The Market for Bio-composites in the Philippines

THE MARKET FOR BIO-COMPOSITES IN THE PHILIPPINES

1.0 INTRODUCTION

Among the group of wood products collectively known as bio-composites, plywood is perhaps the Philippines' most enduring secondary processed wood product. The Philippines took the early lead in veneer and plywood production in Asia and up until the 80s, continued to be a major industry player in the region. From the 1950s up to the early 60s the industry exhibited a remarkable and steady growth, largely due to the demand from the United States which absorbed about 97% of the country's total plywood exports. Then, in 1974, the Philippines' share of the market dropped to 15% (Sanvictores, 1975).

Since then major realignments have occurred. Declining availability of local timber and drastic reduction in logging quotas have resulted to the contraction of the local industry, further resulting to the gradual erosion of the country's share of the market by more competitive countries, notably China, which in 2003, became the largest veneer and plywood producer in the region, overtaking Ghana, Brazil, the Philippines and Malaysia (INFOCOM, 2007).

Over the past four decades the wood processing industry in the region and in the Philippines has been constantly challenged by new technologies and products, changing demand, shifting environmental issues and economic upheavals. But initiatives to re-examine the industry are not wanting. A recent ITTO project led by Indonesia looks at the future of bio-composites and engineered wood products in the region. This study is a component of the country program for the Philippines and in general, aims to review the market for bio-composite products in the country and to determine the potential for future growth of bio-composite products.

DATA SOURCES

Information used in this study were obtained from responses to mailed questionnaires, interviews of key informants in the industry, from official statistics published by the Forest Management Bureau (FMB) of the Department of Environment and Natural Resources (DENR) and from published reports and papers.

Questionnaires were mailed to 17 representatives of the Construction Industry Authority of the Philippines (CIAP), an attached agency of the Department of Trade and Industry mandated to "promote, accelerate, and regulate the growth and development of the construction industry." These respondents were civil engineers and represent the users of bio-composite products. Eight questionnaires were returned.

A different set of questionnaires was mailed to bio-composite producers.

Table 1. Number of respondents

Sector	Number
Construction Industry Authority of the Philippines (CIAP)	17
Plywood producers	8
Particleboard producer	1
Cement bonded board producer	1

2.0 BIO-COMPOSITE PRODUCTS IN THE PHILIPPINES

Bio-composites are a combination of natural fibers such as wood fibers (hardwood and softwood) or nonwood fibers (e.g., wheat, kenaf, hemp, jute, sisal, and flax) held together with some type of bonding material such as adhesive (Golbabaie, M. 2006; Rowell, R 1998). Bio-composites may be adhesives-based or cement-based. The major types of bio-composites in the Philippines are the more traditional adhesive-based bio-composites such as plywood, fiberboard, blockboard and particleboard. Cement-based bio-composites are fiber-cement boards and wood or agri-based cement-bonded boards.

Plywood was the first bio-composite introduced in the country. The plywood industry started in the 1950s and has remained a viable industry despite economic and environmental challenges. Particleboard production was introduced in the 70's but has not gained a strong foothold in the industry. The country produces high density fiberboard, but production is also minimal.

There are 40 plywood producers in the country with a total daily rated capacity of 2,227 cu m. Presently, however, plywood plants operate on average, at less than 80% of capacity because of difficulties in the supply of wood raw materials.

Table 2. Number of bio-composite producers and daily rated capacity.

Bio-composite products	No. of producers	Daily Rated Capacity
Plywood	40	2,227 cu m
Blockboard	7	No data
Fiberboard	1	No data
Particleboard	1	1,000 panels
Cement bonded boards	2	50 panels per day

Source: Philippine Forestry Statistics 2006 and personal interviews

3.0 PRODUCTION AND DISTRIBUTION

3.1 PRODUCTION OF MAJOR BIO-COMPOSITE PRODUCTS

Plywood is still the major bio-composite product produced in the country. From 2001 to 2006, production ranged from 292 thousand to 386 thousand cu m, with the highest production in 2004. Fiberboard and blockboard production, on the other hand was below 100 thousand cu m and was fairly stable from 2001 to 1006.

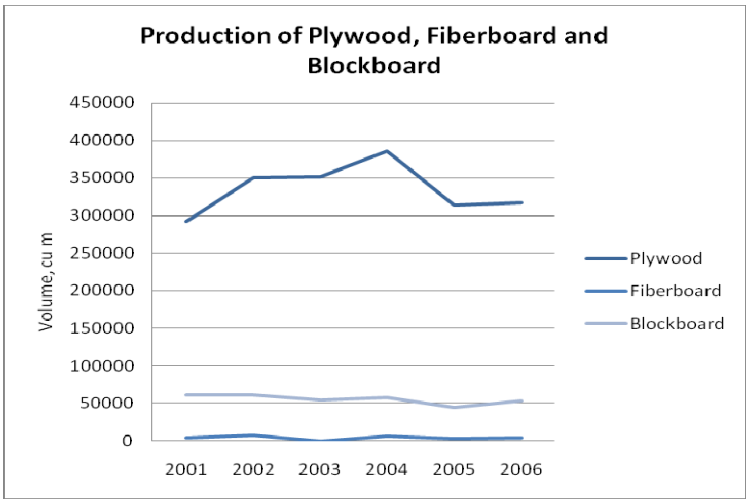


Figure1. Production of Plywood, Fiberboard and Blockboard

3.2 PRODUCT FLOW

The production and distribution chain of processed wood products in the Philippines starts at the natural or plantation forest. Falcata, yemane and lauan species are the more common types of local roundwood species used in bio-composites. The country also imports logs. In 2006, the country imported 65,185 cu m of roundwood, the lowest so far since 1996 when imports peaked at 877,000 cu m.

Sawlogs are further processed into lumber in sawmills. Veneer logs may either go to veneer plants or plywood plants. Plantation thinnings go to particleboard, fiber board or wood wool cement board plants. The bulk of fiberboards used in the local market are imported by local distributors whose buyers come from the furniture and construction sector (Fig 2).

Major end-use markets for bio-composites are the furniture and construction industries and to a smaller extent, builder's woodworks. More than 80% of the direct buyers of plywood and blockboard are traders and 31% of direct buyers are contractors. About 20% are more or less equally distributed between furniture makers and builders woodworks (Table 3).

Table 3. Composition of direct buyers of bio-composites

Type of Buyers	**Plywood and Blockboard Ave %**	**Particleboard Ave %**	**Cement bonded boards Ave %**
Traders	87	20	
Furniture makers	11	80	
Contractors	31		100
Builders woodworks	10		

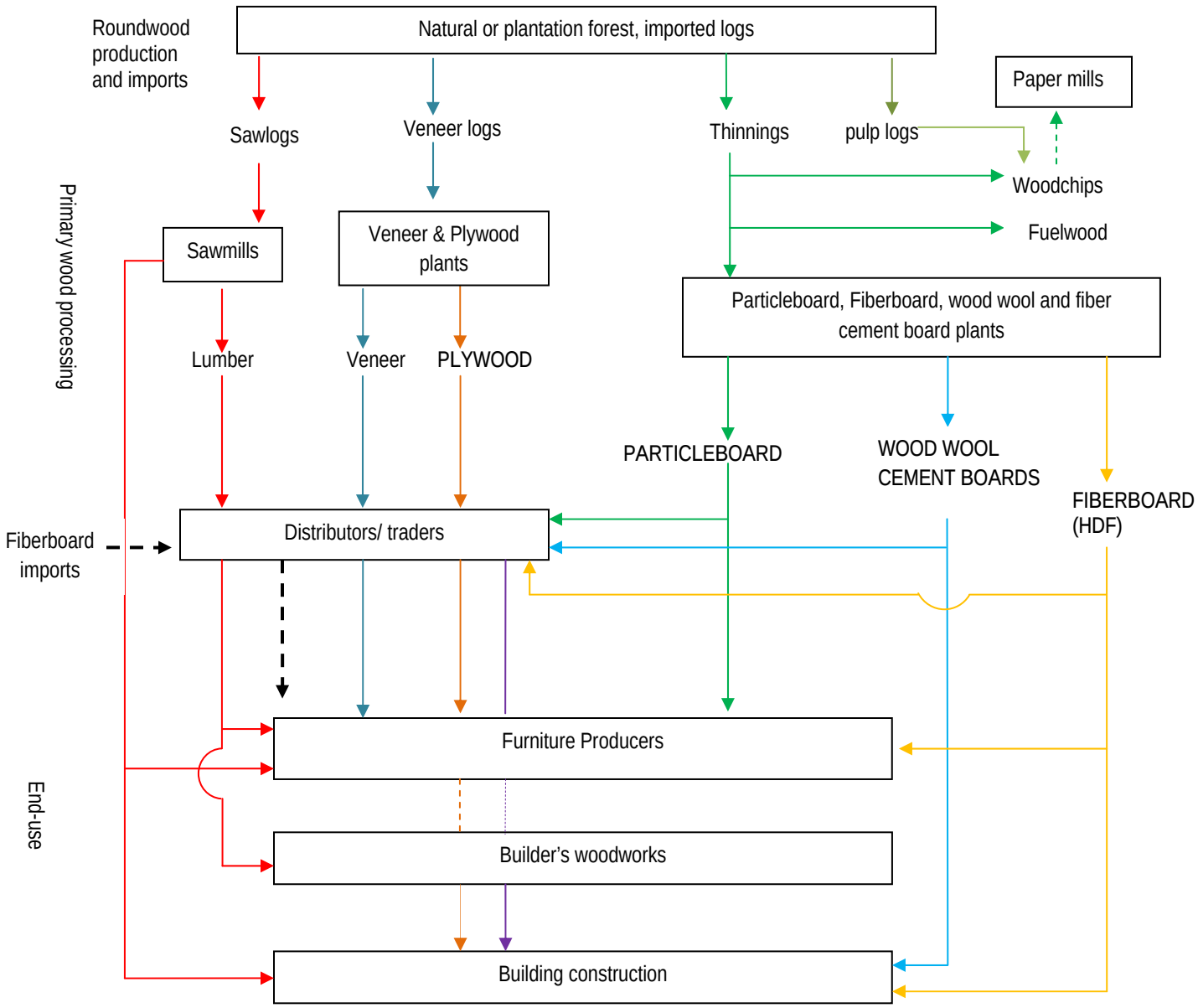


Figure 2. Production and distribution flow of bio-composites

Twenty five percent of the volume of cement bonded boards is channeled through traders; 65% are bought directly by building contractors. The lone producer of particleboard ships directly to furniture producers in Manila and Cebu, the Philippines' major furniture production center.

3.3 Production Centers

The Philippines is divided into three major island groupings—Luzon in northern Philippines, Visayas in the Central part and Mindanao in the south (Fig. 2). The only operating particleboard plant and 29 plywood producers out of the country's total of 40, are located in the Mindanao region, which is also known as the country's "timber corridor." In 2006, 299 thousand cu meters of plywood were produced in this region, representing almost 95 % of the country's total plywood production of (Table 4).

Table 4. Plywood production by region, 2006.

Region	Total Production (cu m)	%
Philippines	**316,922**	**100.00**
Luzon	**17,721**	**5.59**
National Capital Region (NCR)	12,293	
Region 4-A	5,428	
Mindanao	**299,201**	**94.41**
Region 9	32,558	
Region 10	91,876	
Region 11	9,097	
Region 13	165,670	

Source: Philippine Forestry Statistics 2006

In 2006, the Philippine Forestry Statistics listed ten plywood plants in Luzon and only one in the Visayas. However, since there was no recorded plywood production in the Visayas in 2006, this may imply cessation of operations.

While majority of plywood plants are located near the sources of raw material, fiber cement boards and wood wool cement bonded boards are produced in Southern Luzon nearer to the larger markets of Metro Manila and outlying provinces (Fig 1).

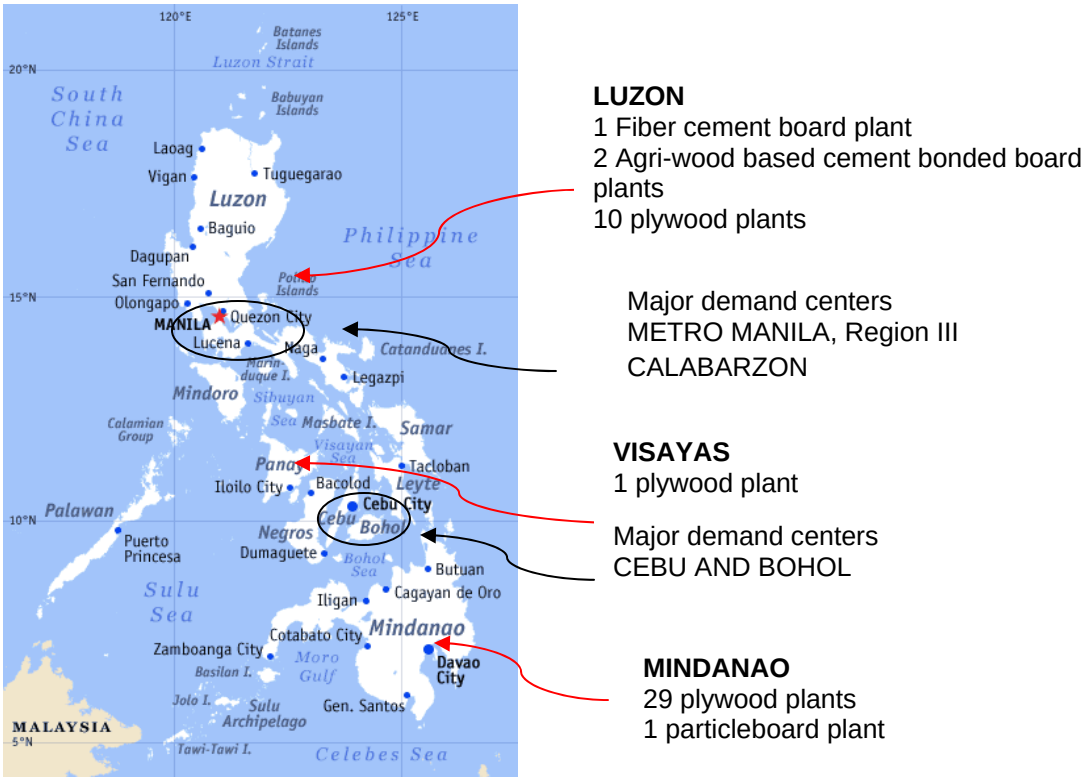


Figure 2. Location and distribution of wood based bio-composite plants and major demand centers for wood bio-composites

4.0 The Macro-environment of the Bio-Composites Industry in the Philippines

4.1 The Construction and Furniture Sectors

The demand for bio-composites is tied primarily to the state of activities of the construction sector and the furniture industry.

Construction Industry

Despite the global financial crisis, the local construction sector did not suffer major slumps in activity. There has been an increasing trend in residential and building construction for the past three years (Fig 2).

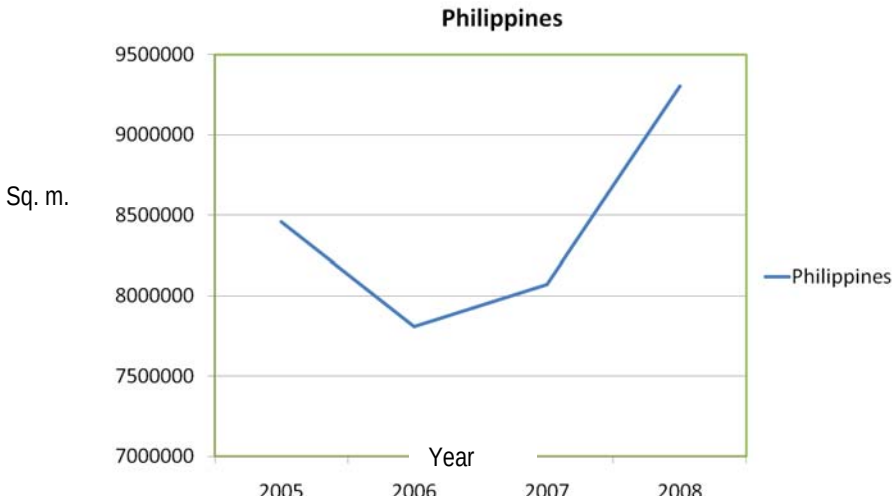
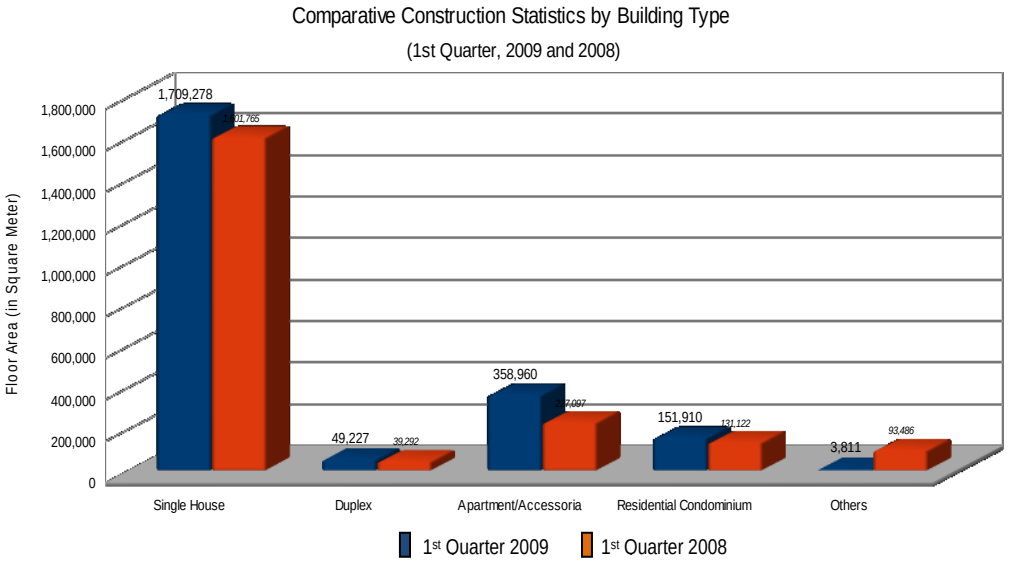


Figure 3. Total construction in square meters, 2005-2006

Comparative figures for the first quarter of 2009 and 2008 also show an increase in residential building construction which rose by 21.3 percent in the first quarter of 2009 compared to the same quarter of 2008. Similarly, non-residential building construction grew to a remarkable 42.6 percent (Fig 3) .

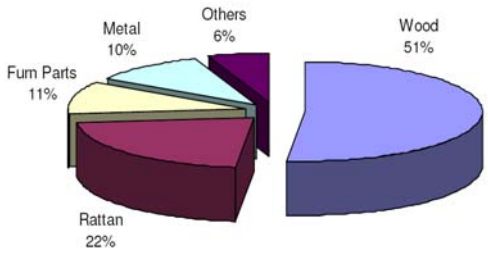
Construction is focused on single-type residential houses, followed by residential condominiums and apartments. There has been an increase of around 180,000 sq m in total floor area for all types of buildings.



Furniture Industry

An estimated 15,000 firms comprise the local furniture industry (Department of Trade and Industry, 2005). Only 2% are considered large ventures and the remaining 98% are small and medium-sized firms.

Wood furniture, mostly in solid wood, is the most common material used in furniture exports, accounting for 59% of total Philippine furniture exports to the world.



Bio composites such as plywood, medium density fiberboard and particleboard are used for panel furniture such as office tables and cabinets, most of which go to the domestic market. Domestic furniture production fills the requirements of new residential, hotel and office buildings. Thus, demand for local furniture and the raw materials used in their manufacture is also fuelled by the construction sector.

4.2 INSTITUTIONAL

Major institutions that impact on the bio-composites industry are the Department of Trade and Industry (DTI), Department of Environment and Natural Resources (DENR) and trade associations such as the Philippine Wood Producers Association (PWPA).

The Bureau of Product Standards (BPS) of the Department of Trade and Industry (DTI) develops, implements and coordinates standardization activities. Of the bio-composite products in the Philippines, standards have been developed only for plywood. Thirty-three plywood plants have been granted product standards certification and can thus use the PS Mark on their products.

The BPS conducts regular and special assessment of manufacturers of plywood, ensuring that no plywood produced by Non-PS Mark License holder shall be sold to, or offered for sale by any marketing outlets. The BPS can also take action and impose fines and penalties against manufacturers, importers, traders, distributors and/or marketing outlets selling substandard plywood or plywood without PS or Import Commodity Clearance (ICC) from the BPS.

The DENR, on the other hand, may cancel a company's Wood Processing Plant Permit (WPP), deny the application for renewal of WPP, padlock the plywood mill and impose fines or penalties against non-WPP holders or violators of the PS mark. It can also cancel the Certificate of Registration for Authority to Import Wood Materials of importers of substandard plywood or plywood without ICC mark.

The PWPA works together with the DENR and BPS to ensure that plywood, whether imported or locally manufactured, conforms with the specific national standard for the protection of the consumers. The PWPA is an association of lumber, veneer and plywood producers and gives voice to the issues currently faced by the wood processing industry.

Policies that impact on the raw material sources of bio-composite plants are shaped by the DENR. Supply of wood raw materials have been affected by policies on "the non-renewal of timber leases and licenses; the prohibition of cutting from old-growth forests (through NIPAS Act or RA 7586 & DAO 02, 1992), the cancellation or suspension of timber concession activities in secondary; and the on and off policy of banning timber" (Carandang, 2005).

4.3 TECHNOLOGICAL

New technologies and processes have given rise to alternative materials and products that directly compete with the more "traditional" wood bio-composites. Fiber cement board is seen as a direct competitor by plywood producers.

On the other hand, most plywood plants were established in the 70s and some are still operating on vintage equipment. Despite these, the industry has managed to adapt and survive.

Most advanced technologies for bio-composites in general, is externally acquired from the more developed nations which have developed newer technologies on bio-composites, particularly on

adhesives and the use of different fiber-base resources in combination with other materials.

4.4 ENVIRONMENTAL

One of the big issues faced by the bio-based composites industry is on the nature of adhesives used, particularly on the volatiles they release when used in bio-composites products. Most local firms have yet to shift to non-formaldehyde based adhesives, partly because of cost considerations and partly, because the local market in general, is not as particular and demanding.

5.0 BIO-COMPOSITES DEMAND AND SUPPLY

5.1 PLYWOOD

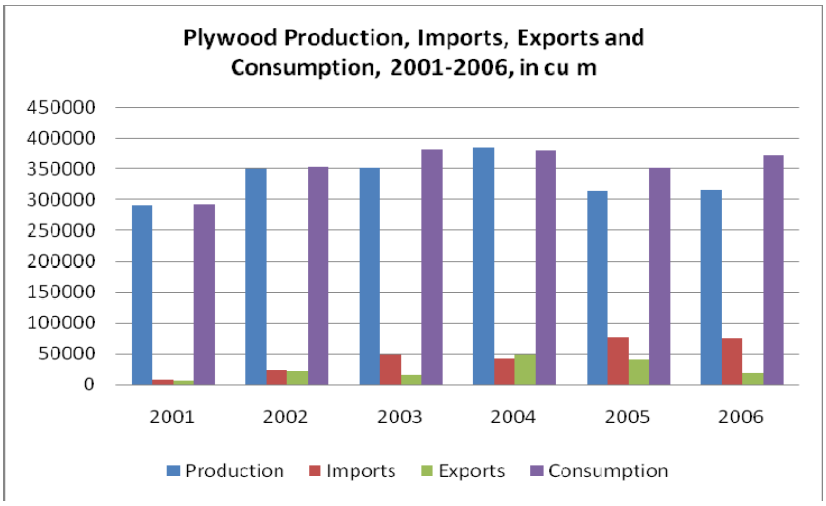
Plywood is still the most common type of bio-composite used. On the average, about 66% of bio-composites used in construction projects of contractor-respondents is plywood, which is used as ceilings and interior walls.

Domestic demand for plywood is met by local production and augmented by imports which increased from 2001 to 2006. Based on these figures, 89% to 98% of total supply went to the domestic market (Table 5).

Table 5. Production, trade and consumption of plywood.

PLYWOOD, cubic meters							
Year	Production	Imports	Supply	Exports	%	Available for Domestic Use	%
2001	292,294	8,242	300,536	6,834	2	293,702	98
2002	350,353	24,847	375,200	21,909	6	353,291	94
2003	350,891	48,557	399,442	16,637	4	382,811	96
2004	385,570	42,045	427,615	47,731	11	379,884	89
2005	314,182	78,005	392,187	40,015	10	352,172	90
2006	316,922	75,135	392,057	19,952	5	372,105	95

Source: Philippine Forestry Statistics



5.2 FIBERBOARD

Compared to plywood, local production of fibreboard is minimal falling on or around 50 thousand cu m per year (Figure 1). Locally produced fibreboards, also called *"lawanit,"* are high density fibreboards (HDF). In construction, they are used as ceilings and interior walls.

The Philippines does not produce medium-density fibreboards (MDF). Demand for MDF and HDF boards and final products is filled in by imports.

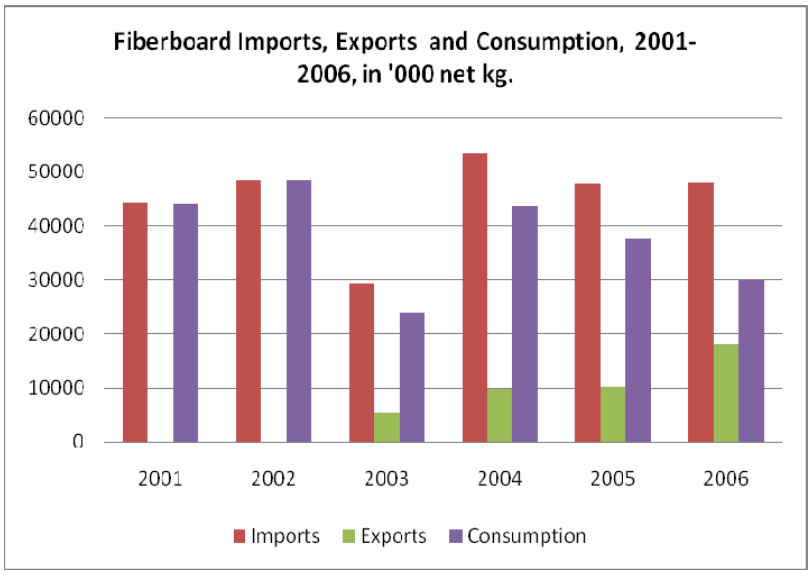
Imports of fiberboards were highest in 2004 but re-exports showed an increasing trend from 2004 to 2006. Domestic consumption, however, decreased from 48 million kg. in 2002 to 30 million kg. in 2006.

Table 6. Production, trade and consumption of fiberboards

FIBERBOARD					
Year	Production cu m	Imports '000 net kg	Supply* '000 net kg	Exports '000 net kg	Domestic Consumption '000 net kg*
2001	5	44,292	44,292	28	44,264
2002	8	48,478	48,478	113	48,365
2003	0	29,315	29,315	5,367	23,948
2004	7	53,527	53,527	9,791	43,763
2005	4	47,937	47,937	10,226	37,711
2006	5	47,981	47,981	17,981	30,000

*local production not included

Source: Philippine Forestry Statistics



5.3 PARTICLEBOARDS

The Philippines has three particleboard plants but as of 2009, only one is operating. The plant can produce 1,000 high density particle boards per day but on average produces only 650 panels a day. It uses Gmelina tops and branches as raw material and prides itself in using formaldehyde-free glue in their products.

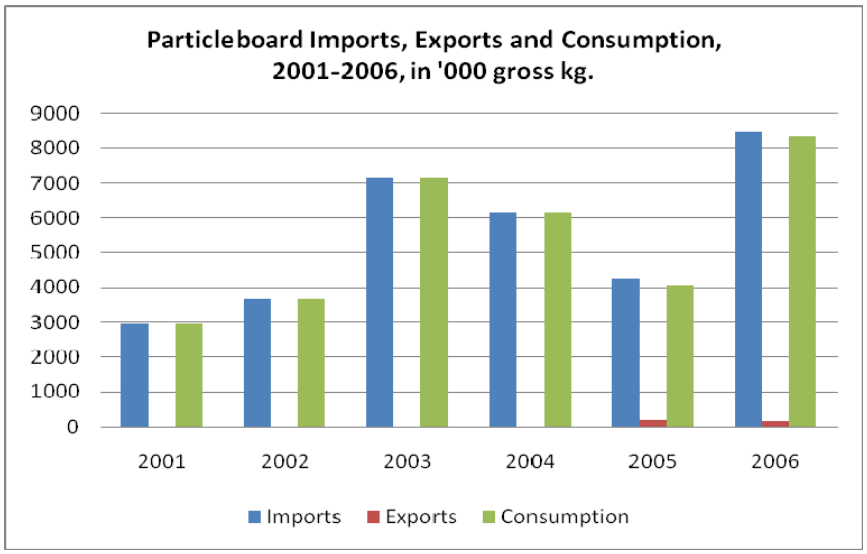
Their boards are shipped direct to furniture makers in Cebu and Manila. Twenty percent of their market is in Cebu, 70% in Manila and 10% goes to the local market in the plant's hometown in Ozamiz.

Although the plant is operating below capacity, the country still imports a sizeable quantity of particleboards. Imports increased from around 3 million net kg in 2001 to 8 million net kg in 2006. Only less than 2 percent is exported.

Table 7. Production, trade and consumption of particleboard.

PARTICLEBOARD, in '000 net kg					
Year	Production	Imports	Supply	Exports	Domestic Consumption
2001	No data	2,948	2,948	-	4
2002	n.d.	3,674	3,674	-	3,674
2003	n.d.	7,162	7,162	-	7,162
2004	n.d.	6,173	6,173	-	6,173
2005	n.d.	4,249	4,249	175	4,074
2006	n.d.	8,478	8,478	140	8,338

Source: Philippine Forestry Statistics



5.4 CEMENT BONDED BIO-COMPOSITES

Other bio-composites in the market are agri-based cement bonded (CBB) boards and fiber cement boards (FCB). There are only two agri-based cement board plants in the country and one large fiber cement board plant. The two CBB plants are owned and operated by architects who produce boards which are used in their respective housing projects. About 65% of production are bought by contrat

Fiber cement (fiber reinforced cement composite) was originally developed by James Hardie in 1980. One of the main ingredients of fiber cement products is cellulose fibers from wood or non-wood sources which are added to reinforce the cement composite. Also, small amounts of chemical additives are utilized to help the process, or provide products with particular characteristics (Golbabaie, M 2006). There is only one producer of fiber-cement board in the country which is traded under the brand Hardiflex. This uses imported virgin pulp fiber.

6.0 BIO-COMPOSITES IN CONSTRUCTION

Bio-composite products have found increasing applications in housing construction compared to other industrial applications. Plywood is still the most common type of bio-composite used by building contractors. All respondents have used plywood and fiber cement boards in their projects, while 50% and 25% have used particleboard and blockboard, respectively, in their projects. These were used as ceilings and interior walls; but only fiber cement boards were used as exterior walls.

Table 8. Uses of bio-composites in construction

Product	Application
Plywood	Ceilings, interior walls
Fiber-cement board	Ceilings, interior and exterior walls
Blockboard	Interior walls
High density fiberboard	Ceilings, interior walls
Particleboard	Ceilings
Cement-bonded board	Ceilings, interior walls

In terms of the product mix, an average of 66% of the bio-composites used in their construction projects is plywood. However, fiber cement boards, which were introduced in the country ten years ago have eaten into the market share of the more "traditional" panel products. An average 23% of bio-composites used by the respondents is fiber cement boards.

Table 9. Extent of use of bio-composites.

Product	Average % Share Used in Projects
Plywood	66
Fiber-cement board	23
Blockboard	15
High density fiberboard	13
Particleboard	7
Cement-bonded board	2

Suitability to the structure being built, durability of the material and quality seems to be the most important attributes considered by the respondents when choosing the type of bio-composite material to use. One implication here is the importance of durability as an attribute. Taken in conjunction with the findings that fiber cement boards have eaten into the share of

plywood, this again reflects the perception that wood is not as durable as say, cement. Price is also a less important consideration than durability or suitability to specific use.

Table 10. Attributes considered in choosing type of bio-composite used.

Attribute	Importance 1=most important
Suitability	1.6
Durability	1.8
Quality	2.5
Availability	4.0
Specification	4.6
Price	4.8
Appearance	5.6

7.0 Growth and Resource Sustainability

Bio-composites will always be acceptable materials for construction and furniture. However, new bio-composite products that substitute directly with another bio-composite, affect how market shares are re-aligned. The introduction of fiber-cement boards for instance has cut into the market share of plywood, although it is still the most popular bio-composite material used in construction. On the other hand fiber cement boards and fiberboards have different applications. Thus, market share of fiberboards basically remain unaffected by fiber cement boards.

The growth of the bio-composites industry will depend on the growth of industries dependent on it and on the introduction of new products, technologies and new applications. Fiber-cement board, introduced ten years ago, is the latest bio-composite to be introduced in the market and has managed to carve a niche in the construction sector. Eighty nine percent of plywood producers and users believe that usage rate for this product will increase significantly in the next three years (Table 11). This reflects the perception that fiber cement boards are a threat to the plywood market. On the other hand, only 54 percent of the respondents are optimistic that there will be a significant increase in demand for plywood; 31 percent believe that demand will remain basically unchanged.

There has also been a surge in the use of fiberboards, as seen in the increase of fiberboard imports. About 80 percent of the respondents think that in the next three years, fiber board usage will increase.

Table 11. Respondents' perceived trend in demand for bio-composites

Product	% of Respondents				
	Increase		Decrease		No change
	Sig.	Not Sig	Sig	Not sig	
Plywood	53.8	7.7	-	7.7	30.8
Fiber cement board	88.9	-	-	-	11.1
Blockboard	42.8	28.6	-	-	28.6
Particleboard	33.3	22.2	11.1	11.1	22.2
MDF	50.0	33.3	-	-	16.7
HDF	14.3	14.3	14.3		57.1

Of the bio-composites in the country, plywood is perhaps the most challenged in terms of raw material sustainability. Unlike new composite products which use smaller elements, plywood production still relies on whole timber. Although these are sourced from plantations rather than from natural forests, very few (30%) bio-composite producers think that there are enough raw materials to sustain production (Table 12). In contrast, 70% of the respondents think otherwise --there will not be enough raw materials to sustain production.

Reasons given by both sides are conflicting. Those who believe that there will be enough resources consider falcata as fast-growing and sustainable and thus see no reason why difficulties in supply should occur. On the other hand, most producers believe that replanting efforts fall short of expectations because of lack of government support. These conflicting perceptions actually point to geographical differences in the supply of raw materials. Those who don't find it difficult to source raw materials are actually located in a region where replanting efforts are relatively strong and their proximity to plantations make it easy for them to acquire raw materials. Apparently, there is no timber surplus to meet the requirements of plywood producers located farther away.

Supply difficulties limit production. One respondent operates for only three days a week due to lack of veneer logs. Often, they have to buy veneer from veneer plants located in another region in the country, just to sustain the three-day-a-week operation.

Table 12 . Perceptions on raw material sustainability

YES, there will be enough raw materials to sustain operations within the next five years	NO, there will NOT be enough raw materials to sustain operations within the next five years
30%	70%
• **"Falcata is a sustainable plantation species"** • **"Replanting of falcata is continuous"**	• "no reforestation; no government support" • "Yearly consumption exceeds replanting" • "Most local farmers do not want to replant due to the many restrictions (*regulations*) imposed…in cutting their own trees" • "less attention given to replanting"

8.0 Conclusion and Recommendations

There will always be demand for bio-composites because of its wide range of application in the housing and furniture industries. This demand is met through local production and importations. Although the country produces plywood, HDF, blockboard, particleboard, fiber cement boards and wood/agri-based cement bonded boards, sizeable importations indicate that local production could not satisfy the volume requirements, and most probably the quality requirements of the local market.

The plywood industry was in its growth stage in the early 60's. During this period, efficiency and productivity of plywood plants established during this period was quite high because equipment and machinery were still new. Today, most of the plywood plants have antiquated equipment and productivity has remained low (Candelaria, C., 2007). This leads to uncompetitive price and quality, in comparison with other bio-composites.

Plywood production depends heavily on timber. The two opposing perceptions on the sustainability of wood resources for plywood stem from differences in the status of plantation development in the locality. Replanting and plantation development efforts of the private and government sector should be doubled to increase the timber supply base and thus meet the volume requirements of plywood producers.

The issue of quality is a major concern of both producers and consumers of bio-composite products. One reason for the increasing market share of fiber cement boards, aside from the perceived durability, is the substandard quality of plywood. Building contractors specifically complain of undersized panels. Plywood producers, on the other hand, recognize that substandard plywood produced by small players can also affect market shares of producers who strive to preserve their "PS Mark" of quality.

Quality standards for plywood have been in place and are constantly being reviewed. The recent agreement forged between PWPA and the BPS towards strengthening product standard implementation for plywood is a welcome development. Strict implementation of quality standards across the plywood industry should give a fighting chance for the industry to win back the share lost to new products.

Quality standards should not be limited to plywood. Standards should also be developed for wood-based and agri-based cement bonded boards to ensure consumer confidence on the product, improve its marketability and sales, and encourage private investment in CBB production. FPRDI is the lead institute in the country which has the capability not only to conduct research on bio-composites but also to develop standards.

Bio-composites compete with each other for a share of a market that has remained fairly constant. Thus the share of the pie of traditional bio-composites is affected by the introduction of new products such as fiber cement boards, which has a wider range of application, particularly in housing construction. Plywood producers have reportedly experienced on the average, a 25% decrease in sales due to the shifting preference towards fiber cement boards (Candelaria, C., 2007).

To ease market share competition within the traditional construction industry, new markets should be developed. This requires exploring new applications for existing bio-composites such as in packaging, and developing products that will serve the non-traditional wood markets. This also necessitates that the industry keep pace with developments in bio-composite research to ensure its viability.

REFERENCES

1. "Philippines Solid Wood Products Annual 2001". GAIN Report. http://www.fas.usda.gov/gainfiles/200506/146130054.pdf

2. Candelaria, C. (2008) "Status of the Plywood Plants in Luzon"

3. Golbabaie, M. (2006) "Applications of Bio-composites in Building Industry" Department of Plant Agriculture, University of Guelph, Ontario, Canada, Dec. 12, 2006.

4. INFOCOM. "Market Information in the Commodities Area", UNCTAD. http://www.unctad.org/infocomm/anglais/oil/sitemap.htm

5. Rowell, R. M. (1992) "Opportunities for Value-added Bio-based Composites ," in Proceedings of the Pacific Rim Bio-based Composites Symposium; 1992 November 9-13; Rotorua, New Zealand.FRI Bulletin 177. Rotorua, New Zealand: New Zealand Forest Research Institute; 1992: 244-252.

6. Rowell, R. M. " The State of the Art and Future Development of Bio-based Composite Science and Technology Towards the 21st Century." In: Proceedings, the Fourth Pacific Rim Bio-based Composites Symposium, November 2-5,1998, Indonesia. p. 1-18.

7. Sanvictores, B. "Moving Moving away from Log Exports" originally presented at the FAO World Consultation on Wood-based Panels held in New Delhi in February 1975. http://www.fao.org/docrep/f6137e/f6137e09.htm#TopOfPage

8. Winandy, J. E. "Advanced Wood- and Bio-composites: Enhanced Performance and Sustainability" in Advanced Materials and Processing IV : Selected, peer reviewed papers presented at the 4th International Conference on Advanced Materials and Processing, 10-13 December, 2006, Hamilton, New Zealand. Zurich : Trans Tech Publications, Ltd., 2007. Advanced materials research ; v. 29-30: ISBN: 0878494669: 9780878494668: Pages 9-14.