

MARKET ASSESSMENT:

Determine where the potential for future market growth for bio composite products exists

A paper prepared for CFC/ITTO-USDL

By

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I. Introduction

This paper provides a brief analysis of how to determine the potential future market for bio composite products, especially for Indonesia's bio composite products. First, current world's demand and its trend for each wood-composite products: plywood, veneer sheets, particleboard and fiberboard were investigated. The principal policies and market forces that are likely to affect the global and regional markets for bio-composite products were also described. Then, shares of Indonesia's bio composite product imports of total bio composite product imports in each major country destination as reported by importer countries were analyzed. Recommended type of Indonesia's bio composite products that should be developed and its potential future market would also be determined. Finally, the need for Indonesia to restructure and revitalize its forest industry were explained.

The principal policies affecting forest products markets in the future are forest law enforcement, governance and trade (FLEGT); forest certification; policies promoting the sound use of wood; research and development related policies; industry competitiveness and investment policy; climate change policy; wood energy promotion policy; trade policy and tariff and non-tariff barriers; and phytosanitary measures. Meanwhile, from demand side, needs for wood composites were driven by population, economic growth, product application and substitution, price level, and Industry push for innovation and value addition to resources

The analysis is based on statistics from the FAOSTAT database (FAO 2008), the latest summary of global forest statistics available. Data on production and trade provided by Ministry of Forestry of Indonesia (MOF) and related agencies such as Central Bureau of Statistics of Indonesia (BPS) as well as other available literature were also used. Meanwhile, description of the principal policies affecting forest products markets in the future was based on Forest Products Annual Market Review published by United Nations Economic Commission for Europe (UNECE) and in Annual Review and Assessment of the World Timber Situation published by ITTO.

II. World's demand and its trend of wood composite products

2.1. Plywood

During the period 2002-2006, world's plywood consumption significantly increased from 59.3 millions m³ in year 2002 to 73.3 millions m³ in year 2006, a 24% increase (Table 1). Over this period, about 312.9 million m³ of plywood were consumed by only 20 countries, which accounted for 91% of world's plywood consumption. Three largest consumers were United States of America, China, and Japan, which together accounted for 68% of world's plywood consumption. Other important consumers were the Republic of Korea, India, and Canada.

Although consumption grew fastest in Brazil (117%) followed by China (88%) and Russian Federation (54%), not only these countries were net exporters but also major world exporters. Meanwhile, consumption grew slightly 3% in United States of America, Japan, and United Kingdom and even decreased in the Republic of Korea (-10%), but these countries were net and major world importers, which together accounted for 54% of world's plywood imports. Production, export, and import of plywood in major consumer countries in the period 2002-2006 are shown in Appendix 1.

2.2. Veneer sheets

During the period 2002-2006, world's veneer sheets consumption significantly increased from 8.5 millions m³ in year 2002 to 11.5 millions m³ in year 2006, a 35% increase (Table 2). Over this period, about 48.6 million m³ of veneer sheets were consumed by only 28 countries, which accounted for 90% of world's veneer sheets consumption. The largest single consumer was China (27%). Other important consumers were the Republic of Korea (9%), Italy (6%), United States of America (6%), and New Zealand (5%).

Consumption grew fastest in Indonesia (1958%) followed by China (196%) and Russian Federation (119%). However, Indonesia and Russian were net exporters, whereas China was a net and one of major world importers. Although consumption decreased in United States of America, the Republic of Korea, and Canada, these countries were still net and major world importers. Coupled with China and Italy, those countries together accounted for 56% of world's veneer

sheets imports. Production, export, and import of veneer sheets in major consumer countries in the period 2002-2006 are shown in Appendix 2.

2.3. Particleboard

During the period 2002-2006, world's particleboard consumption significantly increased from 85.6 millions m³ in year 2002 to 105.9 millions m³ in year 2006, a 24% increase (Table 3). Over this period, about 447.4 million m³ of particleboard were consumed by only 27 countries, which accounted for 93% of world's particleboard consumption. The largest single consumer was United States of America (32%). Other important consumers were Germany (9%), and China (7%).

Consumption grew fastest in China (104%) followed by Ukraine (100%) and Russian Federation (88%). These countries were also net importers. Although particleboard consumption of United States of America grew not as fast as in those three countries, it was the largest single particleboard importer in the world (36%). Other important importers were Germany, United Kingdom, Poland, and the Republic of Korea. Production, export, and import of particleboard in major consumer countries in the period 2002-2006 are shown in Appendix 3.

2.4. Fibreboard

During the period 2002-2006, world's fibreboard consumption significantly increased from 41.5 millions m³ in year 2002 to 67.8 millions m³ in year 2006, a 63% increase (Table 4). Over this period, about 242.6 million m³ of fibreboard were consumed by only 24 countries, which accounted for 88% of world's fibreboard consumption. Two largest consumers were China and United States of America, which together accounted for 49% of world's fibreboard consumption. Other important consumers were Germany, the Republic of Korea, United Kingdom, Brazil, Turkey, Japan, and Italy.

Although consumption grew fastest in Mexico (239%) followed by Turkey (213), China (146%), Iran (134%) and Brazil (101%), in order of importance, major world's importers were United States of America (USA), China, Germany, United Kingdom, Belgium, and the Republic of Korea, which together accounted for 43% of world's import. Production, export, and import of fibreboard in major consumer countries in the period 2002-2006 are shown in Appendix 4.

Table 1. Apparent consumption and net export of plywood in major consumer countries, 2002-2006

Major Consumers	Apparent consumption (million m3)							Net Export = Export - Import (million m3)					
	2002	2003	2004	2005	2006	2002-2006	Change (%)		2002	2003	2004	2005	2006
							annual	2002-2006					
United States of America	18.7	18.6	20.2	20.1	19.3	96.9	1%	3%	-3.4	-3.7	-5.4	-5.7	-5.7
China	11.7	21.3	19.0	21.7	22.1	95.8	17%	88%	0.4	0.5	2.8	4.2	6.0
Japan	7.8	7.2	8.3	7.9	8.3	39.6	2%	6%	-5.1	-4.2	-5.1	-4.7	-5.0
Korea, Republic of	2.2	2.3	1.9	1.9	2.0	10.2	-3%	-10%	-1.3	-1.4	-1.1	-1.2	-1.3
India	1.6	1.7	1.9	2.1	2.1	9.4	7%	31%	0.0	0.0	0.0	0.0	0.0
Canada	1.6	1.7	1.7	1.9	2.1	9.0	7%	30%	0.6	0.5	0.7	0.4	0.2
United Kingdom	1.2	1.2	1.4	1.3	1.4	6.5	3%	11%	-1.2	-1.2	-1.4	-1.3	-1.4
Germany	1.0	1.1	1.2	1.1	1.2	5.7	3%	14%	-0.7	-0.9	-0.9	-0.9	-0.9
Brazil	0.8	0.8	0.8	0.9	1.8	5.2	21%	117%	1.9	2.4	3.0	2.8	1.9
Indonesia	1.7	1.0	0.5	1.2	0.8	5.2	-18%	-54%	5.8	5.1	4.0	3.4	3.0
Russian Federation	0.7	0.8	0.9	1.1	1.1	4.5	11%	54%	1.1	1.2	1.4	1.5	1.5
Italy	0.9	0.9	0.9	0.8	0.7	4.0	-6%	-23%	-0.4	-0.3	-0.4	-0.4	-0.3
Mexico	0.5	0.7	1.0	0.9	0.9	4.0	13%	61%	-0.4	-0.5	-0.8	-0.8	-0.8
France	0.6	0.6	0.6	0.6	0.6	3.1	0%	1%	-0.2	-0.2	-0.2	-0.2	-0.2
Malaysia	0.7	0.8	0.4	0.5	0.6	3.0	-7%	-26%	3.6	3.9	4.3	4.5	4.9
Netherlands	0.5	0.5	0.5	0.5	0.5	2.5	2%	9%	-0.5	-0.5	-0.5	-0.5	-0.5
Spain	0.4	0.4	0.4	0.6	0.5	2.2	6%	26%	0.0	0.0	0.0	0.0	0.0
Singapore	0.4	0.4	0.4	0.4	0.4	2.2	0%	0%	-0.2	-0.2	-0.2	-0.2	-0.2
Philippines	0.4	0.4	0.4	0.4	0.4	1.8	1%	5%	0.0	0.0	0.0	0.0	-0.1
Australia	0.3	0.4	0.3	0.3	0.4	1.8	3%	12%	-0.1	-0.2	-0.2	-0.2	-0.2
Total	53.9	63.0	62.7	66.3	67.0	312.9	6%	24%					
World	59.3	69.1	68.5	72.2	73.3	342.5	5%	24%					

Table 2. Apparent consumption and net export of veneer sheets in major consumer countries, 2002-2006

Major Consumers	Apparent consumption (million m3)							Net Export = Export - Import (million m3)					
	2002	2003	2004	2005	2006	2002-2006	Change (%)		2002	2003	2004	2005	2006
							annual	2002-2006					
China	1.1	3.3	3.3	3.4	3.4	14.5	31%	196%	-0.3	-0.2	-0.2	-0.2	-0.2
Korea, Republic of	1.1	1.0	0.9	0.9	0.8	4.7	-6%	-21%	-0.4	-0.3	-0.3	-0.3	-0.3
Italy	0.6	0.6	0.6	0.6	0.6	3.1	0%	0%	-0.2	-0.2	-0.2	-0.2	-0.2
United States of America	0.7	0.6	0.9	0.6	0.4	3.1	-16%	-50%	-0.3	-0.2	-0.5	-0.2	0.0
New Zealand	0.5	0.5	0.5	0.5	0.5	2.6	3%	15%	0.1	0.1	0.1	0.1	0.1
Brazil	0.6	0.5	0.5	0.4	0.4	2.4	-7%	-26%	0.1	0.1	0.1	0.2	0.2
Indonesia	0.0	0.3	0.1	1.0	1.0	2.4	113%	1958%	0.0	0.0	0.1	0.0	0.0
Germany	0.4	0.4	0.4	0.4	0.5	2.2	1%	6%	0.0	0.0	0.0	-0.1	-0.1
Philippines	0.3	0.4	0.4	0.2	0.2	1.5	-14%	-44%	-0.1	-0.1	-0.1	-0.1	-0.1
Malaysia	0.2	0.3	0.3	0.3	0.3	1.5	11%	50%	0.4	0.3	0.3	0.4	0.3
India	0.2	0.2	0.3	0.3	0.3	1.3	4%	16%	0.0	0.0	0.0	0.0	0.0
France	0.2	0.2	0.2	0.2	0.2	0.9	2%	7%	-0.1	-0.1	-0.1	-0.1	-0.1
Pakistan	0.2	0.2	0.2	0.2	0.2	0.9	8%	35%	0.0	0.0	0.0	0.0	0.0
Ghana	0.1	0.2	0.2	0.2	0.1	0.9	-1%	-4%	0.1	0.1	0.1	0.1	0.1
Japan	0.2	0.2	0.2	0.2	0.2	0.8	0%	-1%	-0.1	-0.1	-0.1	-0.1	-0.1
Spain	0.1	0.1	0.2	0.2	0.2	0.8	8%	37%	-0.1	-0.1	-0.1	-0.1	-0.1
Russian Federation	0.1	0.1	0.2	0.2	0.1	0.7	22%	119%	0.0	0.0	0.0	0.0	0.0
Canada	0.1	0.1	0.1	0.1	0.1	0.5	-3%	-11%	0.6	0.6	0.8	0.8	0.7
Denmark	0.1	0.1	0.1	0.1	0.1	0.5	17%	86%	-0.1	-0.1	-0.1	-0.1	-0.1
Poland	0.1	0.1	0.1	0.1	0.1	0.5	1%	3%	0.0	0.0	0.0	0.0	0.0
Ecuador	0.1	0.1	0.1	0.1	0.1	0.5	6%	28%	0.0	0.0	0.0	0.0	0.0
South Africa	0.1	0.1	0.1	0.0	0.1	0.4	-16%	-49%	0.0	0.0	0.0	0.0	0.0
Singapore	0.1	0.1	0.1	0.1	0.1	0.4	0%	0%	0.0	0.0	0.0	0.0	0.0
Turkey	0.1	0.1	0.1	0.1	0.1	0.4	13%	61%	0.0	0.0	0.0	0.0	0.0
Côte d'Ivoire	0.1	0.1	0.0	0.1	0.1	0.3	-11%	-39%	0.2	0.1	0.2	0.2	0.2
Ethiopia	0.1	0.1	0.1	0.1	0.1	0.3	-12%	-39%	0.0	0.0	0.0	0.0	0.0
Slovenia	0.1	0.0	0.0	0.1	0.1	0.3	-18%	-55%	0.0	0.0	0.0	0.0	0.0
Belgium	0.1	0.0	0.1	0.1	0.1	0.3	-4%	-14%	0.0	0.0	0.0	0.0	0.0
Total	7.6	10.1	10.3	10.5	10.2	48.6	8%	35%					
World	8.5	11.1	11.3	11.8	11.5	54.2	8%	35%					

Table 3. Apparent consumption and net export of particleboard in major consumer countries, 2002-2006

Major Consumers	Apparent consumption (million m3)							Net Export = Export - Import (million m3)					
	2002	2003	2004	2005	2006	2002-2006	Change (%)		2002	2003	2004	2005	2006
							annual	2002-2006					
United States of America	27.2	29.7	31.5	32.4	31.7	152.6	4%	16%	-8.3	-9.0	-9.7	-10.2	-9.7
Germany	7.7	8.2	9.0	9.1	9.1	43.1	4%	17%	1.0	1.1	1.6	1.8	1.8
China	4.6	6.4	7.4	6.7	9.4	34.5	20%	104%	-0.9	-0.9	-0.8	-0.8	-1.0
Russian Federation	3.0	3.6	4.0	4.3	5.6	20.5	17%	88%	-0.3	-0.4	-0.3	-0.3	-1.0
Poland	2.9	3.4	4.1	3.9	4.6	19.0	12%	56%	0.2	0.3	0.0	0.0	-0.1
Italy	3.5	3.6	3.9	3.8	3.8	18.6	2%	8%	-0.2	-0.2	-0.2	-0.3	-0.1
United Kingdom	3.7	3.5	3.7	3.5	3.4	17.7	-2%	-7%	-1.2	-1.0	-1.0	-1.0	-0.8
Spain	3.6	3.5	3.6	3.5	3.5	17.7	-1%	-2%	-0.2	-0.3	-0.3	-0.3	-0.2
France	3.1	3.1	3.4	3.4	3.1	16.2	0%	0%	0.7	0.8	1.0	1.2	1.7
Canada	3.2	2.8	1.9	3.1	4.9	15.9	12%	55%	8.1	8.9	9.4	9.3	8.7
Turkey	2.0	2.3	2.8	2.9	2.8	12.7	9%	39%	0.0	0.0	-0.1	0.0	0.0
Brazil	2.0	2.2	2.4	2.3	2.4	11.2	5%	21%	0.0	-0.1	-0.1	0.0	0.1
Korea, Republic of	1.6	1.5	1.8	1.6	1.8	8.2	3%	13%	-0.9	-0.7	-0.9	-0.8	-1.0
Japan	1.6	1.7	1.6	1.6	1.7	8.2	1%	3%	-0.4	-0.4	-0.4	-0.4	-0.4
Denmark	1.0	1.0	1.1	1.2	1.2	5.4	5%	22%	-0.6	-0.6	-0.8	-0.8	-0.8
Australia	1.0	1.1	1.1	1.0	1.0	5.2	0%	0%	-0.1	0.0	0.0	0.0	0.0
Ukraine	0.7	1.0	0.6	1.3	1.5	5.1	19%	100%	-0.2	-0.3	0.4	-0.2	-0.1
Austria	0.9	0.9	0.9	0.9	0.9	4.6	1%	5%	1.5	1.5	1.5	1.5	1.5
Sweden	0.8	0.8	0.9	0.9	1.1	4.4	8%	35%	-0.2	-0.3	-0.4	-0.4	-0.5
Greece	0.7	0.9	0.8	0.8	0.9	4.1	5%	23%	0.0	0.0	0.0	0.0	-0.1
Belgium	0.8	0.7	0.7	1.0	0.8	4.0	1%	5%	1.7	1.6	1.5	1.3	1.5
Czech Republic	0.6	0.8	0.8	0.9	0.8	3.9	5%	24%	0.2	0.3	0.3	0.3	0.5
South Africa	0.7	0.7	0.7	0.4	0.6	3.1	-5%	-18%	0.0	0.0	0.0	0.0	-0.1
Iran, Islamic Rep of	0.5	0.6	0.7	0.7	0.6	3.1	6%	25%	0.0	0.0	0.0	0.0	0.0
Romania	0.4	0.5	0.6	0.7	0.8	3.0	16%	78%	-0.3	-0.1	-0.1	-0.2	-0.1
Netherlands	0.6	0.5	0.5	0.6	0.6	2.8	3%	11%	-0.6	-0.5	-0.5	-0.6	-0.6
Hungary	0.6	0.5	0.5	0.5	0.6	2.6	0%	-1%	-0.1	0.0	0.0	0.1	0.1
Total	79.1	85.3	90.8	93.1	99.1	447.4	6%	25%					
World	85.6	91.7	98.3	100.3	105.9	481.7	5%	24%					

Table 4. Apparent consumption and net export of fibreboard in major consumer countries, 2002-2006

Major Consumers	Apparent consumption (million m3)							Net Export = Export - Import (million m3)					
	2002	2003	2004	2005	2006	2002-2006	Change (%)		2002	2003	2004	2005	2006
							annual	2002-2006					
China	9.8	13.6	17.1	21.4	24.1	86.0	25%	146%	-2.2	-2.3	-1.7	-0.8	0.0
United States of America	8.4	8.9	10.1	10.3	10.4	48.1	6%	24%	-2.0	-2.2	-2.6	-2.6	-2.5
Germany	2.5	2.8	2.9	2.9	3.3	14.5	7%	31%	1.7	1.9	2.2	2.6	2.6
Korea, Republic of	1.9	1.9	1.8	2.0	2.1	9.7	2%	7%	-0.7	-0.5	-0.3	-0.4	-0.4
United Kingdom	1.6	1.6	1.7	1.5	1.5	7.9	-2%	-7%	-0.8	-0.8	-0.8	-0.7	-0.6
Brazil	1.1	1.3	1.2	1.8	2.1	7.5	19%	101%	0.3	0.4	0.5	0.2	0.2
Turkey	0.7	0.9	1.2	2.3	2.3	7.4	33%	213%	-0.1	-0.1	-0.2	-0.5	-0.2
Japan	1.6	1.5	1.6	1.6	0.9	7.3	-12%	-40%	-0.7	-0.7	-0.7	-0.8	0.0
Italy	1.3	1.3	1.3	1.5	1.5	7.0	4%	17%	0.0	-0.3	-0.3	-0.4	-0.3
Poland	1.0	1.2	1.1	1.5	1.8	6.6	15%	74%	0.4	0.5	0.8	0.8	0.6
Russian Federation	1.0	1.2	1.2	1.4	1.5	6.3	12%	58%	0.1	-0.1	-0.1	-0.1	-0.2
Canada	1.0	0.8	1.2	1.2	1.2	5.4	4%	18%	0.9	1.1	0.9	0.8	0.7
Spain	0.8	0.9	0.9	1.0	1.4	4.9	14%	68%	0.3	0.2	0.4	0.3	-0.1
Belgium	0.5	0.7	0.8	0.9	0.9	3.8	16%	78%	-0.2	-0.4	-0.4	-0.5	-0.6
Mexico	0.3	0.6	0.7	0.8	0.9	3.2	36%	239%	-0.2	-0.5	-0.6	-0.6	-0.8
France	0.5	0.5	0.7	0.7	0.6	3.0	7%	33%	0.6	0.7	0.6	0.6	0.8
Australia	0.4	0.4	0.5	0.5	0.5	2.3	6%	27%	0.3	0.4	0.3	0.4	0.3
Syrian Arab Republic	0.2	0.4	0.6	0.6	0.3	2.0	17%	86%	-0.2	-0.4	-0.6	-0.6	-0.3
Austria	0.4	0.3	0.4	0.5	0.3	1.9	-7%	-25%	0.5	0.5	0.4	0.3	0.4
Sweden	0.3	0.3	0.4	0.4	0.4	1.7	8%	38%	-0.1	-0.2	-0.2	-0.2	-0.2
Iran, Islamic Rep of	0.1	0.3	0.5	0.3	0.3	1.5	24%	134%	-0.1	-0.3	-0.4	-0.3	-0.3
Malaysia	0.2	0.2	0.5	0.3	0.3	1.5	5%	20%	1.0	1.0	1.0	1.0	1.2
Netherlands	0.3	0.3	0.3	0.3	0.3	1.5	1%	3%	-0.3	-0.3	-0.3	-0.2	-0.3
Ukraine	0.3	0.2	0.2	0.3	0.4	1.4	9%	40%	0.0	-0.1	-0.1	-0.2	-0.3
Total	36.2	42.1	48.9	55.8	59.5	242.6	13%	64%					
World	41.5	48.3	56.1	62.7	67.8	276.4	13%	63%					

III. Principal policies

3.1. Forest law enforcement, governance and trade

The most prominent group of policy issues discussed in international and national forums is forest law enforcement, governance and trade (FLEGT). This is a regulation to control imports of illegally-sourced timber from specific countries and will form the legal basis for the licensing scheme and partnership agreements. However, if it is restricted only to logs and sawnwood, it would be negligible. To be essential, this licensing scheme should include all product groups but at the same time would lead to additional administrative burdens, possibly similar to chain-of-custody tracking systems in forest certification (Blasser 2002).

In May 2003, The European Commission issued an "Illegal Logging Action Plan," which proposed the establishment of voluntary bilateral agreements between the EU and timber-producing countries. "Legality licences" would be created, using independent verification, to ensure the origin and legality of timber imports. However, the industry is worried about the functionality, complexity and additional costs of such measures.

3.2. Forest certification

Many factors are considered in forest certification programmes including illegal logging. Rametsteiner and Simula (2003) stated there are some evidences that certification programmes are having a positive impact on forest management practices around the world although doubts about the value and future viability of forest certification from a market perspective exist. Issues related to more comprehensive management planning, plant and animal biodiversity, retention of sensitive areas, and social responsibility have all become more important as certification processes have become more prevalent.

The development of demand for certified forest products through specific public procurement policies have been facilitating by several governments at local, provincial and national levels in the US and Europe. However, these measures

were seen as effectively constituting non-tariff barriers to trade by some developing countries.

3.3. Policies promoting the sound use of wood

The harmonization of functional specifications in standards across borders is clearly important to more efficient use of wood. For example, although no direct regulatory barriers to the use of wood or wood-based products in the construction of residential buildings, differences between sets of regulations act as barriers to common practice across Europe.

The development of wood-based composite products such as oriented strand board (OSB), laminated strand lumber, parallel strand lumber and laminated veneer lumber (LVL) provides is another example of significant advancement in the sound use of wood. This has dramatically affected wood markets and provided new options to forest managers and policy makers. New developments related to wood-based composite products technology is associated with myriad products that can be substituted for products made of solid wood and is likely to stimulate further interest in plantation establishment while at the same time further reducing interest in long rotation periods on industrial forestlands.

3.4. Research and development related policies

In forestry sector, publicly funded research is related to the development of policies aimed at the sound use of wood. The objective of all wood products research program globally is to improve efficiency of wood use, whether through development of new conversion technologies, product designs, building codes and application guidelines or durability enhancements.

In US, advances in process and product development over the past 50 to 60 years have increased the quantity of primary products (e.g. sawnwood, panels, and paper) obtained from a given quantity of industrial roundwood by about 40%. The development of wood composites and engineered structural materials has also allowed better utilization of low value resources to create high value materials, thereby enhancing forest management options. All of these developments have served to greatly extend the forest resources of the US.

However, funding for forestry-oriented research, and for wood utilization research in particular, has declined markedly in the UNECE region in recent decades. For example, in the US, funding for forest products research by the US Department of Agriculture (USDA)-Forest Service has been declined by almost 30% over the last 20 years. The number of USDA Forest Service research scientists involved in wood science and technology-oriented research has also declined by more than 75% since 1985 (National Research Council 2002). Industry funding of research has also declined over this period.

3.5. Industry competitiveness and investment policy

The developed countries is forced to reassess a long-established manufacturing and marketing strategies due to the flow of capital investment to new producing regions, and growing global competition in wood-based commodity products markets. One result in North America is radical new thinking about the nature of paper manufacturing in the future, which is to transform the entire industry to a biochemicals/biofeedstocks/bioenergy/pulp and paper industry, with individual mills operating as integrated biorefineries.

Under this new paradigm, manufacturing centres will have the capacity to produce electricity, liquid fuels (such as ethanol), and a wide variety of bioderived chemicals and chemical feedstocks, in addition to pulp and paper. Paper will effectively become only one of a number of (diverse) co-products. The biorefinery is quickly moving beyond the concept stage, with a major research effort now underway involving both wood products and the agricultural sectors of the US and Canadian economies.

3.6. Climate change policy

Although a considerable research effort has been conducted to quantify carbon flows and storage within forests under various management regimes, it has little impact on forest management practices and uncertainty impacts on markets and trade in the US.

Lecocq (2004) stated the carbon trade market is growing globally with market buyers are mainly Japan, the Netherlands and the Carbon Finance

Business (CFB) of the World Bank (Prototype Carbon Fund and Community Development Carbon Fund). However, carbon sink projects especially those linked to plantations and large-scale hydropower projects face strong NGO resistance, which will likely make such projects less attractive for Carbon Emission Reduction (CER) buyers. On the other hand, the working group of an EU Advisory Committee (EU 2004) has recently focused on carbon sequestration benefits associated with substitution of wood for non-wood materials.

3.7. Wood energy promotion policy

As countries promote renewable energy sources, energy markets and the international biofuel trade are rapidly developing. In Europe, demand continues to increase for the use of forest biomass for energy. This is partly driven by targets to fulfill national commitments under the Kyoto Protocol.

Increase demand for wood as a source of bioenergy in North America and Europe whether as a result of business initiatives or government policies, or both creates a competitive alternative use of raw material in wood-based industries, especially the pulp and paper and panel industries. This new reality means the price of wood fibre will have to be competitive with the price of wood as a fuel even though this is a positive development from the standpoint of profitability of forestry.

3.8. Trade policy and tariff and non-tariff barriers

The massive development of production capacity in China has led to unprecedented growth of Chinese imports into the US. These and other developments have prompted the US government to consider tariff measures under the anti-dumping category in some market segments. As a result, Chinese exporters of wooden bedroom furniture face stiff anti-dumping penalties on exports to the US market.

There is still tariff escalation of forest products in developed countries. But, the overall level of applied tariffs is higher in developing countries than in the industrialized regions, with considerable differences in the applied rates between regions. Reducing tariff barriers would then increase new export market opportunities, which in turn, increase wood and forest products production in the

forest-rich, net exporting countries. On the other hand, non-market barriers, such as those set through environmental, social or health standards, are considerably more difficult to negotiate.

3.9. Phytosanitary measures

The WTO Sanitary and Phytosanitary (SPS) Agreement aims at clarifying inspection and quarantine control procedures. The profile of SPS measures has risen in recent years, partly as a response to increased vigilance and concern about environment and safety issues. Concern is not limited to risks of wood transport from developing countries. Regulations also impact trade between North America and Europe in order to prevent transmission of a range of forest pests across the Atlantic.

IV. Demand drivers

4.1. Population

Demand of bio-composite products are strongly affected by changes in population (growth or decline), age structures and household composition. ITTO (2007) stated that in producer countries total population was increased by almost 600 millions during the period 1987 to 2007. Population in consumer countries was also increases, though more moderately. However, Japan, a major importer, was believed to have ceased its population growth during that period and then declining in its demand would be expected in coming years.

4.2. Economic growth

Since 2000, trends in GDP growth have been similar for all consumer regions, but Asia clearly showed the greatest volatility, with Europe and North America tracking each other's growth within a much narrower band. ITTO (2007) stated that GDP growth for all ITTO Consumers was grown in 2006, where Asia was the fastest (4.9%) and followed by North America (3.4%), non-EU Europe's (2.7%), and the EU (2.5%).

ITTO Producer economies generally have been growing significantly faster than Consumers ever since 2000, with a spread of 2 percentage points expected to persist at least until the end of 2007. ITTO Producer Asia continues to show the most robust growth of all ITTO sub-regions, with Africa running a close second. Latin America has lagged due to relatively slower growth in both Brazil and Mexico. Although Japan remains in number-one position among all ITTO importers of tropical plywood, its imports would expectedly decline hereafter as its population has peaked and its economy has reached a steady state with little or no GDP growth.

4.3. Product application and substitution

Currently, temperate and coniferous plywood is increasingly substituted for tropical hardwoods, holding down the latter's price. This was indicated by a progressive substitution of temperate and boreal conifers for tropical hardwoods

imports of Japan. China, one of major tropical plywood manufacturers, has broadened tropical export panel products to include a variety of combinations of some different core (often China-grown poplar) overlaid with face veneers of tropical woods such as *meranti*. As a result, its plywood products are comparatively lighter and cheaper than Southeast Asian products while their quality has noticeably improved.

Meanwhile, consumption of veneer theoretically not destined for plywood, presumably in the furniture and other secondary processing industries of ITTO member countries, had marked a minor decline of 0.6% to 3.51 million m³ in 2006.

Moreover, there are clear trends for European governments and buyers, in good part responding to expressed desires of producers, to shift their import product mix increasingly away from tropical hardwood roundwood in favor of sawnwood, panels and further-processed products manufactured in producing countries.

4.4. Price level

The future of tropical plywood consumption in most markets is apt to be determined mainly by price competition. Consumer country inflation rates were mostly in a band around 2%, whereas most producer countries held inflation rates near 5% in the period 2000-2005. Prices for most primary tropical timber products and species ended 2006 considerably further strengthened over their already-strong performances during 2005, as supplies of raw materials tightened, severely in some cases. At the same time most ITTO consumer country economies were expanding or at least stabilized, steadying or improving consumer confidence in most markets.

Prices for Asian plywood kept on rising steadily and steeply through 2006, due to basic scarcities of peeler logs in some case heightened by regulatory policies, strong demands from North American and some European consumers as well as transport interruptions due to weather and other factors. However, further price rises were prevented by strong competition from cheaper Chinese combiplywood and the mounting concern of public opinion-leaders over illegal logging.

Meanwhile, the international markets for tropical veneer remain quite small and buyers mainly seek decorative sliced veneers. The individual markets for these very varied sliced veneers are extremely narrow and knowledge of transactions is closely held. There are no representative benchmark species whose prices could serve as indicators of overall market trends. Tropical veneer prices are therefore not regularly covered by the ITTO MIS and are also not regularly quoted by any other readily available source.

4.5. Industry push for innovation and value addition to resources

The highest degree of conversion at least to primary products is in Latin America. In 2005, 86.7% of logs have been converted locally into sawnwood, 10.8% into plywood, and 1.9% into veneer sheets. Moreover, this region has been relatively highly advanced, with about 70% of total exports by value being secondary processed wood products (SPWP) in 2005.

Meanwhile, as roundwood export policies are tightening, the roundwood exports proportion of log production in Producer Asia was declined from 8.8% in 1995 to 7.2% in 2005. The SPWP shares were also increased from about 30% in 1995 to 55% in 2005.

Only African producers still export significant proportions of their log harvests as roundwood, though there is also progressive cutting back on roundwood exports in this region: From 40.6% of the log harvest in 1995, to 17.3% in 2005, 16.3% forecast for 2007. Clearly substantial progress has been made in fostering domestic processing, but evidently there is significant further potential for capture of value-added by the African economies by intensifying industrial development efforts.

Even more dramatic inter-regional differences in progress toward higher-value-added products in the timber industries sector, coupled with higher foreign-exchange earnings from the forest resource, are seen by comparing the proportional values of primary versus further-processed wood products exported.

V. Potential future market of Indonesia wood composite products

5.1. Plywood

MOF (2007) reported over the period 2002-2006, in order of importance, major country destinations of Indonesia's plywood exports were Japan, United States, China, the Republic of Korea, Taiwan, Saudi Arabia, United Arab Emirates, United Kingdom, and Belgium, which together accounted for 83% of Indonesia's plywood exports (Table 5). In Japan, China, the Republic of Korea, and United Arab Emirates, plywood import from Indonesia's was around 27%-33% of their total plywood imports (Table 6). In Saudi Arabia, it was almost 60% of its total plywood imports.

Although China has been the largest plywood producer in the world since 2003 as well as a net exporter (Table 1), its plywood import was still large, ranging from 1.7 to 2.0 millions m³ per year. Meanwhile, even though, consumption in United States of America, Japan, and United Kingdom grew slightly and even decreased in the Republic of Korea (-10%), but these countries were net and major world importers, which together accounted for 54% of world's plywood imports. Hence, It is obvious these five countries would still be the future market for Indonesia's plywood exports.

5.2. Veneer sheets

MOF (2007) reported over the period 2002-2006, in order of importance, major country destinations of Indonesia's veneer sheets exports were Japan, United States, China, the Republic of Korea, Taiwan, Germany, Saudi Arabia, Italy, and United Kingdom, which together accounted for 84% of Indonesia's veneer sheets exports (Table 5). However, In United States, the Republic of Korea, and Italy, veneer sheets import from Indonesia's was much less than 1% of their total veneer sheets imports (Table 6). In Germany and United Kingdom it was around 1% of their total veneer sheets imports. Meanwhile, in Japan, China and Saudi Arabia, it ranged from 5.1% to 6.8% of their total veneer sheets imports.

The fact that most veneer sheets production were consumed domestically over the period 2002-2006 and considered that veneer sheets export price were more than double of plywood export price, then, if Indonesia would domestically process veneer sheets, it should produce high added value forest products. Otherwise, selling veneer sheets is more profitable than to process it first into plywood and then sold it.

5.3. Particleboard

MOF (2007) reported over the period 2002-2006, in order of importance, major country destinations of Indonesia's particleboard exports were the Republic of Korea, Taiwan, Viet Nam, Hongkong, China, and Malaysia, which together accounted for 97% of Indonesia's particleboard exports (Table 5). However, in the Republic of Korea, Viet Nam, China, and Malaysia, particleboard import from Indonesia's was only ranged from 2.3% to 6.9% of their total particleboard imports (Table 6).

Although during that period Indonesia's particleboard exports to those countries were declining, China and Republic of Korea imports of particleboard were still large, ranging from 0.7 to 1.1 millions m³ per year (Appendix 3). Similar to that veneer sheets product, most particleboard were consumed domestically over the period 2002-2006. Coupled with particleboard import that was almost triple over that period, particleboard production should be intended for domestic consumption.

5.4. Fibreboard

MOF (2007) reported over the period 2002-2006, in order of importance, major country destinations of Indonesia's fiberboard exports were China, Saudi Arabia, Republic of Korea, Taiwan, Syria Arab Republic, Egypt, United Arab Emirates, Viet Nam, Philippines, and Hongkong, which together accounted for 89.5% of Indonesia's fiberboard exports (Table 5). In China, the Republic of Korea, and Saudi Arabia, fiberboard import from Indonesia's was around 9.1%-11.5% of their total fiberboard imports (Table 6). For the rest countries, it ranged from 3.3% to 6.1% of its total fiberboard imports.

Table 4 and Appendix 4 show China and the Republic of Korea would still be potentially become major country destinations of Indonesia's fiberboard exports in the future since they are world's major consumers and net importers of fiberboard with imports ranging from 1.7 to 2.6 millions m³ per year for China and from 0.3 to 0.8 millions m³ per year for the Republic of Korea.

Table 5. Major country destinations of Indonesia wood based panels exports reported by Ministry of Forestry over the period 2002-2006

Plywood		Veneer sheets		Particleboard		Fibreboard	
Country Destination	Percentage	Country Destination	Percentage	Country Destination	Percentage	Country Destination	Percentage
Japan	39.6%	Japan	39.8%	Korea, Republic of	27.0%	China	29.7%
United States	8.6%	United States	12.8%	Taiwan, Province of China	21.8%	Saudi Arabia	16.6%
China	7.8%	China	8.5%	Viet Nam	17.0%	Korea, Republic of	16.4%
Korea, Republic of	7.6%	Korea, Republic of	7.1%	Hongkong	16.1%	Taiwan, Province of China	7.2%
Taiwan, Province of China	6.1%	Taiwan, Province of China	4.8%	China	9.3%	Syria Arab Republic	4.7%
Saudi Arabia	4.8%	Germany, Fed. Rep. of	3.4%	Malaysia	6.0%	Egypt	4.1%
United Arab Emirates	4.0%	Saudi Arabia	3.0%	Other countries	2.8%	United Arab Emirates	3.5%
United Kingdom	2.4%	Italy	3.0%			Viet Nam	3.4%
Belgium	2.3%	United Kingdom	2.1%			Philippines	2.1%
Other countries	17.0%	Other countries	15.6%			Hongkong	2.0%
						Other countries	10.5%
Total	100.0%	Total	100.0%	Total	100.0%	Total	100.0%

Table 6. Indonesia wood based panels import shares of total imports reported by importer country over the period 2002-2006

Plywood		Veneer sheets		Particleboard		Fibreboard	
Importer Country	Percentage	Importer Country	Percentage	Importer Country	Percentage	Importer Country	Percentage
Japan	30.6%	Japan	5.1%	Korea, Republic of	3.7%	China	9.1%
United States	9.5%	United States	<< 1%	Viet Nam	6.9%	Saudi Arabia	11.5%
China	28.6%	China	6.0%	China	2.3%	Korea, Republic of	10.8%
Korea, Republic of	27.2%	Korea, Republic of	<< 1%	Malaysia	3.1%	Syria Arab Republic	3.3%
Saudi Arabia	59.9%	Germany, Fed. Rep. of	1.1%			Egypt	5.1%
United Arab Emirates	32.5%	Saudi Arabia	6.8%			United Arab Emirates	4.4%
United Kingdom	10.7%	Italy	<< 1%			Viet Nam	5.1%
Belgium	18.5%	United Kingdom	1.3%			Philippines	6.1%

VI. Indonesia's Forest Industry Revitalization¹

Indonesia's forest sector is facing crisis, due to rapid forest resource loss and degradation that threaten the livelihoods of rural people and the sector's continued contribution to export earnings and economic development. Industrial restructuring and development of alternative timber resources are needed to bridge the growing gap between demand for forest products and sustainable supply. The Ministry of Forestry and most stakeholders recognize the problem of industrial over capacity and the obstacles to revitalization posed by continued illegal logging. There is also recognition that the future of the wood processed industry will depend on an expanded plantation program. In many areas, there is considerable potential to involve the rural poor in plantation production on both community and individually owned land. Expanding plantations will be challenged by conflict over land resources and the need to address issues of due process related to gazettal to help ensure legality of products in international markets. Industry revitalization will also require restructuring of the wood processing industry, the main source of demand for Indonesian timber resources.

With regard to develop operational policies and plans, the Ministry of Forestry established an *In-house Experts Working Group* in June 2006, with a mandate to advise the Minister of Forestry on key issues related to industry revitalization, including plantation acceleration and industry retooling/reform and prepare policy recommendations for the Minister directly. The Working Group, which consists of senior Forestry Ministry experts including representatives from each of the Department's main directorates, as well as the legal and planning bureaus, and outside academics, has: conducted regular meetings with several major stakeholders, visited several forest plantation concessionaires, community forests, and wood processed companies; and conducted stakeholder consultation workshops. Based on *In-house Experts Working Group's* assessments, four working groups: *Woodworking WG*, *Furniture WG*, *Plywood and Other Wood Based Panel WG*, and *Pulp and Paper WG* were then established by Direktorat Jendral Bina Produksi Kehutanan (BPK) in March 2007. *In-house Experts Working Group*

¹ Summarized from MOF. 2007. A Road Map for the Revitalization of Indonesia's Forest Industry. The Forest Industry Revitalization In-house Expert Working Group- Ministry of Forestry, Jakarta.

was then actively guided² those working groups to develop their industry roadmaps and combined them into roadmap of Indonesia wood-based industry.

All involved stakeholders have a shared vision regarding Indonesia wood-based industry. That is, in the future the industry would produce wood products that can enter highly competitive market and be supported by sustainable increasing wood supply. There would be enough log supply from different sources; particularly from certified and sustainable managed production forests and the production level of wood products would be in accordance with that sustainable log supply in the next 20 years. Moreover, Indonesia wood-based industry would operate efficiently and in environment friendly with capacity utilization rate of at least 70%, focus on high value-added products that can enter highly competitive market where at least 20% of them are certified, and enlarge their market share in domestic and foreign markets.

However, they are also recognizing many problems that can hinder Indonesia to achieve that vision. At least six major problems agreed by all stakeholders are facing by the industry. They are: a huge gap between industrial demand for timber and the legal sustainable supply, industrial over capacity, inefficient in wood processing industry, declining in product competitiveness, declining in market share, and low value-added products.

Two-stage strategy with a series of policy and action plans for each strategy in each stage was then recommended. In the first stage or the restructuring phase, which is from 2007 to the year 2014, it will be important strategy to intensify forest plantation, increase productivity of forest plantation, combat forest crimes, develop alternative sources of timber supply, optimize industrial log distribution, improve utilization of natural production forest, monitor operations of wood processing industry, invest in new wood processing technology for efficiency and waste reduction, reduce production cost of wood products, enhance wood products image in international market, facilitate development of wood industry clustering, find new market and sustain traditional market of wood products, invest in secondary wood

² In reference to: (1) Restructuring and Revitalization of Indonesia's Wood-Based Industry: Synthesis of Three Major Studies. T. H. Brown, B. C. H. Simangunsong, D. Sukadri, D. W. Brown, Subarudi S., A. Dermawan, Ruff'ie. Ministry of Forestry, CIFOR, and DFID-MFP. Jakarta. November 2005; (2) Revitalization of Indonesia's Forest Industry: A Supply Side Analysis. 2006. B. C. H. Simangunsong. Paper prepared for the World Bank; and (3) Revitalization of Indonesia's Forest Industry: A Demand Side Analysis. 2007. B. C. H. Simangunsong. Paper prepared for the World Bank.

processing technology, and diversify wood products. This first stage focuses on demand management and supply enhancement and sets the stage for the revitalization phase. Issues, target and strategies in the restructuring phase are shown in Table 7.

Several strategies chosen in the first stage need to be continued in the second stage, the revitalization phase, in addition to strategies that take advantage of different timber supplies, different processing technologies, and different end products for different end markets. Those important strategies are to: intensify forest plantation, primarily for saw logs/veneer logs production; increase productivity of forest plantation, broaden utilization of alternative timber supply sources; broaden implementation of Intensive Silvicultural System (SILIN) in the natural production forest; continue investment in new wood processing technology for efficiency and waste reduction; broaden wood industry clustering; continue production cost reduction; continue enhancement of wood products image in international market; broaden foreign market and sustaining traditional market of wood products; penetrate potential market; invest in secondary wood processing technology; and continue wood products diversification. Issues, target and strategies in the revitalization phase are shown in Table 8.

Table 7. Issues, Target, and Strategy in the Restructuring Phase (2007-2014)

Issues	Target	Strategy
A huge gap between industrial demand for timber and the legal sustainable supply	The legal sustainable log supply is sufficient	Intensify forest plantation
		Increase productivity of forest plantation
		Combat forest crimes
		Develop alternative sources of timber supply
		Optimize industrial log distribution
		Improve utilization of natural production forest
Over capacity	A production level of wood products is based on legal sustainable log supply	Monitor operations of wood processing industry
Inefficient in wood processing industry	Wood processing industry operates efficiently	Invest in new wood processing technology for efficiency and waste reduction
Declining in competitiveness	Wood products is highly competitive	Reduce production cost of wood products
		Enhance wood products image in international market
		Facilitate development of wood industry clustering
Declining in market share	Market share of wood products is restored and even increase	Find new market and sustain traditional market of wood products
Low value-added products	Production focuses on high value-added wood products	Invest in secondary wood processing technology
		Diversify wood products

Table 8. Issues, Target, and Strategy in the Revitalization Phase (2015-2025)

Issues	Target	Strategy
Log deficit	The legal sustainable log supply increases and mostly comes from forest plantation	Intensify forest plantation, primarily for sawlogs/veneer logs production
		Increase productivity of forest plantation
		Broaden utilization of alternative timber supply sources
		Broaden implementation of SILIN in the natural production forest
Inefficient in wood processing industry	Wood processing industry operates efficiently	Continue investment in new wood processing technology for efficiency and waste reduction Broaden wood industry clustering
Declining in competitiveness	Wood products is highly competitive	Continue production cost reduction Continue enhancement of wood products image in international market
A non-significantly increase in market share	Market share of wood products is significantly in the increase	Broaden foreign market and sustaining traditional market of wood products Penetrate potential market
Low value-added products	Production focuses on high value-added wood products	Invest in secondary wood processing technology
		Continue wood products diversification

Series of policy and action plans for each strategy in each stage were recommended and showed in detail in Tables 9 and 10. One or several indicators were also developed and involved parties were also identified for each action plan. Nevertheless, there are several enabling conditions that are needed to be considered such as: good political will of the government, national stewardship, land tenure and use security, good forest governance, and existence of economic institutions. Implications of these chosen strategies are temporarily decrease in output and labour force level so that coordination and collaborations amongs related ministries or departments are a must. On the other hand, these chosen strategies reduce pressure to natural forest utilization and give more space to health and efficient wood-based companies to operate.

Table 9. Strategy, Policy, and Action Plan in the Restructuring Phase (2007-2014)

Strategy	Policy	Recommended Action Plan
Intensify forest plantation	Speeding-up creation of Forestry District Management Unit (KPH)	Expedite issue related regulations and coordinate it with province/district government Optimize function of province/district "tim lahan"
	Accelerating infrastructure development	Integrate forest plantation establishment with regional development
	Simplifying license permit processes of forest plantation development	Expedite license permit processes of forest plantation development Affirm land use security of IUPHHK – HT
	Implementing forest plantation certification	Promote and facilitate system of forest plantation certification developed by national initiative
	Creating tenurial conflict mechanisms and facilitating its resolutions after KPH is built	Optimize function of province/district "tim lahan"
	Providing alternative financial assistance for developing HTR	Expedite establishment of technical organizer BPPH Broaden community acces to financial capital
Increase productivity of forest plantation	Utilizing high quality seedlings	Provide tree improvement technology and silviculture tehniقه through establishment of integrated research centre Optimize seed centre capacity
	Providing database on forestland suitability	Integrate and up-grade forestland suitability database
Combat forest crimes	Combatting illegal logging	Improve integration in combatting illegal logging
	Combatting illegal trade	Improve integration in combatting illegal trade
	Eliminating high cost economy	Disseminate and implement Permenhut 55 to law enforcer about timber legality Impose FAKB for certain conditions maximum 1.5 times of normal period time
	Improving law enforcement	Function the existance of PPNS in wood forest products circulation Harmonize overlapped regulations, particularly regulations that are related with wood forest product circulation, retribution, and levy
Develope alternative sources of timber supply	Utilizing logs produced from crops replanting	Implement document issued by crops estate as legal 'skau' document Disseminate logs produced from crops replanting as alternative raw materials for wood industry
	Perfecting utilization of logs produced from community forest	Revise Permenhut. No. P 51 /2006
Optimize industrial log distribution	Regulating industrial logs distribution	Build wood terminals in industrial centres area Make GIS based database/information system on potential and distribution of wood resources

Table 9. Strategy, Policy, and Action Plan in the Restructuring Phase (2007-2014; Continued)

Strategy	Policy	Recommended Action Plan
Improve utilization of natural production forest	Improving SILIN implementation in the natural production forest	Accelerate SILIN implementation and its incentive mechanism in the natural production forest
	Expediting annual allowable cut (JPT) determination	Expedite issuance of RKT and heavy equipments procurement permits
	Utilizing log waste of natural forest harvesting	Review stumpage levy and forest tax policies
Monitor operations of wood processing industry	Prohibiting illegal logs consumption	Conduct an effective log audit by independent third party
	Curbing primary wood industry without RPBBI	Close down wood companies that are consumed illegal logs
		Control issuance of new wood company permits
Invest in new wood processing technology for efficiency and waste reduction	Replacing old and inefficient machines and equipments	Facilitate wood company with acces to finance institutions or capital Expedite a process and assist a company to get permit for replacing old and inefficient machines and equipments
	Retooling machines and equipments of wood industry	Provide technical assistance, primarily to UKM, for replacing old and inefficient machines and equipments
		Support establishment of domestic wood processed machines industry
Reduce production cost of wood products	Establishing transportation infrastructures	Build container ports in exported product centre areas
		Build transportation infrastructure from wood resources to wood industrial centres and then to ports
	Improving processing productivity	Provide trainings for machine operators, supervisors, managements, product designers
	Reviewing import regulations of sample and exhibition products	Reduce or eliminate import tariff of sample and exhibition products
	Conducting energy diversifaction for efficiency	Support utilization of low-cost energy such as bio-diesel and coal
Enhance wood products image in international market	Eliminating transaction costs	Revise government regulations on company operational permits
	Implementing chain of custody	Support implementation of chain of custody for wood products legality
Facilitate development of wood industry clustering	Promoting wood products regularly	Integrate wood products promotion and intensify public relation
		Accelerate development of wood industry clustering in districts and provinces
		Map out distribution of wood resources in each district
	Establishing integrated primary and secondary wood processing industry	Develop wood industry based on a specific district/province

Table 9. Strategy, Policy, and Action Plan in the Restructuring Phase (2007-2014; Continued)

Strategy	Policy	Recommended Action Plan
Find new market and sustain traditional market of wood products	Enlarging domestic market	Standardize wood products
		Campaign to use domestically produced wood products
		Provide information of imported wood products for domestic consumers protection
	Intensify wood products promotion to foreign market	Conduct roadshows of wood products
		Lobby traditional foreign markets such as Japan, United States, European Union
		Conduct market researches and benchmarking of Indonesia wood products with its competitors
		Collaborate with forest industry associations and NGO's on regional and international wood products marketing
		Strengthen national forest industry associations role at regional and international level to promote and market Indonesian wood products
	Dealing with tariff and non-tariff barriers in international trade of wood products	Lobby major country export destinations
Negotiate import tariffs of wood products in trade pact forum such as APEC		
Invest in secondary wood processing technology	Providing financial incentives for machines and equipments procurement	Reduce or remove import tariff of machine and equipment capital
		Give financial incentive such as low lending rate for importing machine and equipment capital
		Facilitate wood company with acces to finance institutions or capital
	Improving labor skills	Provide trainings for machine operators, supervisors, managements, product designers
Establish educational institutions that produce certified skilled labour in secondary wood processed production		
Diversify wood products	Stimulating research and development in wood industry	Provide incentives to the wood company, which conducts research and development, in marketing of its new wood products
		Develop wood industry and wood products design centres collaborations
		Facilitate the wood company, which conducts research and development, to obtain a patent of its new wood products

Table 10. Strategy, Policy, and Action Plan in the Revitalization Phase (2015-2025)

Strategy	Policy	Recommended Action Plan
Intensify forest plantation, primarily for sawlogs/veneer logs production	Giving priority to timber planting for sawlogs/veneer logs production	Integrate establishment of forest plantation to produce sawlogs/veneer logs with regional development
		Provide incentives for investing in timber plantation to produce sawlogs/veneer logs
		Continue facilitating of tenurial conflict resolutions
	Continuing provision of alternative financial assistance for developing HTR	Broaden and improve community access to financial capital
Increase productivity of forest plantation	Continuing forest plantation certification	Develop a system of forest plantation certification with international scheme
	Continuing infrastructure establishment	Integrate establishment of forest plantation with regional development
	Continuing utilization of high quality seedlings resulted from tree improvement and genetic engineering	Improve integrated researching
Broaden utilization of alternative timber supply sources	Continuing utilization of logs resulted from crops replanting	Continue dissemination of utilizing logs produced from crops replanting as alternative raw materials for wood industry
Broaden implementation of SILIN in the natural production forest	Compulsorily implementing SILIN in the natural production forest for IUPHHK	Impose implementation of SILIN as pre-requisite for issuance of RKT in the natural production forest
Continue investment in new wood processing technology for efficiency and waste reduction	Retooling machines and equipments to produce marketable wood products	Continue technical assistance, primarily to UKM, for replacing old and inefficient machines and equipments
Broaden wood industry clustering	Continuing establishment of integrated primary and secondary wood processing industry	Continue integration of wood industry establishment with regional development

Table 10. Strategy, Policy, and Action Plan in the Revitalization Phase (2015-2025; Continued)

Strategy	Policy	Recommended Action Plan
Continue production cost reduction	Eliminating transaction costs	Continue illegal levy elimination
	Establishing transportation infrastructures	Build container ports in exported product centre areas Build transportation infrastructure from wood industrial centres and then to ports
	Improving processing productivity	Continue machine operators, supervisors, and managements trainings
Continue enhancement of wood products image in international market	Continuing chain of custody implementation	Continue implementation of chain of custody for wood products legality
	Promoting wood products regularly	Continue integrated promotion of wood products and intensive public relation
Broaden foreign market and sustaining traditional market of wood products	Continuing intensive wood products promotion to foreign market	Continue roadshows of special quality wood products Continue lobbying country export destinations Continue market researches and benchmarking of Indonesia wood products with its competitors
	Dealing with tariff and non-tariff barriers in international trade of wood products	Continue wood products certification
Penetrate potential market	Developing marketable wood products	Develop new marketable wood products
Invest in secondary wood processing technology	Providing financial assistance for machines and equipments procurement of secondary wood processing industry	Reduce or remove import tariff of machine and equipment capital Give financial incentive such as low lending rate for importing machine and equipment capital Facilitate wood company with acces to finance institutions or capital
	Continuing labor skills improvement	Provide trainings for machine operators, supervisors, managements, product designers
Continue wood products diversification	Stimulating research and development in wood industry	Provide incentives to the wood company, which conducts research and development
		Develop wood industry and wood products design centres collaborations
		Comply with wood product standard of market destinations
		Protect wood products patent

VII. SUMMARY

Based on current world's demand and its trend, shares of Indonesia's bio composite product imports of total bio composite product imports in each major country destination as reported by importer countries and considering the principal policies and market forces that are likely to affect the global and regional markets, both plywood and medium density fibreboard made from small diameter log would be plausible to be developed for international market (i.e. Japan, China, the Republic of Korea, Taiwan, Saudi Arabia, and United Arab Emirates) as well as for domestic market. Meanwhile, veneer sheets and particleboard made from small diameter log would be plausible to be developed for domestic market.

To realize those potential future markets, Indonesia needs to restructure and revitalize its forest industry. This must involve all stakeholders in order to implement the selected strategies explained in Chapter VI. Coordination and cooperation from several ministries and departments is also absolutely vital. On the other side, these strategies will reduce pressure on natural forests and at the same time provide room for efficient wood composite companies to operate.

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Appendix 1. Production, export, and import of plywood in major consumer countries, 2002-2006

Major Consumers	Production (million m3)					Exports (million m3)					Imports (million m3)				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
United States of America	15.3	14.9	14.8	14.4	13.7	0.5	0.5	0.5	0.5	0.5	3.9	4.2	5.9	6.2	6.1
China	12.2	21.8	21.8	26.0	28.1	2.1	2.4	4.6	6.2	7.8	1.7	1.8	1.8	2.0	1.8
Japan	2.7	3.0	3.1	3.2	3.3	0.0	0.0	0.0	0.0	0.0	5.1	4.2	5.1	4.7	5.0
Korea, Republic of	0.9	0.9	0.8	0.7	0.7	0.0	0.0	0.1	0.0	0.0	1.3	1.4	1.2	1.2	1.3
India	1.6	1.8	1.9	2.1	2.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Canada	2.2	2.2	2.3	2.3	2.3	1.1	1.0	1.0	1.1	0.9	0.5	0.5	0.4	0.7	0.8
United Kingdom	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	1.3	1.3	1.5	1.5	1.5
Germany	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.9	1.1	1.2	1.1	1.2
Brazil	2.7	3.2	3.8	3.7	3.7	1.9	2.4	3.0	2.8	1.9	0.0	0.0	0.0	0.0	0.0
Indonesia	7.6	6.1	4.5	4.5	3.8	5.8	5.1	4.0	3.4	3.1	0.0	0.0	0.0	0.0	0.0
Russian Federation	1.8	2.0	2.2	2.6	2.6	1.2	1.2	1.4	1.5	1.6	0.0	0.0	0.0	0.1	0.0
Italy	0.5	0.5	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.2	0.6	0.6	0.6	0.5	0.6
Mexico	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.8	0.8	0.8
France	0.5	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.4
Malaysia	4.3	4.8	4.7	5.0	5.4	3.6	4.0	4.3	4.5	5.0	0.0	0.0	0.0	0.0	0.1
Netherlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.5	0.5	0.5	0.6
Spain	0.4	0.4	0.4	0.6	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
Singapore	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3
Philippines	0.4	0.4	0.4	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Australia	0.2	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2
Total	53.9	63.3	62.8	67.0	67.9	17.1	17.5	20.2	21.2	22.0	17.2	17.3	20.1	20.5	21.1
World	59.3	68.8	68.6	73.2	74.3	20.7	21.5	24.5	25.7	26.7	20.8	21.8	24.3	24.7	25.7

Appendix 2. Production, export, and import of veneer sheets in major consumer countries, 2002-2006

Major Consumers	Production (million m3)					Exports (million m3)					Imports (million m3)				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
China	0.8	3.1	3.1	3.1	3.2	0.2	0.2	0.2	0.2	0.1	0.5	0.4	0.4	0.4	0.4
Korea, Republic of	0.7	0.7	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.3	0.3
Italy	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2
United States of America	0.4	0.4	0.4	0.4	0.4	1.1	1.1	1.2	0.4	0.4	1.4	1.3	1.7	0.5	0.3
New Zealand	0.6	0.6	0.7	0.7	0.7	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0
Brazil	0.6	0.6	0.6	0.6	0.6	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Indonesia	0.0	0.3	0.2	1.0	1.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany	0.4	0.4	0.4	0.4	0.4	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Philippines	0.2	0.3	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Malaysia	0.7	0.6	0.6	0.7	0.6	0.6	0.5	0.4	0.4	0.3	0.2	0.1	0.1	0.0	0.1
India	0.2	0.2	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
France	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2
Pakistan	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ghana	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Japan	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Spain	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2
Russian Federation	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Canada	0.7	0.7	0.9	0.9	0.8	0.9	0.8	1.0	1.0	1.0	0.3	0.2	0.3	0.3	0.3
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Poland	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ecuador	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Africa	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Singapore	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turkey	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Côte d'Ivoire	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0
Ethiopia	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovenia	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Belgium	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	7.4	10.0	10.2	10.9	10.6	3.6	3.4	3.8	3.1	2.8	3.7	3.5	3.9	2.7	2.4
World	8.5	11.0	11.3	12.2	12.0	4.2	4.1	4.6	4.0	3.8	4.2	4.1	4.6	3.6	3.3

Appendix 3. Production, export, and import of particleboard in major consumer countries, 2002-2006

Major Consumers	Production (million m3)					Exports (million m3)					Imports (million m3)				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
United States of America	18.9	20.8	21.8	22.2	21.9	0.7	0.6	0.6	0.5	0.5	9.0	9.6	10.2	10.7	10.2
Germany	8.7	9.3	10.6	10.9	10.8	2.5	2.6	3.2	3.5	3.5	1.5	1.5	1.6	1.7	1.8
China	3.8	5.6	6.5	5.8	8.5	0.2	0.1	0.2	0.1	0.1	1.0	1.0	1.0	1.0	1.1
Russian Federation	2.7	3.2	3.6	3.9	4.6	0.1	0.2	0.2	0.2	0.3	0.4	0.6	0.6	0.6	1.3
Poland	3.1	3.7	4.1	3.9	4.5	0.7	0.9	0.9	0.9	0.9	0.6	0.6	0.9	0.9	1.0
Italy	3.3	3.4	3.7	3.5	3.7	0.5	0.3	0.4	0.4	0.5	0.7	0.6	0.7	0.7	0.6
United Kingdom	2.4	2.5	2.7	2.6	2.6	0.2	0.3	0.2	0.2	0.2	1.4	1.2	1.3	1.1	1.0
Spain	3.5	3.2	3.2	3.2	3.3	0.4	0.3	0.4	0.4	0.5	0.6	0.6	0.8	0.7	0.7
France	3.8	3.9	4.4	4.6	4.8	1.4	1.4	1.6	2.0	2.4	0.6	0.7	0.7	0.8	0.8
Canada	11.3	11.6	11.3	12.5	13.7	8.8	9.2	9.8	9.8	9.7	0.7	0.4	0.4	0.5	0.9
Turkey	2.0	2.3	2.7	2.9	2.8	0.1	0.1	0.2	0.3	0.2	0.1	0.2	0.3	0.3	0.2
Brazil	1.9	2.1	2.4	2.3	2.5	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.1	0.1	0.1
Korea, Republic of	0.7	0.8	0.9	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.9	0.7	0.9	0.8	1.0
Japan	1.2	1.2	1.2	1.2	1.2	0.0	0.0	0.0	0.0	0.0	0.4	0.4	0.5	0.4	0.5
Denmark	0.3	0.4	0.4	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.8	0.9	0.9
Australia	1.0	1.0	1.0	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1
Ukraine	0.5	0.7	1.0	1.2	1.3	0.1	0.1	0.7	0.2	0.2	0.3	0.4	0.3	0.3	0.3
Austria	2.4	2.4	2.4	2.4	2.4	1.7	1.8	1.8	1.9	1.9	0.2	0.3	0.3	0.4	0.4
Sweden	0.6	0.5	0.4	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.5	0.5	0.6
Greece	0.8	0.8	0.8	0.8	0.8	0.1	0.1	0.2	0.2	0.1	0.0	0.1	0.1	0.1	0.2
Belgium	2.5	2.3	2.2	2.4	2.3	2.0	1.9	1.8	1.7	1.8	0.3	0.3	0.3	0.3	0.4
Czech Republic	0.9	1.1	1.1	1.2	1.2	0.5	0.5	0.6	0.6	0.8	0.3	0.2	0.2	0.3	0.3
South Africa	0.7	0.7	0.7	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Iran, Islamic Rep of	0.5	0.5	0.6	0.7	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Romania	0.1	0.4	0.5	0.5	0.7	0.1	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.4
Netherlands	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.6	0.6	0.6	0.7	0.8
Hungary	0.5	0.5	0.5	0.6	0.6	0.2	0.3	0.3	0.4	0.3	0.3	0.2	0.3	0.3	0.2
Total	78.2	84.9	90.7	92.3	98.2	20.5	21.2	23.6	23.7	24.8	21.4	21.7	23.7	24.5	25.7
World	85.8	92.1	98.4	100.6	106.3	24.3	25.5	28.7	29.4	31.1	24.1	25.1	28.6	29.1	30.7

Appendix 4. Production, export, and import of fibreboard in major consumer countries, 2002-2006

Major Consumers	Production (million m3)					Exports (million m3)					Imports (million m3)				
	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006	2002	2003	2004	2005	2006
China	7.6	11.2	15.3	20.6	24.1	0.3	0.3	0.5	1.2	1.7	2.5	2.6	2.3	2.0	1.7
United States of America	6.4	6.7	7.5	7.7	7.9	0.5	0.5	0.6	0.7	0.8	2.5	2.7	3.2	3.3	3.3
Germany	4.3	4.7	5.1	5.5	5.9	3.0	3.1	3.4	3.8	3.6	1.2	1.2	1.2	1.2	1.0
Korea, Republic of	1.2	1.3	1.6	1.7	1.7	0.1	0.1	0.1	0.0	0.0	0.8	0.6	0.3	0.4	0.5
United Kingdom	0.8	0.8	0.9	0.8	0.9	0.2	0.2	0.2	0.2	0.2	1.0	1.0	1.0	0.9	0.8
Brazil	1.4	1.7	1.7	2.0	2.3	0.4	0.5	0.6	0.5	0.5	0.0	0.1	0.1	0.3	0.3
Turkey	0.6	0.8	1.0	1.7	2.1	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.4	0.7	0.5
Japan	0.9	0.9	0.9	0.9	0.9	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.7	0.8	0.0
Italy	1.3	1.0	1.1	1.2	1.2	0.7	0.4	0.5	0.3	0.3	0.7	0.7	0.7	0.7	0.7
Poland	1.5	1.7	1.9	2.3	2.4	0.7	0.9	1.2	1.2	1.0	0.3	0.4	0.4	0.4	0.4
Russian Federation	1.0	1.1	1.2	1.3	1.3	0.2	0.3	0.3	0.4	0.4	0.2	0.3	0.4	0.5	0.6
Canada	2.0	2.0	2.1	1.9	1.9	1.4	1.7	1.6	1.5	1.4	0.4	0.5	0.6	0.7	0.7
Spain	1.1	1.2	1.2	1.2	1.2	1.0	0.8	1.0	0.9	0.7	0.6	0.6	0.6	0.7	0.8
Belgium	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.7	0.8	0.9	1.0	1.0
Mexico	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.6	0.6	0.8
France	1.1	1.2	1.3	1.3	1.4	1.1	1.2	1.1	1.3	1.4	0.5	0.5	0.6	0.7	0.7
Australia	0.7	0.8	0.8	0.8	0.8	0.4	0.4	0.4	0.5	0.4	0.1	0.1	0.1	0.1	0.1
Syrian Arab Republic	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6	0.3
Austria	0.8	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.2	0.2	0.2	0.2	0.2
Sweden	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.3
Iran, Islamic Rep of	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.3	0.3
Malaysia	1.2	1.2	1.5	1.4	1.5	1.1	1.1	1.1	1.2	1.3	0.1	0.0	0.1	0.1	0.1
Netherlands	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.4	0.4	0.4	0.4	0.5
Ukraine	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.2	0.3	0.3
Total	34.8	39.9	46.7	54.1	59.1	12.5	12.9	14.1	15.2	15.4	13.9	15.1	16.3	16.9	15.8
World	41.1	47.0	54.5	61.9	67.5	16.9	17.6	19.9	21.6	21.6	17.3	18.9	21.5	22.4	21.9