI and the DOST Provincial S & T Center (PSTC) located in Oroquieta.

The Project Site and Respondents

Misamis Occidental in Northern Mindanao is composed of 14 municipalities (Annex A) and the 3 cities of Oroquieta, Ozamiz and Tangub. The project site, which is in the municipality of Clarin, was identified through the DOST PSTC. Clarin, the first town north of Ozamiz City has a small group of bamboo furniture makers. The municipality also has a number of residents who have skills in bamboo furniture making and who have had experience in the commercial production of bamboo furniture. Three bamboo pole traders and 15 bamboo furniture makers and *amakan (sawali)* weavers were interviewed. DTI officials, DOST PSTDs and officials of the municipality of Clarin also provided information that shed light on the status and development of the bamboo industry in the area.

Table 1. Number of respondents

Municipality	No. of Respondents		
	Bamboo and rattan Furniture Makers	Bamboo pole traders	Amakan weaver
Clarin	4 active 6 stopped	-	
Plaridel	2	-	1
Tudela	1	-	-
Ozamiz City	3	3	-

Table 2. Respondents' Profile

Descriptors	No. reporting
Age (yrs)	
< 31	1
31-40	4
41-50	5
51-60	3
> 60	1
Number of years in business	
< 1	3
1 – 5	6

6 – 10	2
11– 15	2
>15	1
Business classification	
Single proprietorship	14 (100%)
Initial capitalization (Php)	
< 10,000	8
11,000 – 20,000	4
21,000 – 30,000	2
> 30,000	0
Financing source	
Informal lenders	9
Banks	0
Personal funds	3
Cooperative	2
Number of workers	
1 – 3	8
4 – 6	4
7 – 9	1
> 9	1
Source of know-how/ skills of 10 furniture makers	
DTI – sponsored training	1
From previous job	4
From parents/relatives	8

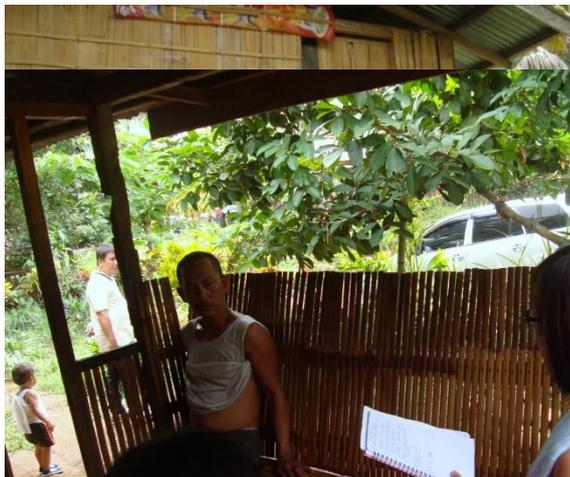
Most of the respondents, who were also the proprietors, are between 30 to 50 years old. The majority (9 out of 14) are relatively new in the business having been around for a maximum of only five years. Initial funds used to start their business ranged from Php 10,000.00 to Php 30,000.00 and were sourced from informal lenders, personal funds and from credit cooperatives. These were used to buy bamboo poles, finishing materials, tools and for the construction of a display area cum production area, usually located along the national road. The micro-scale production level of these establishments is evidenced by the small number of workers, with majority of the respondents having only from 1 to 3 workers.



A one-man shop in Brgy. Masabud, Clarin can be reached via a hanging bridge.

Raw Materials

Bamboo furniture producers get their poles either from traders who deliver these in “Elf” vehicles, or they gather the poles themselves from nearby areas, as done by bamboo furniture and *amakan* producers in Plaridel. Price of bamboo poles delivered to furniture producers range from Php 60.00 to 125.00 per pole. Half of the respondents process at least 50 bamboo poles per month while the larger producers process as much as 200 poles per month.



Left – crushed bamboo used as walls
Right – 35-yr old bamboo floor shows no signs of deterioration
Below – Bamboo seats are common house fixtures

In Ozamiz City, there is a designated area where at least 12 traders sell bamboo poles and slats which are used in the construction of houses and poultry pens. The traders harvest poles at the rate of 3 to 20 clumps per month from surrounding fields in Ozamiz. According to them, one clump yields from 100 to 200 poles. Price of bamboo clumps range from Php 1,000.00 to Php 5,000.00 per clump or Php 10.00 to Php 25.00 per pole. At present, bamboo furniture producers and the local municipal and DTI officials agree that bamboo is still in good supply in the province.



This respondent is one of 12 traders in the bamboo trading station in Ozamiz City.



Kawayan tinik poles being delivered to a bamboo furniture producer in Clarin, Misamis Occidental.



Table 3. Bamboo Furniture Production and Marketing

RAW MATERIALS	
Raw materials used	Kawayan tinik, bayog, botong
Sources of bamboo	- Bamboo pole traders - from around the vicinities where the establishments are located (Clarín, Plaridel, Ozamiz)
Volume of bamboo poles used by 8 bamboo furniture makers (poles/month)	No. of respondents
< 50 poles	4
51 to 100	1
101 to 150	1
>151	2
Volume of bamboo poles gathered by 3 bamboo pole traders	3 to 20 clumps per month at 100 to 200 poles per clump
Price of bamboo (25 – 30 ft)	
Delivered	Php 60.00 to Php 125.00 per pole
Farm gate	Php 10.00 – Php 25.00 per pole
PRODUCTION and MARKETING	
Product lines	Sala sets, beds, rocking chairs, divans, <i>amakan</i>
Quantity produced per month	
Sala set (5 pcs /set)	3 to 8 sets per month
Beds	8 to 15 pcs per month
<i>Amakan</i>	90 to 120 pcs per month (4' x 8')
Product design	Generic, copied, unoriginal, dependent on skills and know-how of workers
Price	
Sala set	Php 2,500.00 to Php 4,000.00 per set
Bed	
- single	Php 700.00 to 900.00 per pc
- double	Php 1,200.00 to Php 1,300.00 per pc
Market	Local tourists/motorists
Promotional methods	Number reporting
Display area	8
Signages	1
Join trade fairs	0
Gross sales from bamboo furniture	Php 10,000.00 to Php 13,000.00 per mo.
Peak months	Nov, Dec, April, May
PRODUCTION TOOLS AND METHODS	
Tools	Bolo, saw, blow torch, brush, chisel, spoke shave, brush, drill, hammer, "Baygon"
Drying	Sun drying of bamboo poles, 4 days during summer and 5 to 7 days during rainy months

Preservative treatment	Mixture of crude oil and kerosene applied by brushing
Finishing materials	Varnish, clear gloss lacquer, putty, sandpaper

Production and Marketing

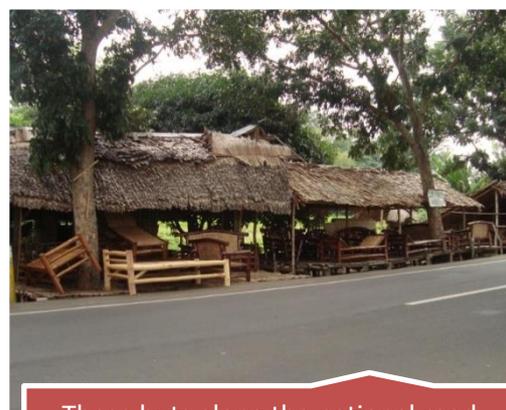
The most common product produced in Mis Occ is the bamboo sala set, sold in sets of 4 or 5 pieces. Bamboo furniture may be combined with rattan or may be made entirely of bamboo. Sometimes, hemp is used for decorative effect. As is common in the furniture and handicraft industries, but more evident in micro producers, designs tend to be copied. In Mis Occ, furniture designs are thus typical and generic.

About 4 to 8 sala sets and 8 to 15 beds are produced per month. Cost of production, profit margin and competitor's price are all considered in setting the prices of bamboo furniture. Prices of sala sets range from Php 2,500.00 to Php 4,000.00 per set and beds, between Php 700.00 and Php 1,300.00 per piece.

Very little effort is spent on promoting products. The common marketing strategy is to put up an open display cum production area along the national road hoping to attract a sale from local travelers and motorists passing through. None of the respondents has ever joined trade fairs. Only one producer had a visible signage to identify his establishment. Nevertheless, gross sales from bamboo furniture alone can range between Php 10,000.00 to Php 13,000.00 per month. Production and sales peak in November, December, April and May.



Only one producer has a visible signage to advertise his shop.



These huts along the national road serve as both display and production areas

Bamboo Processing Tools and Methods

Bamboocraft making is an indigenous skill requiring simple tools. In Mis Occ, this skill is put to use in bamboo furniture production. But unlike more progressive bamboo production communities, the level of technology in the province is rudimentary. Basic tools are the bolo or "sundang," chisel, saw, *sansan*, hammer, blow torch, brush and "Baygon" sprayer.



The bolo or sundang is used for splitting bamboo poles into strips which are woven into bamboo mats (*sawali* or *amakan*). Weaving is usually done by women. A special wooden tool called *sansan* is used to push and fix the woven strips into place (see picture).

Bamboo poles are sun-dried for 4 days during the summer months and 7 days during the rainy season. As a preservative measure, a mixture of crude oil and kerosene is brushed on the furniture before varnish is applied. The finishing process consists of putty application on nailed and rough surfaces; sanding, to further refine the bamboo surface; and the application of varnish or clear gloss by brushing. The blow torch is used to add decorative effects on the furniture piece, although not all producers have this tool. One peculiar improvisation to make up for the lack of a compressor and spray gun is the use of a Baygon insect sprayer to spray on varnish.

TOOLS OF THE TRADE



"Sansan"



Saw



Hammer & Chisel



Bolo



Blow torch



A mixture of kerosene and crude oil is used as preservative



The Baygon mosquito sprayer is an improvised spray gun

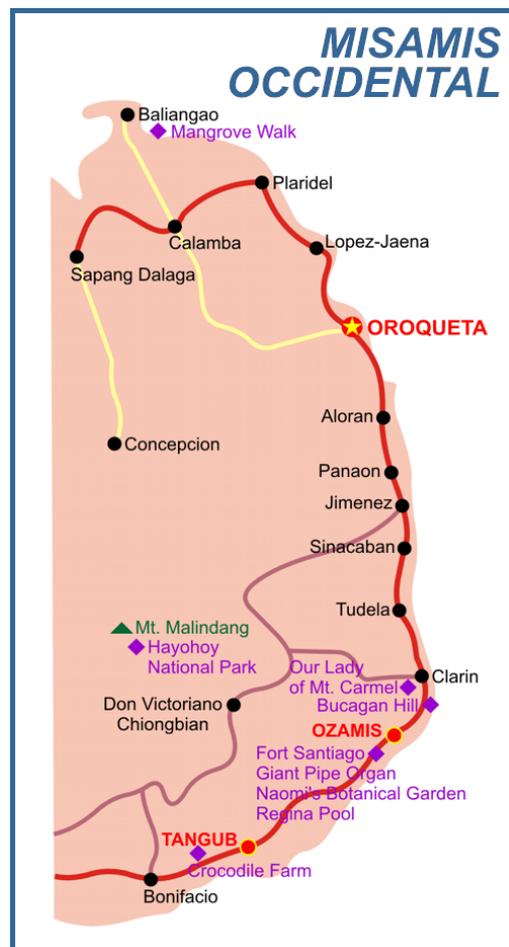
Conclusion

The bamboo craft “industry” in Misamis Occidental, like any of the bamboo craft–making industries found throughout the Philippine countryside is artisanal in nature. However, it differs from that of the Pangasinan or Iloilo bamboo craft communities in terms of the sophistication of product design, processing techniques, tools and equipment, market reach and business models.

- **Product design** – tends to one generic style; design originating from one producer usually end up being produced by competitors
- **Processing techniques** – traditional; commonly acquired from inter-generational sources; respondents have not attended any skills improvement training program
- **Tools and equipment** – simple, rudimentary, improvised
- **Business model** – village-type “make-and-sell” production;
- **Market** – local (within the province); indiscriminating with simple needs; no captive market unlike in Pangasinan, Pampanga and Iloilo which are sub-contracting hubs for exporters

Municipalities of Misamis Occidental

1. Aloran
2. Baliangao
3. Bonifacio
4. Calamba
5. Clarin
6. Concepcion
7. Don Victoriano
8. Jimenez
9. Lopez Jaena
10. Panaon
11. Plaridel
12. Sapang Dalaga
13. Sinacaban
14. Tudela



Appendix 2

Survey of bamboo enterprises¹

Province/ Municipality	Name of enterprise	Species used	Sources	Price/pole (PhP)	Products	Poles needed/ month	No. of employee s
Laguna							
Calauan, Laguna	Berris Agri Co. Inc.	Buho Tinik	Cavinti & Nagcarlan, Laguna	120.00	Bamboo Stick Bamboo Slat	Seasonal: ave of 500 poles / month	3
Magdalena, Laguna	Ariels Arts & Crafts	Bolo	Magdalena	120.00	Bamboo Fashion Accessories/ GTH made of Bamboo	500	2 (+hire add'l workers for bulk orders)
		Tinik	CDO	150.00	Furniture		4
Pakil, Laguna	The Whittlers Arts & Crafts of Pakil	Buho	Sta Cruz	120	Bamboo Carvings/ Lampshade/ GTH made of Bamboo Furniture		30
		Sina	Pakil,	100			
		Matinik	Cavinti,	100			
Magdalena, Laguna	Danilo N. Yumol Handicrafts	Bamboo Tinik	Magdalena, Laguna		Miniatures Bamboo Houses	Seasonal	2
Sta. Cruz	Glo de los Santos ¹	Bolo	Luisiana	Buys at 45/80/120/ 180; sells at 60/100/150/2 00 depending on size	Slats, rooster cages, tepees	Sells about 150 poles/mo, no estimate on poles used	2
Bagong Kalsada, Calamba	Eddie Lagra ²	Bolo	Luisiana	55/60/80/ 120 depending on size; sells at 150, 250, 350 for scaffolgings	Slats, Bahay kubo, kiosks, tepees, rooster cages	Uses about 400/month	35 during project, 18 regulas
Rizal							
Cardona	Cardona MPC Inc	K. Tinik	Talim Island	From P70.00 to P120.00	Table top, Room divider, sala set, Wine holder, lamp shade, Celphone holder etc.	200 poles/mo .	8
Pililla	Kawayan Farm	K. Tinik	Halayhayin, Pililla	From P45.00 to P100.00	Poles & puno	200- 400pcs/m o	6
		Giant Bamboo (butong)	Halayhayin, Pililla	From P120.00 to P150.00	Poles	20/mo	
Cavite							

Maragondon	Kawayang Maragondon Cooperative	Kawayan tinik Buho Taywanak Bayog	Maragondon	Ranges from P 45-250	Sala set Sawali Furniture Handicraft Barbecue stick Engineered bamboo tiles (plan)	200-500 (approximately)	5
Noveleta	NS Alba Handicraft	Kawayan Tinik	Maragondon	P 150/pole	Furniture Handicraft	25	5
Bacoor	Samahang Mandaragat	Kawayan tinik	Maragondon, Ternate	P 55-80/pole	Fishcage	2,000 poles after harvest (6 mos.)	1 person/hectare
Palawan							
Palawan	Alpha Omega Lumber	Boho	Local forest	P1.00/pole	Sawali	500 pcs	two (2)
Camarines Sur							
Camarines Sur/Bula	BAMBUZA	Kawayan Tinik	Bula, Bato, Buhi and Nabua.	75.00	Dining Set, Bed, Table, and Engineered Bamboo	150 poles	6 (4M;2F)
Camarines Sur/Bato	Cris Bamboo Shop	Kawayan Tinik	Bula, Bato, Buhi, Balatan and Nabua.	50.00	Sandalan, Sala Set, Bed, and Coin bank	200 poles	6 (5 M; 1 F)
Camarines Sur/Bato	Amalia Sergio Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, and Bed.	180 poles	4 (3M; 1F)
Camarines Sur/Bato	Mayeth Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	180 poles	4 (3M; 1F)
Camarines Sur/Bato	Bersabe Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, and Bed.	180 poles	4 (3M; 1F)
Camarines Sur/Bato	Avelina Tagom Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan and Nabua.	50.00	Sandalan, Sala Set, Bed, and Coin bank	150 poles	3 (2M;1F)
Camarines Sur/Bato	Openg Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	180 poles	5 (3M;2F)
Camarines Sur/Bato	Emie Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, and Bed.	160 poles	3 (2M;1F)
Camarines Sur/Bato	Danilo Goita Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	140 poles	2 (1M;1F)

Camarines Sur/Bato	Nelson Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	145 poles	2 (2M)
Camarines Sur/Bato	Cherry Sanchez Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	175 poles	4 (2M; 2F)
Camarines Sur/Bato	There Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	157 poles	3 (2M;1F)
Camarines Sur/Bato	Dhels Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	150 poles	
Camarines Sur/Bato	MCC Bamboo Craft	Kawayan Tinik	Bula, Bato, Buhi, Balatan, Nabua and Libon.	50.00	Sandalan, Sala Set, Bed, and Coin bank	150 poles	3 (2M;1F)
Ilo-ilo							
Maasin	Ilo-ilo Kawayan Marketing	Kawayan tinik	Ilo-ilo and nearby provinces	45.00 1 st class; 26.00 2 nd class	Barbecue sticks, chopsticks, toothpicks, charcoal briquettes	8,000 (2,000/w eek)	50
Batangas							
Tanauan City	Tanauan Bamboo Craft Workers Assoc. Mr. Vitaliano Garcia, Chrmn	Kawayan tinik	Brgy Boot, Tanauan City	150	Duyan (made of yantok), bamboo stand, nipa hut, chairs & beds, etc.	30 poles/mo	5
Tuy	ABK 101 Corp Mr. Ed Fajardo	Kawayan tinik, Bayog	Tuy, Batangas, Talim Is. Cardona, Rizal	85	Constructio n materials, furniture, handicrafts	450 poles/mo nth	5 regular, additional during peak season
Sto. Tomas	Social Ventures Multi Purpose Cooperative , Mr. Tony Espineda	Kawayan tinik	Sto. Tomas	100-150	Amplified bamboo, wine holder, chairs, benches, lampshades , cannisters	100 poles/mo when there is bulk orders	15 workers composed of ALS, OSY, PWDS
Quezon							
Pagbilao	Ace & Vilma Bamboo Craft	Kawayan tinik	Pagbilao	25 - 70	Sala set, dining set, frames, lampshades , cribs, accessories	100 poles/mo	2 regular, 3 additional
Pagbilao	Pikto Bamboo Craft	Kawayan tinik	Pagbilao	40-50	Sala set, dividers, bed	200 poles/mo	3 regular, 2 owners

Tayabas City	Noel & Mercy Bamboo Craft	Kwayan tinik	Candelaria, Lucena City, Sariaya	40-60	Kubo, sala set, dining set, bed, double deck	110-120 seasonal	Kubo-6, Silya 3, magkaka yas 1
Davao del Sur							
Digos City	Lagaspi Bamboo Furniture	Kawayan tinik Bayog Botong Laak		100-130 100-150 120-130	Furniture, kubo	-	-
Occidental Mindoro							
	F. C. Torralba Native Products	Kawayan tinik	Ilin Island, Sn Jose, Occ Min.	100-120	Sala set, bamboo bed	288 200	3-4
Oriental Mindoro							
Oriental Mindoro / Bulalacao	Samahan ng mga Manggagawa ng Yunot Nasucob (SAMAYUN A)	Kawayan Tinik	Upper Yunot, Nasucob, Bulalacao	80.00	Sala Set & Bed	200	19
Marinduque							
Marinduque / Boac	Imelda Rey	Kawayan Tinik	Cawit, Boac & Caganhao, Boac	Linis na – 100 Hindi pa Linis – 1200 per 30 pcs (Php 40.00)	1. Sala Set 2. Divider 3. Katre 4. Sofa Bed	Between 12 to 40 pcs	2
Aklan							
Estancia, Kalibo, Aklan	Marife Ventura (Bamboo Dealer)	Bamboo (Botong)	Barangay Madalag, Libacao	180-200	Fence	300	4
Estancia, Kalibo, Aklan	Reynaldo Siason (Bamboo Dealer)	Bamboo (Botong)	Barangay Madalag, Libacao	100-250	Fence	1,000	3
Estancia, Kalibo, Aklan	Turang store (Bamboo Dealer)	Bamboo (Botong)	Barangay Madalag, Libacao	80-250	Fence	1000	6
Bulwang Numancia, Aklan	GRY Bamboo (Bamboo Dealer)	Bamboo (Botong)	Anywhere in Aklan	80-100	Fence	1,500	4
Ibajay, Aklan	Reynaldo Valejo (Furniture shop)	Bamboo (Botong)	Aparicio, Ibajay	80-100	Cabinet, Sala Set, Dining Set		
Ibajay, Aklan	James Yu (Furniture shop)	Anonu-o (Tinik)	Naisud & Paraw Ibajay Naisud & Paraw Ibajay	80-100	Cabinet, Sala Set, Dining Set	100	4
Ibajay, Aklan	Ariel Apayo (Furniture Shop)	Anonu-o (Tinik)	Tina, Makato	80-100	Cabinet, Sala Set, Dining Set	30	2

Ibajay, Aklan	Catherine's Furniture(Furniture Shop)	Anonu-o (Tinik), Bamboo(botong)	Tangalan Agbago, Ibajay, Nabas,	80-100	Sofa Bed, Sala Set, Kubo plex, Cabinets	250	13
New Wahington ,Aklan	Arnaldo NalanganDealer)	Anunuo Bamboo Tinik Botong	Pook, Kalibo, Aklan	80-100	Fence	500	2
Romblon							
Odiongan	Severo Furniture	Kawayan tinik	Malilico/Prog. Weste/Rizal/Mayha /Tuburan/Libertad/ San Andres/Recto/Tumingad/Poctoy	80	Sala set	50	2
Odiongan	Tot's Furniture	Kawayan tinik	Malilico/Prog. Weste/Rizal/Mayha /Tuburan/Libertad/ San Andres/Recto/Tumingad/Poctoy	80	Sala set	25	1
Odiongan	Greenfields Crops & Crafts	Kawayan tinik	Tuburan	100	Bamboo Fan, plates	10	5
Odiongan	Sheryl F. Magay	Kawayan tinik	Poctoy/Dapawan	80	Salaset	50	2
Odiongan	Jolly Galangera	Kawayan tinik	Malilico/Prog. Weste/Rizal/Mayha /Tuburan/Libertad/ San Andres/Recto/Tumingad/Poctoy	80	Salaset	100	3
Odiongan	Zaldy F. Falqueza	Kawayan tinik	Poctoy/Dapawan	80	Sala set	20	3
Odiongan	Alice Fontamillas	Kawayan tinik	Dapawan	80	Sala set	10	1
	Bobong Tambalque	Kawayan tinik	Tulay	80	Sala set	10	1
Odiongan	Eddie Sediaco	Kawayan tinik	Tulay	80	salaset	10	1
Odiongan	Emma Fabro	Kawayan tinik	Poctoy/Prog. Weste/Tumingad	80	Sala set	80	4
Odiongan	Perlita Falqueza	Kawayan tinik	Poctoy/Prog. Weste/Tumingad	80	Sala	21	1

¹Survey conducted by regional offices and provincial offices of the Department Science and Technology

²Personal interview

Appendix 3

List of erect bamboos in the Philippines

Scientific Names	Common Names	Origin	Major Uses
Bambusa			
<i>B. atra</i> Lindley	Long pipe bamboo	North Guinea	Handicraft, ornamental
<i>B. bambos</i> (L.) Voss	India bamboo	Introduced	Construction
<i>B. blumeana</i> J. A. & J. H. Schultes	Kawayan tinik	Introduced	Construction, furniture
<i>B. cornuta</i> Munro	Lopa (Isnig)	Native to North Luzon	Edible shoots, handicrafts
<i>B. dolichomerithalla</i> Hayata	Taiwan bamboo	Introduced	Handicraft, ornamental
<i>B. maculata</i> Widjaja	Tiger bamboo	Introduced	Furniture, handicraft
<i>B. merrilliana</i> (Elmer)	Bayog	Endemic	Construction, furniture
<i>B. multiplex</i> (Lour.) Raeuschel ex J. A. & J. H. Schultes	Chinese bamboo	Introduced	Ornamental, wind break
<i>B. multiplex</i> (Lour.) Raeuschel ex J. A. & J. H. Schultes forma <i>variegata</i> (Camus) Hatusima (<i>forma variegata</i>)	Japanese bamboo	Introduced	Hedge, ornamental
<i>B. oldhamii</i> Munro	Oldham bamboo	Introduced	Construction, edible shoots
<i>B. philippinensis</i> (Gamble) McClure	Laak	Native	Banana props
<i>B. tuldooides</i> Munro	Buddha bamboo	Introduced	Ornamental
<i>B. utilis</i> Lin	Kawayan gamitin	Introduced	Agricultural implements
<i>B. vulgaris</i> Schrad. Ex Wendl.	Kawayan kiling	Panatropic, introduced	Light construction
<i>B. vulgaris</i> Schrad. ex Wendl. cv. Vittata McClure	Kawayan dilaw	Introduced	Ornamental
<i>B. vulgaris</i> Schrad. ex Wendl. cv. Wamin McClure	Wamin	Introduced	Ornamental
Dendrocalamus			
<i>D. asper</i> f. (Schultes f.) Backer ex Heyne	Giant bamboo	Introduced	Construction, edible shoots
<i>D. brandisii</i> (Munro) Kurz	(No common name in the Philippines)	Introduced	Construction, handicraft
<i>D. giganteus</i> Wallich ex Munro	Giant bamboo (Eng)	Introduced	Construction, edible shoots
<i>D. latiflorus</i> Munro	Machiku	Introduced	Construction, handicraft
<i>D. membranaceus</i> Munro	Waya (Eng)	Introduced	Construction, edible shoots
<i>D. strictus</i> (Roxb.) Nees	Solid bamboo	Introduced	Handicraft, edible shoots
Gigantochloa			
<i>G. atrovioleacea</i> Widjaja	Black bamboo	Introduced	Furniture, handicraft
<i>G. atter</i> (Hassk.) Kurz	Kayali	Introduced	Construction, handicraft
<i>G. levis</i> (Blanco) Merr.	Bolo	Introduced	Construction, furniture
Guadua			
<i>G. angustifolia</i> Kunth	Iron bamboo	Introduced	Construction
Melocanna			
<i>M. baccifera</i> (Roxb.) Kurz	Muli	Introduced	Handicraft, pulp & paper
Phyllostachys			
<i>P. aurea</i> Carr. ex A. & C. Riviere	Fish pole	Introduced	Handicraft
<i>P. bambusoides</i> Sieb. & Zucc.	Timber bamboo	Introduced	Medicinal
<i>P. nigra</i> (Lodd.) Munro	Black bamboo	Introduced	Furniture, ornamental
<i>P. pubescens</i> Mazel ex H. de Leh.	Moso bamboo	Introduced	Construction, edible shoots
Pleioblastus			

<i>P. argenteostriatus</i> (Regel) Nakai	Okinadake	Introduced in Japan	Ornamental
<i>P. viridistriatus</i> (Siebold) Makino	Kamurozasa	Introduced in Japan	Ornamental
Sasa			
<i>S. kurilensis</i> (Ruprecht) Makino & Shibata	Chishima zasa	Introduced in Japan	Food
<i>S. nipponica</i> Makino	Miyako-zasa	Introduced in Japan	Mulching material
Schizostachyum			
<i>S. brachycladum</i> (Kurz) Kurz (green form)	Green buho	Introduced	Handicraft
<i>S. brachycladum</i> (Kurz) Kurz (yellow form)	Buhong dilaw	Introduced	Ornamental, fence
<i>S. lima</i> (Blanco) Merr.	Anos	Native	Sawali, boards
<i>S. lumampao</i> (Blanco) Merr.	Buho	Endemic	Sawali, baskets, flutes
Shibataea			
<i>S. kumasasa</i> (Zoll.) Nakai	Okame-zasa	Introduced	Ornamental
Thyrsostachys			
<i>T. siamensis</i> (Kurz) Gamble	Monastery bamboo (Thailand bamboo)	Introduced	Handicraft, landscaping, ornamental
Yushania			
<i>Y. niitakayamensis</i> (Hayata) Keng f.	Utod	Native	Ornamental, soil conservation

Lifted from Rojo et al. (2000). *Philippine Erect Bamboos. A Field Identification Guide: Forest Products Research and Development Institute, College, Laguna.*

List of climbing bamboos in the Philippines

Scientific Names	Common Names	Origin	Major Uses
Cyrtochloa			
<i>Cyrtochloa toppingii</i> (Gamble) S. Dransf.	Bukawe, Topping bakal	Endemic (Rizal)	General purpose
<i>C. fenixii</i> (Gamble) S. Dransf.	Puser, Paua	Endemic (Luzon – Abra, Ilocos)	General purpose, fence
<i>C. luzonica</i> (Gamble) S. Dransf.	Luzon bika	Endemic (Zambales)	Fence, trellis of crops
<i>C. puser</i> S. Dransf.	Puser	Endemic (Abra)	Fence
<i>C. hirsuta</i> S. Dransf.	Baitu	Endemic (Bataan)	Barbecue sticks
<i>C. mindoroensis</i> J. Dransf.	Mindoro bikal	Endemic (Mindoro)	General purpose, fence
<i>C. major</i> (Pilg.) J. Dransf.	Bikal baboy	Endemic (Bataan)	General purpose, fence
Cephalostachyum			
<i>Cephalostachyum</i> <i>mindorensis</i> Gamble	Bagtok, Minodoro bikal	Endemic (Mindoro and Camarises provinces)	Handicraft, containers, novelty items
Dinochloa			
<i>Dinochloa palawanensis</i> (Gamble) S. Dransf.	Balikaw, Palawan bikal	Endemic (Palawan)	No known uses
<i>D. acutiflora</i> (Munro) Soenarko	Bikal baboy, Balikau	Endemic (Laguna and Quezon)	General purpose
<i>D. luconiae</i> (Munro) Merr.	Osiu, Bikal	Native to the Philippines and Borneo	Basketry, fences
<i>D. robusta</i> S. Dransf.	Balikaw, Palawan bikal	Endemic (Palawan)	No known uses
<i>D. oblonga</i> S. Dransf.	Palawan bukawe, Bikal	Endemic (Palawan)	No known uses
<i>D. elmeri</i> Gamble	Elmer bikal	Endemic	No known uses
<i>D. pubiramea</i> Gamble	Bukau	Borneo, Philippines	General purpose
<i>D. dielsiana</i> Pilg.	Tagisi	Endemic	General purpose

Source: Escobin, R. P., et al. (2005). *Identification manual on Philippine Climbing Bamboos. Forest Products Research and Development Institute, DOST, College, Laguna.*

Appendix 4

Calculation of demand of sectors for culms

Banana props

Assume that 30% of the total hectarage of banana plantations of the PBGEA of 42,000 or 12,600 ha are applied with bamboo props. According to the Provincial Agriculturist Office⁴⁹ of Compostela Valley there are about 2000 hills of banana in a hectare. This would mean a total of 25,200,000 hills of bananas requiring 1 culm of bamboo every 2-3 years. If the service life of the bamboo pole is 2 years then the total requirement is 12,600,000 culms a year but if service life is 3 years then the number of annual culm requirement of the banana industry (PBGEA members) is 8,400,000. The total culm requirement of the PBGEA for props is from 8,400,000 to 12,600,000. This does not include the requirements of the small growers which are not included in the estimate.

Fish pens and fish cages in the Laguna Lake and Taal Lake

Fish pens and fish cages in the Laguna Lake use about 50% bamboo and 50% anahaw (*Livistona rotundifolia* (Lam.) Mart. var *luzonensis* Becc.) trunks for posts. There are 3,122 structures in the Laguna Lake as of June 30, 2015 (Table 3.5). Of these 323 are fish pens and 2,799 are fish cages. Of the 323 structures, 219 were registered and 104 unregistered. The total area covered by the fish pens and cages amounted to 11,948.94 ha⁵⁰. At 50%, the area of pens and cages that use bamboo poles is 5,974.47 ha. The distance of the bamboo poles in the pens and cages is 1 m.

There is one fish pen with an area of 50 ha using bamboo poles. Assuming a square configuration of the pen for easy estimate of the number of bamboo poles used, there would be 2,828 bamboo poles used. The estimate of the distribution of the rest of the area to various sizes of pens is shown in Table 3.6. What is sure is that the fish cages are small in area but most of them are less than a hectare, it is estimated that there are about 1,000 fish cages in the lake. The estimate of the number of bamboo poles used for fish pens and cages is shown in Table 3.6. There are a total of 942,653 bamboo poles used for these purposes in Laguna Lake. The bamboo poles have a life span of about a year and about half of the number of poles is replaced. The annual requirement of bamboo poles in Laguna Lake for pens and cages is 570,827 culms .

Floating cages are also maintained in the Sampaloc Lake in San Pablo City. It is estimated by the Clearance and Permits Division of LLDA that one floating cage covers a total area of 600 m².

Another lake where there are fish cages is Taal Lake. Taal Lake is part of the Taal Volcano Protected Landscape which was established under Presidential Proclamation No. 923 issued on November 19, 1996. According to Forester Vic Mercado who is the Protected Area Supervisor (PASu)⁵¹ there are about 6,000 fish cages in the Taal Lake. About 60% of the fish cages use bamboo for poles. It was also estimated that a fish cage would use 50 to 60 bamboo poles. The others use metal poles.

At 60% there would be 3,600 fish cages that use bamboo poles, and at an average of 55 bamboo poles a fish cage the total number poles utilized for fish cages would be 198,000 poles. At 50%

⁴⁹ Provincial Agriculturist Office, Compostela Valley, interviewed by Kenneth Barroga, Science Research Specialist II of the Department Science and Technology provincial office of Compostela Valley, August 2015

⁵⁰ Data/information from the Clearance and Permits Division of the Laguna Lake Development Authority (LLDA), data obtained on September 9, 2015.

⁵¹ Mercado, V. Protected Area Supervisor of the Taal Volcano Protected Landscape, personal communication. September 15, 2015.

replacement a year the annual requirement of bamboo poles for cages in the Taal Lake would be 99,000.

Table 1 - Number and area of fish pens and fish cages in the Laguna Lake

Type of structure	Registered		Unregistered		Total	
	No. of structures	Area (ha)	No. of structures	Area (ha)	No. of structures	Area (ha)
Fish pen	219	5,966.34	104	4,304.83	323	10,271.17
Fish cage	1,024	630.21	1,775	1,047.56	2,799	1,677.77
	1,243	6,596.55	1,879	5,352.39	3,122	11,948.94

Source: Clearances and Permits Division, Laguna Lake Development Authority, September 9, 2015

Table 2 - Estimate of number of poles/pen-cage/number of poles per size of pen or cage

Area (ha)		Number of pens/cages		Number of poles/pen or cage		Total number of poles	
Fish pens	Fish cages	Fish pens	Fish cages	Fish pens	Fish cages	Pens	Cages
50		1		2,828		2,828	
20		20		1,789		35,780	
15		30		1,549		46,470	
10		100		1,265		126,500	
5		500		894		447,000	
2		500		565		282,500	
1	1	575	500	575	400	575	200,000
Total Poles						941,653	200,000
Grand Total						1,141,653	

Extrapolated from data coming from the LLDA

Pulp and paper production from bamboo

Bamboo is the main raw material for pulp and paper production in India and many other countries. One big paper company, Kimberly Clark, is planning to use bamboo as raw material⁵². Bamboo has long fibers, longer than most hardwood, and has also the advantage that there is no need to replant because only culms are harvested from a clump, unlike wood plantations that need replanting once the plantation is harvested.

Table 3 - Fiber dimension of some Philippines bamboos

Species	Fiber length, mm	Fiber width, mm	Cell wall thickness, mm
Kawayan tinik	1.95	0.018	0.007
Giant bamboo	3.78	0.019	0.007
Bulo	1.80	0.027	0.006
Kawayan killing	2.33	0.017	0.004
Bayog	2.16	0.014	0.004
Buho	2.42	0.014	0.006

Source: Tamolang, F. N. et al. 1957. Fiber dimension of certain Philippine broadleaved woods and bamboos as cited in FPRDI Monograph on Production and Utilization of Philippine bamboos, February 2007.

Bamboo is very suitable for the production of pulp and paper because of its long fibers. The length of fibers, fiber width and cell wall thickness is shown in Table 3. Giant bamboo has the longest fibers with an average of 3.78 mm followed by buho and Kawayan killing and buho. The fibers of Kawayan tinik is only 1.95 mm.

⁵² Manda, E. 2015. Power point preservation.

There are a number of values on the weight of newly harvested *Kawayan tinik*. One value ranges from 60 to 80 kg, another from 40 to 50 kg⁵³ and 25.8 kg⁵⁴. The last one however, refers to the dry weight of the culm while the first two are fresh weight of the culm. The lower the weight of culms from which the fibers are obtained the more raw materials are needed. On the basis of 25.8 kg dry weight the amount of raw materials needed to provide fibers for the production of 100 tons of writing paper is estimated, thus:

The fiber content of dry bamboo is about 30%. The 25.8 kg dry bamboo would yield 7.74 kg of pulp. To produce writing paper the pulp undergoes bleaching and bleaching would reduce the pulp by 10%. After bleaching the remaining pulp would weigh 6.966 kg. To produce 100 tons of writing paper it would require 100,000 kg divided by 6.966 kg pulp per culm or 14,285.7 culms a day. On the basis of 300 working days a year, the annual requirement would be 4,285,714 culms. A hectare of mature bamboo plantation would yield about 1,000 culms a year. The area of plantation needed to provide the raw material requirements of a 100 ton paper mill would be 4,286 ha of bamboo plantation.

The national consumption of paper in 2011 was estimated to be 1.643 million tons (Table 3.17). The estimated production was 0.95 million tons and the import was 0.823 million tons with an export of 0.130 million tons. A pulp and paper mill with a daily production of 100 tons would produce about 30,000 tons of paper a year. It would take 27.43 pulp and paper mills of 100 tons daily capacity to produce an amount of paper equivalent to our importation. Assuming that only 30 per cent of the imported paper is made from bamboo raw materials there would be a need for 8 mills with a daily production of 100 tons of papers. The total annual culm requirement for the 8 mills would be 34,285,712. At 1,000 culm production per hectare per year, the total area of plantation needed to supply the requirements of the 8 100ton capacity mills would be 34,288 ha.

Based on the plantation requirement of one 100 ton pulp and paper mill of 4,286 ha, the total bamboo plantation requirement would be 34,288 ha.

Table 4- Paper Industry in the Philippines: Current state and background

	2001	2010	2011 Estimate	Historical trend % p.a.
Number of paper mills	43	27	24	
Industry capacity, '000 tons	1,580	1,297	1,100	-3%
Production	1,056	1,038	950	-1%
Imports	533	961	823	+5.4%
Exports	139	165	130	-2.8%
Consumption	1,450	1,834	1,643	+2.2%
Paper and board per capita consumption	16	20	19	+2%

Source: Proposed Roadmap for the Pulp and Paper Industry

Bamboo arm chairs for elementary and secondary government schools

EO No. 879 mandates the Department of Education to procure 25% of all desks and chairs of government elementary and secondary schools made of bamboo. Based on the experience of the Lubao Bamboo Nature Park (LBNP) in Lubao, Pampanga, one arm chair requires 130 slats of 1.2 m long. One pole of 1.2 m long produces an average of 7 slats of 3-5 cm width. One can use only 4-5

⁵³Virtucio, F. 2015. Personal communication. His personal experience

⁵⁴FAO/INBAR 2005. Forest Resources Assessment



poles per culm since the butt portion is not usually used because it is too hard and too thick if Kawayan tinik is used. On this basis one arm chair would require 4.5 culms.

The DepEd allocates Php 1 Billion a year for the procurement of school desks and chairs⁵⁵. EO No. 879 prescribes that 25% of the amount or PhP 250 M is allocated for bamboo furniture. The ceiling price of school desks and chairs is Php 930 per piece. This would translate to 269,000 arm chairs a year. At 4.5 culms per chair the annual culm requirements for bamboo arm chairs and desks would be 1.21 culms.

The production cost of one bamboo arm chair at the LBNP is Php 1,100. At the price of Php 930/chair the LBNP would be losing if it sold its chairs to DepEd. The high cost of production is constraining the supply of bamboo arm chairs to DepEd. The cost of the bamboo raw material accounts for 40% of the cost, while labor and other expenses account for 30% each. An increase of available bamboo culms for industrial purposes can reduce the cost of raw materials and concomitantly reduce the cost of the producing the arm chairs. This could lead to the bamboo industry being able to supply the school chairs and desks requirements of DepEd.

Bamboo chips for fuel for power generation

The estimate of the number of culms needed to supply of chips for power generation is based on the requirements of Bataan 20-20 Pulp and Paper Mill of 720 tons of chips a day at 10% moisture content.

The assumptions are that a freshly cut culm has a moisture content of 70 per cent and weighs from 25-40 kg. On this basis, the weight of the culms equivalent to the 720 tons of chips at 70% moisture content would be 1.112 million kg. At an average weight of a culm at 70% the total number of culms needed per day would be 34,238 culms. Assuming that the plant operates 300 days a year the total culms needed would be 10,271,000. At production rate of 1,000 culms per ha per year the total plantation requirement needed to supply the chips of 720 tons a day would be 10,271 ha.

If 5 units of biomass power plant similar to the Bataan 20-20 boiler plant that it is planning to establish is constructed the total area needed would be 51,355 ha of plantation

⁵⁵Angeles, J. 2015. Marketing of bamboo and its by-products. That Thing Called Kawayan: A Forum on Bamboo Processing and Utilization Technologies. SMX Convention Center. MOA. July 28, 2015.

Appendix 5

PCAARRD funded projects on bamboo

Title of Project	Duration	Researcher	Budget (Php)
1. Improving and maintaining productivity of bamboo for quality shoots and timber in Australia and the Philippines – Market Analysis (ERDB)	Sept 1, 2002 – Feb 28, 2004	Merlyn Carmelita Rivera	168,048.56
2. Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines	Mar 1, 2001 – Feb 28, 2004		131,442.58
3. Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines (MMSU)	Mar 1, 2001 to Dec 31, 2006	Beatriz Malab, Stanley Malab	1,063,401.7
4. Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines (DENR)	Mar 1, 2001 – Dec 31, 2006	Conrado Marquez, Neil Gigare	620,313.71
5. Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines (FPRDI)	Mar 1, 2001 – Feb 28, 2004	Marina Alipon	515,491.96
6. Improving and maintaining productivity of bamboo for quality timber and shoots in Australia and the Philippines (ERDB)	Aug 1, 2003 – Dec 31, 2004	Merlyn Carmelita Rivera	168,048.56
7. Basic properties evaluation of silviculturally treated bamboo species in the Philippines	Mar 1, 2001 – Feb 28, 2004	Marina Alipon	150,000
8. GIS-based assessment of bamboo resources and supply chain analysis	Oct 1, 2011 – Sept 30, 2012	Annie Deriada	2,022,630
9. Soil erosion management in Taganibong watershed in Musuan, Bukidnon	Dec 1, 2012 – Nov 30, 2015	Rico Marin	1,803,226
10. Development of ethnic bamboo shoots into noodles	Nov 1, 2002 – May 31, 2003		40,000
11. Survey of bamboo stands and establishment of database of economically important bamboo resources in the Philippines	Jan 1, 2011 – Mar 31, 2012	Florencio Serra, Jr Noel Soriano	142,000
12. Philippine Bambusetum	Sept 1, 1988 – Dec 31, 2002	Alfredo Agpaoa, Fatima Tangan, Tony Baldino	70,000
13. Promoting the bamboo industry towards enterprise development in the City of San Fernando, La Union	Jan 1, 2002 – Dec 31, 2007	Anita Aala, Camilo Domingo, Cesar Orallo, Lourdes Calacal	200,000
14. Community S & T based project on the production of quality planting stocks in selected sites in Reg 3	Aug 1, 2012 – July 31, 2014		5,000,000
15. Streambank stabilization using bamboo	Oct 1, 1998 – Oct 31, 2003		80,000
16. Production and commercialization of deformed bamboo for furniture parts and accessories in Ilo-ilo City	Mar 1, 2000 – Mar 30, 2003	Conrado Marquez, Neil Gigare	26,000
17. Development and management of Bambusetum in Jawili, Tangalan, Aklan	Oct 1, 2000 – Oct 30, 2005	Alicia Lustica, Ernesto Arevalo	835,000
18. Establishment of Davao Bambusetum	Jan 1, 1989 – Feb 1, 2002		105,000
19. Generation of technical basis for development of standards for engineered bamboo products	Feb 2, 2009 – Jan 31, 2011	Marina Alipon, Rico Cabangon	1,724,893
20. Improving technology use in harvesting, post harvest and material preparation to increase productivity and assure the quality of engineered bamboo	Feb 2, 2009 – Jan 31, 2011	Ramon Razal	2,326,576
21. Digital moisture meter calibrated to Philippine bamboos and other non-timber forest products	Dec 1, 2008 – Dec 30, 2010	Marina Alipon	1,151,639
22. High quality charcoal from bamboo for industrial use	Dec 1, 2013 – Nov 30, 2015	Belen Bisana	2,986,225
23. Performance valuation of organic-based preservatives from five Philippine plant species in the prevention and control of biodeteriorating organisms in bamboo	Oct 1, 2013 – Sept 30, 2016	Carlos Garcia	2,299,161
24. Technical feasibility of producing structural bamboo composites for housing	Oct 2, 2002 – Dec 31, 2003	Dwight Eusebio	30,000
25. Chemical properties of climbing bamboos	Jun 1, 2003 – May 31, 2006	Ma Salome Moran	55,000
26. Physical and mechanical properties of climbing bamboos	Jan 1, 2003 – Dec 31, 2003		43,000

27. Anatomical structure and properties of climbing bamboos	Jan 1, 2003 – Dec 31, 2003	Mario Maruzzo	35,000
28. Feasibility of producing structural bamboo composites for housing	Jan 1, 2002 – Dec 31, 2002	Dwight Eusebio	55,000
29. Identification Manual for climbing bamboos in the Philippines	Jan 1, 2001 – Dec 31, 2003		134,000
30. Natural durability climbing bamboos	Jan 1, 2002 – Dec 31, 2004	Antonio Reyes	95,000
31. Design and fabrication of kiln for the production of bamboo charcoal and light distillate for rural application	Jan 1, 2000- Dec 31, 2002	Belen Bisana	210,000
32. Utilization of bamboo for cement bonded board (CBB)	Jan 1, 2000 – Dec 31, 2001	Dwight Eusebio	8,000
33. Production of Giant Bamboo propagules using intermittent mist clonal propagator	Jan 10, 2010 – Jun 9, 2011	Danie Sayo	152,500
34. Watershed regenerative potentials of bamboo	Jun1, 1996 – May 31, 2006	Victorino Bayed	222,000
35. Bamboo plantation development Project in La Union	Jan 1, 2002 – Dec 31, 2006		450,000
36. Strengthening S & T interventions for the promotion and commercialization of engineered kawayan: Academe-LGU partnership model (E-kawayan)	Oct 16, 2008 – Sept 15, 2011	Stanley Malab	3,860,716.25
37. Development of the kawayan tile maker machine	Jan 1, 2000 – Dec 31, 2002	Jose Zafaralla, Stanley Malab	160,000
38. Effects of site preparation and weeding frequency on the survival and early growth of bayog and kawayan tinik	Jan 1, 1996 – Dec 31, 2000	Charito Samsam, Joselito Rosario	345,000
39. Bamboo based farming system for rolling areas in Pampanga	Jan 1, 1997 – Dec 31, 2003	Carmelito Tarun	358,184
40. Supply chain improvement of bamboo: a quasi- integration model in Region 1	Sept 16, 2009 – Mar 15, 2011	Stanley Malab	1,118,776
41. Marketing and IEC of engineered bamboo products	Sept 1, 2008 – Aug 31, 2011	Priscilla Dolom	2,097,929
42. Do-it-yourself bamboo shelter for calamity-stricken communities	Jul 1, 2014 – Dec 31, 2014	Alberto Pareja, Rico Cabangon	695,439
43. Technology transfer of kiln dryer, preservation and finishing facilities in Region X	April 1, 2013 – Mar 31, 2015	Rico Cabangon	4,500,000
44. Growth responses of Kawayan tinik (Bambusa blumeana) seedlings using different levels of bamboo biochar and organic fertilizer	May 1, 2011 – Apr 30, 2012	Charlie Batin	150,000
45. Outdoor showcasing of S & T based ERDB technologies on planting stock production of commercial and ornamental bamboo species and planting stock production of forest tree species	Oct 1, 2011 – Sept 30, 2012	Maria Dayan	200,000
46. Bambusetum and palmetum establishment and entrepreneur development toward productivity and environmental protection in Isabela	Jan 1, 2002- Dec 21, 2004	Roger Medrano	50,000
47. Pilot commercialization of the MMSU Kawayan pole maker (MMSU KPM JAZ 02)	Apr 1, 2001 – Aug 31, 2002	Jose Zafaralla, Stanley Malab	499,800
48. Design and fabrication of bamboo veneer lathe	Oct 1, 2001 – Sept 30, 2003	Belen Bisana	708,477
49. Development of quality furniture handicraft and construction materials from bamboo, rattan and oil palm	Apr 1, 2003 – Mar 31, 2004		65,000
Total			40,443,410.28

Appendix 6
PROPOSED NATIONAL INVENTORY OF BAMBOO RESOURCES
AND BAMBOO-USING INDUSTRIES IN THE PHILIPPINES

Rationale

- Available data suggest that there exist incomplete and likely unreliable estimates of bamboo resources and on the number, type, size and raw material requirements of bamboo-using industries/bamboo users in the country;
- The bamboo inventory will provide statistically valid bamboo resource statistics and statistics on the number, type, products and requirements of the bamboo-based industries; and,
- Valid statistics on bamboo resources and bamboo-based industries would provide the necessary data to guide investors in bamboo manufacturing enterprises as well as bamboo plantation developers.

Methodology

The country shall be divided into two groups of regions: bamboo-rich (BR) and bamboo poor (BP) regions. **Sampling population:** barangays in the six priority regions or whole country, as the case may be.

Priority regions: - In case there is not enough budget or time to do the national bamboo inventory in one sweep, the following regions shall have priority over the other regions: CAR, 1, 2, 5, 6 and 10. These six priority regions are considered “bamboo-rich”; they include 32 provinces (Batanes excluded), 629 municipalities and thousands of barangays.

Bamboo resources inventory

Sampling design: multi-stage stratified random sampling

The sampling stages

- Stage 1: random sample 40 to 60 municipalities/cities from the 629 municipalities/cities in the 32 provinces of the 6 BR regions
- Stage 2: random sample of 130 to 180 barangays from the 40 to 60 sample municipalities/cities

The strata

1. Stratum 1 – bamboo-rich (BR) barangays in BR municipalities in BR provinces
2. Stratum 2 – BR barangays in bamboo-poor (BP) municipalities in BR provinces; BR barangays in BR municipalities in BP provinces; BR barangays, in BP municipalities in BP provinces
3. Stratum 3 – all other barangays, e.g., BP barangays in BR municipalities in BR provinces; BP barangays in BP municipalities in BR provinces; BP barangays in BR municipalities in BP provinces; BR barangays in BP municipalities in BP provinces

Sample size per stratum:

1. Stratum 1 – 50 to 60 barangays to be selected at random
2. Stratum 2 – 40 to 60 barangays to be selected at random
3. Stratum 3 – 40 to 60 barangays to be selected at random

Sampling error/precision of estimates: The inventory shall be designed and implemented to attain a sampling error of not more than 5% for the whole inventory and about 10 to 15% per stratum. In case the desired precisions of estimates are not attained, additional sample barangays will be selected at random to achieve the desired precisions subject to time and budget constraints.

Statistics to be generated (mean and standard error):

1. Ha of bamboo per ha of “barangay area” (BA)
2. No. of clumps per ha of BA
3. No. of poles per ha of BA

The samples of barangays, clumps and poles; classifying the provinces, municipalities and barangays into BR or BP: - The provinces, municipalities in each province and barangays in each municipality shall be classified into BR or BP. This will be done through a questionnaire with the DENR/DTI/Association of Bamboo Manufacturers (Is there such an association?) as primary respondents. (**Note:** A province, municipality or barangay shall be classified as BR if there are visible, known or significant bamboo resources within its jurisdiction.) The results shall be used to draw the stratified random sample of barangays to be visited/inventoried. The sample barangays, about 130 to 180 of them for the three strata, shall be drawn from about 40 to 60 municipalities and cities also randomly drawn from the 629 municipalities and cities in the 32 provinces. For each sample barangay, the area of bamboo stands shall be measured, the no. of clumps shall be counted, and 31 to 40 clumps shall be drawn at random for “pole- count” enumeration.

Activities/manpower/estimated cost of the bamboo resource inventory for the six priority regions

1. Technical Supervisors (TS), Crew Leaders and Assistant Crew Leaders’ (CL) training in field sampling/data collection, one TS per region and one CL per province in the six priority regions – 6 TSs and 32 CLs. The training shall be conducted by the Project Leader/Coordinator (PL/C) and Assistant Project Coordinator (APC).
 - Travel to training site and back 240,000
 - Board and lodging (7 days for 42 persons)294,000
2. Field sampling: 6 to 8 crew-days per sample barangay; a field crew shall be composed of the Crew Leader (CL), Assistant Crew Leader (ACL) and 1 local assistant/laborer.
 - Salaries and wages
 - 6 TS, 1,000/day 7,560,000
 - CLs, 800/day, 1,260 crew-days1,008,000
 - ACLs, 600/day, 1,260 crew-days 756,000
 - Local assistant, 450/day, 1,260 crew-days 567,000
 - Travel to “sample barangay” and return 252,000
 - Daily allowances for CLs and ACLs 1,260,000
3. Field sampling supervision: by PL/C, APC and regional TSs.
 - Travel to some “sample barangay” and return 1,000,000
 - Daily allowances for PL/C, APC and TSs 800,000
4. Instruments: GPS, 20-m metric tape (nylon)
 - GPS, 40 units 800,000
 - 20-meter metric tapes (nylon), 40 units 80,000
5. Insurance 160,000
6. Supplies/materials: clip boards, field data forms, pencils, ball pens, plastic folders/envelops, first-aid kits, “barangay sample” maps, 40,000
7. Communication 50,000
8. Data encoding, collation and analysis 50,000
9. Preparation of report 80,000
10. Presentation of report, venue rental and food 100,000
11. Contingencies 500,000
12. Others (PL/C’s/APC’s professional fees (normally 100% of all other costs!))

**Estimated total cost of bamboo resource inventory for the 6 regions:
 PHP 15,597,000 plus professional fees including salaries of PL/C and APC.**

Inventory of Bamboo-based Industries (Firms/Users)

Sampling design: stratified sampling (based on number of bamboo poles used by firm/company per year)

- Stratum 1 – large firm: 100,000 poles or more poles per year
- Stratum 2 – medium-sized firm: 50,000 to 99,999 poles per year
- Stratum 3 – small firm: < 50,000 poles per year

Sampling error: Similar level of precision as the bamboo resource inventory shall be used for this part of the Project.

Sample sizes: Based on a list of all known bamboo users/firms in the 32 provinces (6 BR regions), a stratified random sample of 15 to 30 firms per stratum shall be drawn. (**Note:** If the size, in number of poles used per year, of each known bamboo firm in the province is available, a “probability-proportional-to-size” sampling may be used instead of stratified sampling.)

All “bamboo users” in the sample barangays shall also be enumerated.

Bamboo user data

The data to be gathered for each sample bamboo user/firm shall include the following:

- Name, address, contact number, ...
- Number of poles used per year; bamboo species used
- Source(s) of bamboo poles; buying price per pole (at source, delivered or at bamboo market)
- Bamboo products processed: type and quantity; price by type
- Number of employees: management/supervisors, workers
- Equipment used
- Capitalization

Activities in “bamboo user/firm” enumeration (survey), manpower and estimated cost:

(Notes on manpower: 1 Project Leader/Coordinator (PL/C); 1 Assistant Project Coordinator (APC); 6 Regional Technical Supervisors (TS); in addition, 32 Crew Leaders (CL), 32 Assistant Crew Leaders (ACL) and 32 crew (local) members for the resource inventory; 32 CLs and 32 crew (local) assistants for users survey.)

1. Crew Leaders (CL) training in bamboo firm sampling/data collection, one CL per province in the six priority regions or 32 CLs. The training shall be conducted by the Project Leader/Coordinator (PL/C) and Assistant Project Coordinators (APC).
 - Travel to training site and back 144,000
 - Board and lodging (7 days for 32 persons) 224,000
 2. Enumeration of all known bamboo users/firms in each province
 3. Drawing of appropriate random samples for the two inventories
 4. Field sampling: 6 to 8 crew-days per sample barangay; a field crew shall be composed of the Crew Leader (CL) and 1 local assistant/worker.
 - Salaries and wages
 - CLs, 800/day, 1,260 crew-days 1,008,000
 - Local assistants, 450/day, 1,260 crew-days 567,000
 - Travel to “sample barangay” and return 200,000
 - Daily allowances for CLs 630,000
 5. Instruments: GPS, 20-m metric tape (nylon)
 - GPS, 32 units 640,000
 - 20-meter metric tapes (nylon), 32 units 64,000
 6. Insurance 144,000
 7. Supplies/materials: clip boards, field data forms, pencils, ball pens, plastic folders/envelops, first-aid kits, “barangay sample” maps, 30,000
 8. Communication 40,000
 9. Data encoding, collation and analysis 50,000
 10. Preparation of report 100,000
- Total additional cost for Bamboo Industries inventory: Php 3,697,000**

Estimated Total Cost of the Bamboo Resource and Bamboo-based Industries Inventories (6 Bamboo-rich Regions): Php 19,294,000 plus professional fees including salaries of PL/C and APC (normally 100% of non-professional or all other costs).



Duration of the bamboo resource and industries inventories: about 30 calendar months if 2 crews are fielded for the resource inventory and 2 crews are also used in the industries inventory; if 4 crews each are fielded: about 15 calendar months!

Additional Notes:

- A bamboo resource and industries inventory for the whole country would likely cost about 45 million Php plus professional fees and other indirect costs or a total of about 90 million Php.
- The bamboo statistics generated would be precise at the national level (or for the 6 regions taken together) hence these can be used for policy and planning purposes at this level.

avr/29aug2015

Appendix 7

Draft Bill to Promote the Bamboo Industry in the Philippines

AN ACT TO PROMOTE THE DEVELOPMENT OF THE BAMBOO INDUSTRY IN THE PHILIPPINES AND AMEND CERTAIN PROVISIONS OF EXECUTIVE ORDER NO. 879 THAT CREATED THE PHILIPPINE BAMBOO INDUSTRY DEVELOPMENT COUNCIL (PBIDC), EXPANDS ITS MANDATES, PROVIDE ADDITIONAL PERSONNEL AND REGULAR BUDGET OF THE SECRETARIAT OF THE COUNCIL

Explanatory Note

The value of worldwide bamboo market was estimated to be 8 billion US dollars⁵⁶ for traditional and non-traditional bamboo products. Bamboo is gaining in popularity as construction material as a result of the declining supply of wood. Bamboo being widely distributed in private lands in the low lands as well as in forest lands can be a vehicle for generating more jobs and self-employment opportunities especially in the rural areas.

The destruction of the natural forest and the concomitant decline in the supply of wood, the research sector started to develop technologies to improve the properties of bamboo as well as developed manufacturing processes for producing new products such as the engineered bamboo. The furniture industry likewise responded by incorporating bamboo in furniture designs that actually improved aesthetic value of the products. Architectural designs of building such as churches, office edifices, airports also incorporated bamboo and some instances some of these infrastructures were built entirely of bamboo. The pulp and paper industry is now considering the use bamboo as raw materials. The banana industry in the Davao provinces has returned to the use of bamboo poles as banana props.

The progress in the bamboo utilization is not likely to be sustainable in the Philippines because of the low supply of the raw material. The reported demand for bamboo poles in the country by all industry sectors is about 22 million culms a year. The estimated supply of the preferred species bamboo such as kawayan tinik, giant Bamboo, bulo, buho, bayog, kawayan killing, kayali and laak is only about 10 million culms. Government's desire to stimulate the bamboo industry is manifested by the issuance of Executive Order No. 879 in May 2010 which created the Philippine Bamboo Industry Development Council (PBIDC). The main functions of the Executive Committee of the PBIDC whose purpose is mainly to direct the preparation of the Philippine Bamboo Industry Development Plan 2010-2020 and to identify, prioritize and recommend initial strategic interventions, research directions and critical data needs while the Development Plan is being drawn up.

It has been 6 years since the issuance of EO 879 and there is still no national bamboo development program. One of the main reasons for this is that the Council was not imbued with sufficient power to direct other government agencies and the private sector that are members of the Council to formulate the industry development program. Furthermore, The Secretariat of the Council does not have permanent personnel. Its manpower complement is composed of personnel from agencies of the Council who have been assigned to the Secretariat but not on a permanent basis. The Council does not have a regular budget. The Twenty Million Pesos (Php 20 million) that was originally allocated for

⁵⁶EO No. 879. Creating the Philippine Bamboo Industry Development Council (PBIDC) to promote the bamboo industry development project and directing the use of bamboo for at least twenty five (25%) percent of the desk and other furniture requirements of public elementary and secondary schools and prioritizing the use of bamboo in furniture, fixtures and other construction requirements of government facilities and allocating funds therefore and other purposes. May 14, 2010.

the operations of the Council has long been expended and it has not been replenished. The budget request for the Council for 2016 has been scraped by the Department of Budget and Management.

This Law will develop the bamboo industry to generate employment, help the bamboo export sectors of the industry capture a greater segment of the export market, promote environmental sustainability and reduce carbon emission and help mitigate the impacts of climate change and help the government achieve inclusive economic growth.

**REPUBLIC OF THE PHILIPPINES)
First Regular Session)**

SENATE OF THE REPUBLIC OF THE PHILIPPINES

S.B. No. _____

INTRODUCED BY THE HONORABLE BAM AQUINO

AN ACT TO PROMOTE THE DEVELOPMENT OF THE BAMBOO INDUSTRY IN THE PHILIPPINES AND AMEND CERTAIN PROVISIONS OF EXECUTIVE ORDER NO. 879 THAT CREATED THE PHILIPPINE BAMBOO INDUSTRY DEVELOPMEN COUNCIL (PBIDC), EXPANDS ITS MANDATES, PROVIDE ADDIONAL PESONNEL AND REGULAR BUDGET OF THE SECRETARIAT OF THE COUNCIL

Be enacted by the Senate and the House of Representatives of the Philippines in Congress Assembled:

SECTION 1. Title - This Act shall be known as the Philippine Bamboo Industry Development Law of 2016.

SECTION 2. Basic Policy - It is the policy of the State to promote and support industries that create and generate employment especially in the rural areas, reduce poverty, promote sustainable environment, mitigate the impacts of climate change, and promote inclusive growth.

SECTION 3. Objectives – It is the objective of this Act to promote Philippine bamboo industry by providing the institution to manage it, prepare and implement industry development program, provide incentives to investors in the establishment bamboo plantations and processing plants, establish regional, provincial and municipal councils that will establish their own bamboo industry development programs.

SECTION 4. Membership of the Philippine Bamboo Industry Development Council (PBIDC)– The membership of the Philippine Bamboo Industry Development Council shall be amended to include the League of Provinces.

SECTION 4.1 Abolition of the Executive Committee – Section 1.2 of EO No. 879 is amended to abolish the Executive Committee. The Undersecretary of the Department of Trade and Industry (DTI) for Regional Operations and Development Group (RODG)

SECTION 5. Strengthening of the Secretariat of the Philippine Bamboo Industry Development Council – The Secretariat of the Philippine Bamboo Industry Development Council shall be headed by the Undersecretary for Regional Operations and Development Group (RODG) of the Department of Trade



and Industry (DTI). The Undersecretary for RODG shall be the ex-officio Executive Director of the Secretariat of the Council. The Head of the Secretariat shall be assisted by a Deputy Executive Director who shall be appointed by the Chairman of the Council upon the recommendation of the Executive Director.

SECTION 4.1 Divisions of the Secretariat –The Secretariat shall consist of two Divisions, a Technical Division and an Administrative Division. The composition of the two Divisions shall be prepared by the Executive Director and approved by the Council. The personnel complements of the two Divisions shall follow the Civil Service rules and regulation including the salary ranges of the various levels of the personnel.

SECTION 4.2 Appointments of Personnel of the Secretariat – The personnel of the Secretariat shall be appointed by the Council upon the recommendation of the Executive Director.

SECTION 4.3 Functions of the Secretariat - Section 1 of EO No. 879 shall be amended to include in the functions of the Secretariat as indicated in Section 5 under the Duties of the Executive Director.

SECTION 5. Duties of the Executive Director – The Executive Director shall have the following duties and responsibilities:

1. Formulate the Bamboo Industry Development Program for approval of the Council and implement the program as approved by the Council;
2. Establish and manage a data and information system on the bamboo industry and provide such data and information upon request by the stakeholders;
3. Generate funds and resources for the implementation of the Industry Development Program and for other purposes that will promote the bamboo industry
4. Receive donations and apply for loans from international sources for implementation of programs of the industry
5. Recommend to the Council through the Executive Committee the appointment of Secretariat personnel
6. Prepare the annual budget of the Secretariat and the Council through the Executive Committee for the approval of the Council and for inclusion in the Appropriations Act;
7. Perform other activities as ordered by the Council.

SECTION 6. Duties of the Deputy Executive Director – The Deputy Executive Director shall have the following duties and responsibilities:

1. Assume the duties and responsibilities of the Executive Director during his absence
2. Assist the Executive Director implement the latter’s duties and responsibilities

SECTION 7. Provision of incentives to investors in plantation development and bamboo processing factories – The following incentives shall be provided to investors in plantation development and bamboo processing factories:

1. Free from payment of rent for the use of government lands for commercial bamboo plantation for the first plantation for the first 5 years or when the plantation owner starts to harvest his plantation;
2. Forest plantations in private lands shall not require a cutting permit for harvesting nor shall it need a transport permit, for as long as the plantation is registered with the Community Environment and Natural Resources Office (CENRO) of the DENR. All that is required is for the plantation owner to inform the CENRO that the plantations will be harvested in a given date, including the estimated volume that will be harvested. Inventory of the plantation prior

- to harvest shall not be required. CENROs are obligated to approve and enter into their book of registry, application for registration for plantations in private lands.
3. Free from payment of forest charges and other fees or taxes that local government units may impose;
 4. Bamboo from plantation from public and private lands shall not be subjected to inspection in check points;
 5. Plantation developers can access development loans from the public financial institutions
 6. Insurance coverage of plantations and plantation development equipment by the Philippine Crop Insurance Corporation
 7. Tax-free importation of plantation development equipment; including tree nursery facilities;
 8. Expenses incurred shall be allowed as deductible expenses for income tax purposes, subject to the provisions of the National Internal Revenue Code of 1997, as amended. Provided, that the deduction shall only apply to the taxable period, when the expenses were incurred;
 9. Expenses incurred in the development and operation of a bamboo plantation prior to the commercial harvest shall be regarded as ordinary and necessary expenses or as capital expenditures;
 10. The Board of Investments (BOI) shall classify bamboo plantations as pioneer and preferred areas of investment under its annual priority plan, subject to pertinent rules and regulations;
 11. The plantation developer shall be given priority to access credit assistance being granted by Government-owned, -controlled and/or -supported financial institutions;
 12. Plantations shall be accepted as collateral for loans in government owned or controlled banks.
 13. For tenured-developer, upon the premature termination of the agreement at no fault of the holder, all depreciable permanent and semi-permanent improvements such as roads, buildings, and nurseries including the planted and standing trees and other forest crops, introduced and to be retained in the area, shall be properly evaluated and the holder shall be entitled to a fair compensation thereof, the amount of which shall be mutually agreed upon by both the Department and the tenure-holder and in case of disagreement between them, by arbitration through a mutually acceptable and impartial third party adjudicator;
 14. Plantation logs, lumber and other finished wood products and plantation-grown non-wood may be exported without restrictions in volume; and
 15. Processors of bamboo may import processing equipment, tax-free; and
 16. The National Economic and Development Authority (NEDA) shall include in its annual investment program, the use of forest lands to establish industrial bamboo plantations, and to give first priority in allocating adequate funds, both from external and internal sources.

SECTION 8. Establishment of Provincial and Municipal Bamboo Industry Development Councils and Bamboo Industry Development Programs – Provincial and Municipal Local Government Units (PLGUs and MLGUs) are hereby directed to establish Provincial and Municipal Bamboo Industry Development Councils and to formulate and implement their respective Bamboo Industry Development Programs within two (2) years from the enactment of this Law.

SECTION 9. Survey of local bamboo resources and processing enterprises – The Municipal Local Government Units through their Municipal Bamboo Industry Development Councils are hereby directed to conduct a survey of existing bamboo clumps and bamboo processing enterprises in their municipalities.

SECTION 10. Budget of the Secretariat – The Secretariat shall have an initial appropriation of One Hundred Million Pesos (Php 100,000,000) upon enactment of this bill into law and shall have an annual appropriation of no less than One Hundred Million Pesos annually to be included in the Annual Appropriations Act to carry out its functions. The DTI shall provide for the budget of the Philippine Bamboo Industry Development for its operations. The members of the Council shall be entitled to an honorarium the amount of which shall be as provided by law for each meeting attended.



SECTION 11. Allocation of funds to support bamboo plantation development and processing by the Land Bank of the Philippines and the Development Bank of the Philippines – The Land Bank of the Philippines and the Development Bank of the Philippine shall allocated One Billion Pesos (Php 1,000,000,00) annually for loans to investors in the bamboo industry at preferential interest rates.

SECTION 12. Implementing Rules and Regulations –The Department of Trade and Industry in consultation with the Department of Environment and Natural Resources (DENR) and other agencies concerned in government and the private sector, shall formulate the implementing rules and regulations within 90 days after the approval of this Act.

SECTION 13. Separability clause – If any section or provision of this Act shall be declared invalid or unconstitutional, such shall not invalidate any other section or provision of this Act.

SECTION 14. Repealing Clause – All laws, decrees, executive orders, rules and regulations or parts thereof which are in conflict or inconsistent with the provisions of this Act are hereby repealed or modified accordingly.

SECTION 15. Effectivity – This Act shall take effect thirty (30) days following its full publication in the Official Gazette or two (2) major daily newspaper of general circulation.

Approved

Appendix 8

Draft Philippine standard for engineered bamboo

DRAFT PHILIPPINE NATIONAL STANDARD

DPNS xxxx: 2011

Engineered bamboo from slats for general purpose - Specification

1. Scope

This standard specifies the requirements and test methods for engineered bamboo from slats for general purpose.

2. References

The titles of the standard publications referred to in this standard are listed on the inside back cover.

3. Definitions

For the purpose of this standard, the following definitions apply:

3.1 Bending strength

A measure of the ability of the material to resist applied load to cause it to bend and fail

3.2 Bonding

The act of glue laminating crushed/flattened bamboo or slats using a suitable adhesive

3.3 Borer

Organisms that have the ability to penetrate culms, poles, slats leaving distinct holes on the surface of the bamboo

3.4 Cross-ply

A type of engineered bamboo construction in which the grain direction of crushed/flattened bamboo slats are at right angle to adjacent layers

3.5 Crushed bamboo

Pressed bamboo wherein it almost breaks into pieces

3.6 Delamination

A visible separation of layers within the panel or plank due to failure of the bond/adhesive

3.7 Engineered bamboo

Products that are manufactured by binding together veneers, strands, particles, fibers, strips or slats of bamboo with a suitable adhesive to form a composite material designed to meet specific uses.

3.8 Flattened bamboo

Pressed bamboo wherein its surface is level or even rather than its curved sloping original shape

3.9 Gap

A space in between two adjacent slats

3.10 Shearstrength

Ability to resist applied forces that tends to cause adjacent glue-bonded layers to slide in opposite directions

3.11 Slats

Narrow pieces of bamboo resulting from the splitting, and ripping of a bamboo pole

3.12 Split

Lengthwise separation of the bamboo fibers caused chiefly by shrinkage in drying and mechanical damage

3.13 Unidirectional

A type of engineered bamboo construction in which crushed/flattened bamboo or slats are aligned/oriented in one direction

4. Materials

4.1 Bamboo

4.1.1 Crushed/flattened bamboo or slats shall be taken from a mature bamboo of over four years in age.

4.1.2 Crushed/flattened bamboo or slats shall be treated with environment friendly preservative.

4.2 Adhesive

4.2.1 The adhesive to be used shall be environment friendly.

5. Classification

Engineered bamboo shall be classified based on the following:

5.1 Bond Quality

5.1.1 Type I – Water resistant

5.1.2 Type II – Moisture resistant

5.1.3 Type III – Dry Class

5.1.4 Appearance (Grade)

5.1.5 Grade A



5.1.6 Grade B

5.1.7 Grade C

6. Construction

6.1 Cross-ply

6.2 Unidirectional

7. Grading of engineered bamboo and its allowable defects

7.1 Appearance of surfaces - The appearance of surfaces for each grade of engineered bamboo shall be as indicated in Table 1.

Table 1 - Permissible defects for the classification by appearance of surfaces of general purpose engineered bamboo

Kind of Defect	Grade		
	A	B	C
1. Splits and gaps	Practically no appearance defect	Permitted (if properly filled with a flexible and stain-absorbing filler), up to an individual maximum width of 3 mm, maximum length of about 10% of the board and in number up to 1-3 per meter of board width.	Permitted
2. Delamination		Not permitted	Permitted up to 10% of the board
3. Defects due to borers			
a) worm/insect holes up to maximum diameter of 1.5 mm		Permitted if not excessive, not concentrated in the node and not more than 3 per square foot of the board	Permitted
b) worm channels of 1.5 mm		Not permitted	Not permitted
4. Sound discoloration		Not permitted, except for natural discoloration	Permitted
5. Hollow, bumps and imprints		Permitted up to 10% of the board	Permitted up to 10% of the board
6. Roughness		Permitted if very slight and not exceeding 5% of board surface area	Permitted
7. Sanding through		Not permitted	Permitted up to an extent of 1000mm ² per m ² of board surface
8. Glue penetration		Permitted up to 5% of board surface area	Permitted
9. Other defects which are not indicated	To be considered under the category of defect to which it most closely resembles	Permitted	

Note: For Grade C, boards shall be free from rot and must be well glued. Defects inherent in bamboo and manufacturing defects are permitted provided that they do not impair the serviceability of the board.

For engineered products from crushed/flattened bamboo, only Grades A and C apply. Splits and gaps for Grade A products shall be properly filled with a suitable filler and no cracks on such fillers should occur.

7.2 Allowable defects - The allowable defects for each grade of engineered bamboo for general purposes shall be as indicated in Table 1. Defects, which are limited in number, size or extent, are enumerated or evaluated per square meter, calculated as an average of their incidence over the total surface of the board, with the exception of checks, splits and open joints, which are related to one meter of board width.

8. Shapes and dimensions

8.1 Length, width and tolerances – The length, width and tolerance of the board shall be as specified in Table 2:

Table 2. Length, width and tolerances of the board, mm

Category	Length	Width	Tolerance
Plank	1200	102	±2mm
	1800	152	
	2400	203	
		305	
Panel	1219	610	
	1829	914	
	2438	1219	

8.2 Thickness, number of layers and tolerances – The thickness and number of layers of the board shall be as specified in Table 3:

Table 3 - Thickness, number of layers and tolerances

Thickness, mm	Number of layers	Tolerance, mm
4	1 to 5	±0.24
6		±0.45
9		
12		±0.60
15		
18		
24		

8.3 Squareness – The difference between two diagonal measurements shall not exceed 3.2mm.

8.4 Edge straightness - The deviation in edge straightness shall not exceed ±1 millimeter per meter length of board.

Flatness - The amount of distortion that can be tolerated will depend not only on the thickness of the board, the construction and the species but also on the requirements of the end use.

9. Property requirements

9.1 Moisture content

The moisture content of the board shall not exceed 15%.

9.2 Bond quality

9.2.1 Type I (Water resistant) - The bond for type I engineered bamboo shall withstand water exposures and shall pass the test prescribed in ISO 12466-2 (Class III).

9.2.2 Type II (Moisture resistant) – The bond for type II engineered bamboo shall withstand water exposure for short periods and where the service moisture condition is higher than the Type III class and shall pass the test prescribed in ISO 12466-2 (Class 2).

9.2.3 Type III (Dry Class) - The bond for type II engineered bamboo shall withstand normal interior climates excluding any extended direct exposure to weather and shall pass the test prescribed in ISO 12466-2 (Class I).

10. Other requirements

Additional requirements where specific properties are needed especially for applications such as flooring and similar uses and where hardness and bending strength are critical.

10.1 Hardness

The hardness of the board shall not be less than 4.56 kilonewton (kN).

10.2 Bending strength

The bending strength or modulus of rupture of the board shall not be less than 80 megapascals (MPa).

11. Test methods

11.1 Moisture content – The moisture content of engineered bamboo shall be tested as described in Annex B of PNS 196.

11.2 Bond test - The quality of bonding of engineered bamboo shall be tested as described in ISO 12466-2.

11.3 Hardness – The hardness test shall be conducted in accordance with ASTM D 143.

11.4 Bending strength – The bending strength or modulus of rupture (MOR) of engineered bamboo shall be tested in accordance with PNS ISO 16978.

12. Sampling

Engineered bamboo shall be sampled by the random method. One (1) board shall be selected from a batch of 50 boards.

12.1 Dimensional measurements – The samples shall be measured as described in Annex A of PNS 196.

12.2 Laboratory tests – The size of the test pieces shall be large enough to provide the number of shear strength specimens as indicated in Table 4.

Table 4. Number of shear strength test specimens per test piece

Number of layers	Types I, II & III
3	4
5	8

13. Packing and marking

13.1 Engineered bamboo shall be packed/crated to provide suitable protection from the elements to the boards.

13.2 Each board shall be marked by edge branding and shall contain the following information:

13.2.1 Name of manufacturer/registered brand name

13.2.2 Type, grade and thickness

13.2.3 The words “Made in the Philippines” or country of origin (if imported)

References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PNS 196 – Plywood Specification

PNS ISO 12466-2 – Plywood – Bonding quality – Part 2: Requirements

PNS ISO 16978 – Wood-based panels – Determination of modulus of elasticity in bending and of bending strength

ASTM D143 – Standard Test Methods for Small Clear Specimens of Timber

Appendix 9

List of Some Enterprises Marketing Bamboo in the Philippines¹

Buglas Bamboo Institute, Inc.

BBI compound Km 21, MaayongTubig
Dauin, Negros Oriental
Tel: +63 9275086655

Business Type: Bamboo manufacturing

Visit Their Website:

buglas-bamboo.weebly.com

Rizalito Bamboo Craft

Balagtas
Batangas City, Batangas

Business Type: Manufacturer (Bamboo Craft-Kubo)

BAMBOO CRAFT

DEL PILAR MAC ARTHUR HI-WAY
SAN FERNANDO , PAMPANGA
Tel: (045) 963-7430

Business Type: BAMBOO AND RATTAN CRAFTS

MJ Bamboo Craft

Gulod Labac
Batangas City, Batangas

Business Type: Retailer(Bamboo Craft)

JSZ BAMBOO TORCHES & HOUSEWARES CORP.

Lot 16 Florida St., Southville Binan Laguna
Manila, Metro Manila
Tel: (632) 699-6207; (049) 241-2496
Fax: (049) 839-1942; (632) 838-9511

Business Type: Furniture and Houseware

FAR EAST BAMBOO EXPORTS, INC.

Brgy. Tawagan, Tayud, Consolacion, Cebu City
Cebu, Region 7
Tel: (034) 495-5706 to 08
Fax: (034) 495-5709

Business Type: Furniture and Houseware

ROPAR BAMBOO AND RATTAN FURNITURE

Diversion Road, Mandurriao, Iloilo City
Iloilo, Region 6

Business Type: Furniture and Houseware

C.M. BAMBOO CRAFT CENTER

#2 Jereos St., La Paz, 5000 Iloilo City
Iloilo, Region 6
Tel: (63-33) 320-0053; (632) 740-8655
Fax: (632) 740-8655

Business Type: Furniture and Houseware

TROPICOR BAMBOO, TRDG., INC.

2044 San Rafael Village, Mabiga, Mabalacat, Pampanga
Pampanga, Region 3
Tel: (045) 331-6042
Fax: (045) 331-6042

Business Type: Furniture and Houseware

ORTIGAS BAMBOO CRAFT & COCO LUMBER TRADING

54 ORTIGAS AVE.,
PASIG , METRO MANILA

Business Type: RETAILER

CAROLINA BAMBOO GARDEN

SITIO TANZA, SAN JOSE, ANTIPOLLO
Rizal

Business Type: RETAILER

FAD BAMBOO STORE

3263 RAMON MAGSAYSAY BLVD STA MESA, BGY 427, ZONE 043 SAMPALOC,
MANILA

Business Type: RETAILER

Rose & Rizza Bamboo Furniture & Native Products

Brgy. Balele
Tanauan City, Batangas
Tel: 0915-434-6932

Business Type: Furniture Store

Gelene Bamboo Craft

Hi-way 2000 San Juan Taytay Rizal
Business Type: Trading

5R Bamboo Supply

Agham Road
Quezon City, Metro Manila
Tel: 02 508 0881

Business Type: Specialty Stores

KEONA COCO AND BAMBOO ENTERPRISES

HABAY I,
BACOR , CAVITE
Tel: 0939-1618559 / 0939-1618559

Business Type: COCO LUMBER

ZKT NIPA & BAMBOO RETAILER

294 ZAPOTE III
Bacoor, Cavite
Tel: (046) 873-0463

Business Type: Retailer

VENANCIO HOUSE OF WOOD AND BAMBOO - STA. CRUZ

SITIO GUMAMELA, STA CRUZ, ANTIPOLO
Rizal
HOLLYWOOD HILLS II SUMULONG HIGHWAY, MAMBUGAN, ANTIPOLO, Rizal

Business Type: RETAILER

[Ventura / Jean Bamboo Craft](#)

Camias
San Miguel , Bulacan

Business Type: Handicraft Retailer

[OLAVIDES BAMBOO CRAFT](#)

497 TALABA VII
Bacoor, Cavite
Tel: (046) 4172456 417-2456

Business Type: Retailer

[SANTOELI BAMBOO CRAFT](#)

TIRONA HI-WAY HABAY I
Bacoor, Cavite
Tel: 0910-9159495

Business Type: Retailer

[Jessabel Wood Bamboo Works](#)

Commonwealth Avenue
Quezon City, Metro Manila
Tel: +63 926 790 0728

Business Type: Furniture And Houseware

[CERAFICA BAMBOO SET FURNITURE](#)

B-80 L-1 P-1 MABUHAY CITY-BRGY. BACLARAN
Cabuyao , Laguna
Tel: 9208961909

Business Type: RETAILER - NON ESSENTIAL

[A.D.S. BAMBOO CRAFTS](#)

SICAYAB Dipolog
Dipolog City, Zamboanga Del Norte
Tel: 0910-2240461

Business Type: Furniture and Houseware

[Antonio C. Torres Native Crafts Store](#)

184 Km 15 Mac Arthur Highway
Valenzuela, Metro Manila

Business Type: Bamboo Craft

[JDH BAMBOO CRAFTS](#)

c/o GTH PHILS., #544 3rd Street, Lourdes Subd., Sta. Mesa, 1016 Manila
Manila, Metro Manila
Tel: (632) 714-6662

Business Type:

ALFONSO'S BAMBOO INC.

Km. 63 Manila East Rd., Brgy. Halayhayin, Pililia, Rizal
Rizal, Region 4
Tel: (02) 655-0143
Fax: (02) 655-0143

Business Type:

BANSALAN BAMBOO EXPRESSIONS

c/o GTH PHILS., #544 3rd Street, Lourdes Subd., Sta. Mesa, 1016 Manila
Manila, Metro Manila
Tel: (632) 714-6662

Business Type:

CASTILEX INDUSTRIAL CORP.

M.L. Quezon Street, Cabanalan, Mandaue City, 6014 Cebu
Cebu, Region 7
Tel: (63-32) 346-0213; (63-32) 346-3035
Fax: (63-32) 346-0428

Business Type: Furniture and Houseware

POLYMART, INC.

No. 97 Wawa Street, Alabang, Muntinlupa City
Muntinlupa, Metro Manila
Tel: 842-2147 / 850-1007
Fax: 842-2987 / 821-6178

Business Type: Furniture and Houseware

PACIFIC INTERIOR SUPPLY

Pacific Bldg., 1325 Filmore Ave. Makati City, Metro Manila, Philippines
Makati, Metro Manila
Tel: 832-5076
Fax: 833-2492

Business Type: Furniture and Houseware

SASON SHOP, INC.

Brgy. Alijis, Bacolod City, 6100 Negros Occidental
Negros Occidental, Region 6
Tel: (63-34) 434-0654
Fax: (63-34) 434-4759

Business Type: Furniture and Houseware

CIELITO MANUFACTURING CO., INC.

Corner Canghangat, Tawason, Mandaue City, Cebu
Cebu, Region 7
Tel: (032) 422-1803
Fax: (032) 422-1312

Business Type: Furniture and Houseware

Charms Angel Enterprise

Ground Floor Makati Guadalupe Mall
Makati, Makati
Tel: 00639184697443

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

HM TRADING CORPORATION

2nd Ave, Sta.Maria Industrial Estate, Bagumbayan, Taguig, Metro Manila
Taguig, Metro Manila
Tel: (632) 837-2171 to 74 local 114 to 115 / 893-2251 to 54
Fax: (632) 837-2175

Business Type: Furniture and Houseware

KOZMAR TRADING CORPORATION

#2416-A Nobel Street., Brgy. San Isidro, 1234 Makati City
Makati, Metro Manila
Tel: (632) 843-9960; (632) 843-9862
Fax: (632) 843-9862

Business Type: Furniture and Houseware

KINGTEX ENTERPRISES

2nd Floor, Macrima Bldg., 1666 Escuela St. cor. EDSA, 1200 Makati City
Makati, Metro Manila
Tel: (632) 882-3234; (632) 882-1433; (632) 882-1483
Fax: (632) 882-1482

Business Type: Furniture and Houseware

INFINI EXPORT COLLECTION, INC. (FORMERLY INFINI HANDICRAFT COLLECTION)

A.S. Fortuna Street, Banilad, Mandaue City, 6014 Cebu
Cebu, Region 7
Tel: (63-32) 346-1151; (63-32) 416-1656
Fax: (63-32) 346-0671

Business Type: Furniture and Houseware

Charms Angel Enterprise

2392 Antipolo St
Guad. Nuevo, Makati

Tel: 7294663

Fax: 7294663

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

HOME & LIFESTYLE FURNITURE

#45 Kamias Rd., West Kamias Q.C. Metro Manila, Philippines

Quezon City, Metro Manila

Tel: +63 2 646. 7640 / 75; 928. 8836

Fax: +63 2 646. 7640; 928.3836

Business Type: Furniture and Houseware

DANSCOR MFG. & MARKETING, INC.

#412 Zamora St., Fortune 7 Vill., Malinta, 1440 Valenzuela City

Valenzuela, Metro Manila

Tel: (632) 294-1715; (632) 294-2729

Fax: (632) 294-2722

Business Type: Furniture and Houseware

FORMAPLY INDUSTRIES, INC.

#22 Scout Santiago Street, Quezon City

Quezon City, Metro Manila

Tel: 373-0302 - 05

Fax: 373-0306

Business Type: Furniture and Houseware

OBRA CEBUANA INCORPORATED

Arcenas Compound, Banawa, 6000 Cebu City

Cebu, Region 7

Tel: (63-32) 261-2935; (63-32) 261-2939; (63-32) 261-2844

Fax: (63-32) 253-1621; (63-32) 254-6189

Business Type: Furniture and Houseware

MIRCAN FURNITURE MANUFACTURING, INC.

2nd Ave., Sta. Maria Ind'l Estate, Bagumbayan, Taguig, Metro Manila

Taguig, Metro Manila

Tel: (02) 837-2171 / 74

Fax: (02) 837-2175 / 831-0388

Business Type: Furniture and Houseware

CADET DEVELOPMENT CORP.

Unit S-24, 2/F, Sunvar Plaza, Amoroso St. cor. Pasay Rd., 1200 Makati City

Makati, Metro Manila

Tel: (632) 845-3435

Fax: (632) 535-2655; (632) 532-2197

Business Type: Furniture and Houseware

TAMIO ARTCRAFTS

Blk 31 Lot 1 Jane de Joya B.F. Resort Village Talon dos
Las Pinas, Laguna
Tel: (632) 873-0351
Fax: (632) 873-0351

Business Type: Exporter of Baskets and Housewares product

Visit Their Website:

www.tamioartcrafts.com

ART ENERGY

202-203 University Courtyard, La Salle Ave., Bacolod City, Negros Occidental 6100
Negros Occidental, Region 6
Tel: (034) 709-9985 / 433-0685
Fax: (034) 709-9985

Business Type: Furniture and Houseware

MANDATORY TOUCHES, INC.

#1130 McCollough St., 1550 Mandaluyong City
Mandaluyong, Metro Manila
Tel: (632) 727-5017; (632) 723-9430
Fax: (632) 724-5360

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

SOUTHERN PHILIPPINES SHELLS AND CRAFTS

Isabela Village, Pala-o, 9200 Iligan City
Lanao del Norte, Region 10
Tel: (63-63) 221-2845
Fax: (63-88) 857-3601

Business Type: Furniture and Houseware

WOODEN WORLD FURNISHING

Mandurriao, Iloilo City
Iloilo, Region 6
Tel: (033) 321-2521
Fax: (033) 321-2521

Business Type: Furniture and Houseware

By Nature & Mr. 8

011 Pendatun St.
Kidapawan City, Cotabato
Tel: +639185233688

Business Type: Furniture and Houseware

Visit Their Website:

bynatureandmr8.multiply.com

GILLETTE INT'L. EXPORT CO.

#160-A Cuneta Avenue, 1300 Pasay City
Pasay, Metro Manila
Tel: (632) 831-4036 / (632) 831-6105
Fax: (632) 831-3791

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

ISAF FURNITURE DESIGN

Brgy. Baldoza, La Paz, Iloilo City
Iloilo, Region 6
Tel: (033) 320-1140; 320-1249
Fax: (033) 320-1249

Business Type: Furniture and Houseware

OPM INTERNATIONAL CORPORATION

#38 Scout Torillo cor. Sct. Rallos, 1100 Quezon City
Quezon City, Metro Manila
Tel: (632) 330-8167; (632) 928-5471
Fax: (632) 928-5466

Business Type: Furniture and Houseware

MFG.COARAMBI RP.

852 G. Araneta Ave., Tatalon, Quezon City
Quezon City, Metro Manila
Tel: 732-1714 / 09178178916
Fax: 743-9029

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

REVOTE ENTERPRISES

1922 Firmeza St. cor. Kundiman, Sampaloc, 1008 Manila
Manila, Metro Manila
Tel: (632) 749-0814; (632) 749-5615
Fax: (632) 743-6598

Business Type: Furniture and Houseware

JAMANDRE INDUSTRIES, INC.

Rizal St., La Paz, Iloilo City
Iloilo, Region 6
Tel: (033) 320-1279
Fax: (033) 337-0120

Business Type: Furniture and Houseware

Sitio Antonio Wavepool Resort

Bagong Barrio Bunsuran I
PANDI, BULACAN
Tel: 0933 245 2292

Business Type: Hotels and Resorts

IMAGE HANDICRAFT CENTER

#132 Saint Claire St., Villa Angelina, Angeles City, 2009 Pampanga
Pampanga, Region 3
Tel: (63-45) 322-8633; (63-45) 887-2942
Fax: (63-45) 888-5007

Business Type: Furniture and Houseware

A.D. BARVILLA ENTERPRISES

Villa Las Palmas, Tabuc, Suba, Jaro, Iloilo City
Iloilo, Region 6
Tel: (033) 329-3734
Fax: (033) 320-0664

Business Type: Furniture and Houseware

VISAGE CRAFTS COORDINATES, INC.

499 T.Sulit St., Aguho, Pateros, Metro Manila
Manila, Metro Manila
Tel: (632) 641-5823
Fax: (632) 641-8112

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

SAN NICOLAS HANDICRAFT

#11 Narra St., Sta Lucia, San Fernando, Pampanga
Pampanga, Region 3
Tel: (045) 961-3817
Fax: (045) 961-3817

Business Type: Furniture and Houseware

MOTAVA ARTS & CRAFTS

#6 Bayabas, Palmera Homes Subd., Fairview, 1118 Quezon City
Quezon City, Metro Manila
Tel: (632) 418-2522; (632) 937-7580
Fax: (632) 937-7580

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

BANAY-BANAY HANDICRAFTS

Banay-Banay, 8208 Davao Oriental
Davao Oriental, Region 11

Business Type: Furniture and Houseware

MIANES LOKAL CRAFTS

Poblacion, Leganes, Iloilo
Iloilo, Region 6

Business Type: Furniture and Houseware

Q-DESIGN INTERNATIONAL

Suite 202, 2nd Flr., ICDC Bldg., J.M Basa-Guanco Sts., Iloilo City
Iloilo, Region 6
Tel: (033) 335-0935;335-0984; 337-9867
Fax: (033) 335-0026

Business Type: Furniture and Houseware

OLM TREASURES ENT. INC.

Block 1 Lot 2, Ortigas Ave. cor. Bayanihan Village, Cainta Rizal
Rizal, Region 4
Tel: (632) 240-3240 / (632) 240-3242
Fax: (632) 240-3239

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

EDWARD PAUL FURNITURE

Brgy. Dapdap, Tigbauan, Iloilo City
Iloilo, Region 6

Business Type: Furniture and Houseware

PHILIPPINE WONDERS ENTERPRISES

Room 505, Gedisco Terrace, #1148 Roxas Blvd., Ermita, Manila
Manila, Metro Manila
Tel: (632) 523-4178 / 524-4734 / 525-4821
Fax: (632) 521-2175

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

DOREVI INDUSTRIES

#98 Martin P. Posadas Ave., San Carlos City, 2420 Pangasinan
Pangasinan, Region 1
Tel: (63-75) 531-3047; (63-75) 532-4672
Fax: (63-75) 531-3047

Business Type: Furniture and Houseware

VERA WOOD INDUSTRIES (VERA MULTICRAFT MFG.)

1265 Diamond Street, Ramar Village, San Agustin, San Fernando, 2000 Pampanga
Pampanga, Region 3
Tel: (63-45) 961-4530
Fax: (63-45) 961-4530

Business Type: Furniture and Houseware

F4 CORPORATION

0177 Bgy. San Jose, Magalang, Pampanga
Pampanga, Region 3
Tel: (045) 343-4924 / 866-1124
Fax: (045) 343-4925

Business Type: Furniture and Houseware

RUPIKAL ENTERPRISES

Block 5, Lot 6, White Plains Street, Console XII, San Pedro, 4023 Laguna
Laguna, Region 4
Tel: (632) 568-3459; 0919-4550528

Business Type: Toys, Souvenirs, Gifts, Jewelry and Decors

HANSENCRAFT EXPONENTS

c/o Philexport-Pangasinan, 2/F, Star Bldg., Arellano St., Dagupan City, 2400
Pangasinan
Pangasinan, Region 1
Tel: (63-75) 515-3183; (63-75) 523-4031
Fax: (63-75) 552-3472

Business Type: Furniture and Houseware

UNIQUE LAZO

Lambunao, Iloilo City
Iloilo, Region 6

Business Type: Furniture and Houseware

C.T. HOUSEHOLD ESSENTIALS

Brgy. Cagamutan Sur, Leganes, Iloilo City
Iloilo, Region 6
Tel: (033) 524-9801

Business Type: Furniture and Houseware

REBENA SASH AND HOME FURNISHINGS

J.V. Bldg. J.V. Jocson St., Dulongan Arevalo Iloilo City
Iloilo, Region 6
Tel: (033) 336-7604; 337-0027
Fax: (033) 336-7604

Business Type: Furniture and Houseware

[SOUTHERN CABATUAN PRIMARY MULTI-PURPOSE COOP., INC.](#)

Brgy. Calayo, Cabatuan, Iloilo City
Iloilo, Region 6

Business Type: Furniture and Houseware

[Country Accents Inc](#)

Country Accents Inc Marlboro Street, Calibutbut
Bacolor, Pampanga
Tel: +63458882693
Fax: +63458882693

Business Type: Furniture Designer and Manufacturer

Visit Their Website:

www.countryaccentsfurniture.com

[CRC INDUSTRIES](#)

3/F Agape Center 7033 Kabihasanan Road, San Dionisio Street
Paranaque City, Metro Manila
Tel: +632 826 9859; +632 342 3446
Fax: +632 826 9859

Business Type: Eco-Packaging Manufacturer and Supplier

Visit Their Website:

[FB - CRC Industries](#)

[ALVIC HANDICRAFT](#)

Sr. Jose Road, Cabeldatan, Basistas, 2422 Pangasinan
Pangasinan, Region 1
Tel: (63-75) 592-3812

Business Type: Furniture and Houseware

[Philippine Furniture](#)

Rose Mendoza Compound PO Box 1036
Cebu City, Cebu
Tel: 63-9178928478

Business Type: Philippine Furniture and Accessories

Visit Their Website:

www.philippinefurniture.com

[WBPHIL INTERNATIONAL CORP.](#)

zone 14 cem ; drive talamban cebu
Icebu city, Cebu
Tel: +6332-4159434

Business Type: seashells/handicrafts, toys decoratives

Visit Their Website:

www.wbphil.com

BARRIOTIKA

Blk. 17, Bata Subd., Bacolod City
Negros Occidental, Region 6
Tel: (034) 434-4332

Business Type: Furniture and Houseware

ELM AND OAK ENTERPRISES, INC.

67 E. Lopez St., Jaro, Iloilo City
Iloilo, Region 6
Tel: (033) 320-2765

Business Type: Furniture and Houseware

CONTEMPLATIVE OUTREACH TO THE POOR, INC.

Sitio Kati Kati, San Miguel Jordan, Guimaras, 5000 Iloilo City
Iloilo, Region 6
Tel: (0918) 901-6745; (0918) 761-5710
Fax: (63-33) 336-2360

Business Type: Furniture and Houseware

ALTA MODA FURNITURE, INC.

H. Abellana St., Canduman Mandaue City
Cebu, Region 7
Tel: 346-6324; 421-0863
Fax: 346-6324

Business Type: Furniture

MARIANNE'S FURNITURE & GENERAL MERCHANDISE

Unit L-IE Makati Cinema Square, Chino Roces Ave., Makati City
Makati, Metro Manila
Tel: +63 2 811. 1225; 844.4138
Fax: +63 2 811. 1225

Business Type:

HAWAIIAN STYLE FURNITURE TRADING, INC

B23 Lot 20 to 25, 2nd Street, Plaridel II, Angeles City, 2009 Pampanga
Pampanga, Region 3
Tel: (63-45) 887-2304; (63-45) 322-1048
Fax: (63-45) 887-6254

Business Type:

BAMBUSA PACIFIC, INC.

55 Pershing Subic Bay, Freeport Zone Zambales, Zambales, Philippines
Zambales, Region 3
Tel: +63 47 252.3527
Fax: +63 47 252.3527

Business Type:

ARTS & CRAFTS EXPORT, INC.

#99 Dona Rosario Subd., Novaliches, Quezon City
Quezon City, Metro Manila
Tel: (632) 937-2993 / 418-3260
Fax: (632) 937-2992

Business Type:

Spektrum Native Arts and Trading

Caneba Kimba Bravo
CITY OF TALISAY, CEBU
Tel: 09351972957

Business Type: Supplier of Native Fashion Accessories, Components

Spektrum Native Hut Shop

Kimba Bravo Cansojong Talisay City Cebu Kimba Bravo
CITY OF TALISAY, CEBU
Tel: 09351972957

Business Type: Native Fashion Accessories

Visit Their Website:

www.spektrumnativehutshop.weebly.com

JIMENEZ ARTCRAFTS, INC

c/o GTH PHILS., #544 3rd Street, Lourdes Subd., Sta. Mesa, 1016 Manila
Manila, Metro Manila
Tel: (632) 714-6662

Business Type:

Johneiah Anahaw Leaves Dealer

sitio ilaya Laguna
GUMACA, QUEZON
Tel: 09153866735

Business Type: Buy and Sell

¹List of enterprises obtained from the internet, does not include those that were interviewed