

Competitiveness and Efficiency of the Forest Product Industry in Indonesia

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ABSTRACT

This paper provides an assessment on policy and structural changes in the Indonesian wood-based industries. The author shows that the tremendous growth of production and exports has been made possible through heavy subsidies, resulting in inefficiencies in harvesting and production. Subsidies created an incentive to delay the use of cost- and wood-saving technology. Constant market share analysis revealed that competitiveness of forest product exports declined during the period 1993-2003, and could only be partially compensated by an increased shift towards pulp and paper exports. Indonesia is losing competitiveness in slow growing industries like wood products, especially plywood. Further restructuring of the forest product industry in favor of pulp and paper industry with proper environmental management is the right policy direction, but there are also concerns that the huge demand for wood by the industry is already exceeding sustainable harvest levels.

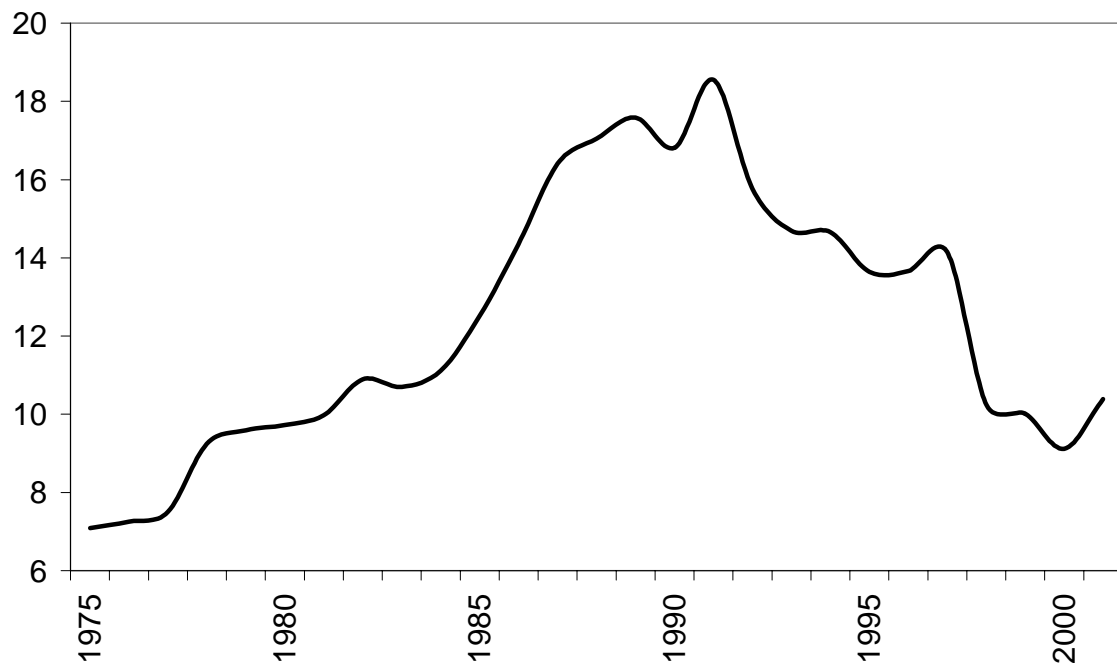
Keywords: *Indonesia, forestry, competitiveness, trade.*

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Introduction

Forest resources undoubtedly provide considerable benefits to the Indonesian economy. The contribution of wood products to total manufacturing value added more than doubled from 7% of in 1975 to 10% in 1980. By 1990 the value-added share of timber-based products had risen further to 19%, ranked third in the creation of manufacturing value-added after food and beverages and textiles. Rapid growth of electronics during the 1990s dislodged the position of wood products. Just prior to the crisis, the share of value-added generated from wood products declined to 14% of total manufacturing value-added. The crisis has further reduced the contribution of wood and wood products to just only 9% in 2000.

Figure 1: Percentage share of wood products in manufacturing value added

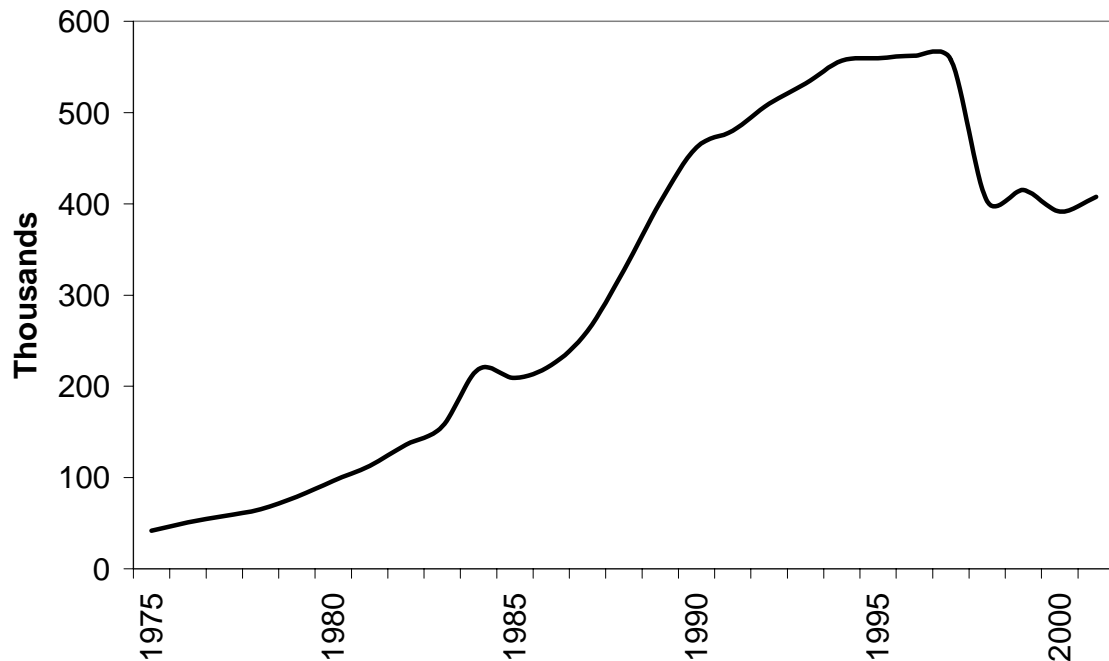


Source: author's calculation based on BPS (Central Bureau of Statistics), Survey of industries

The impact on employment and income has also been substantial. The Department of Forestry estimated that the total number of people working directly in the logging and wood processing industry at more than 489,000 in 1995. According to the large and medium scale statistics, total employment in wood and wood products has increased from only around 42,000 in 1975 to 562,000 just before the crisis before declining to 392,000 in 2000. In fact, the strong growth in wood products industry has been

matched by equally rapid growth in employment making the sector the third largest employer in the manufacturing sector.

Figure 2: employment in wood-based industries

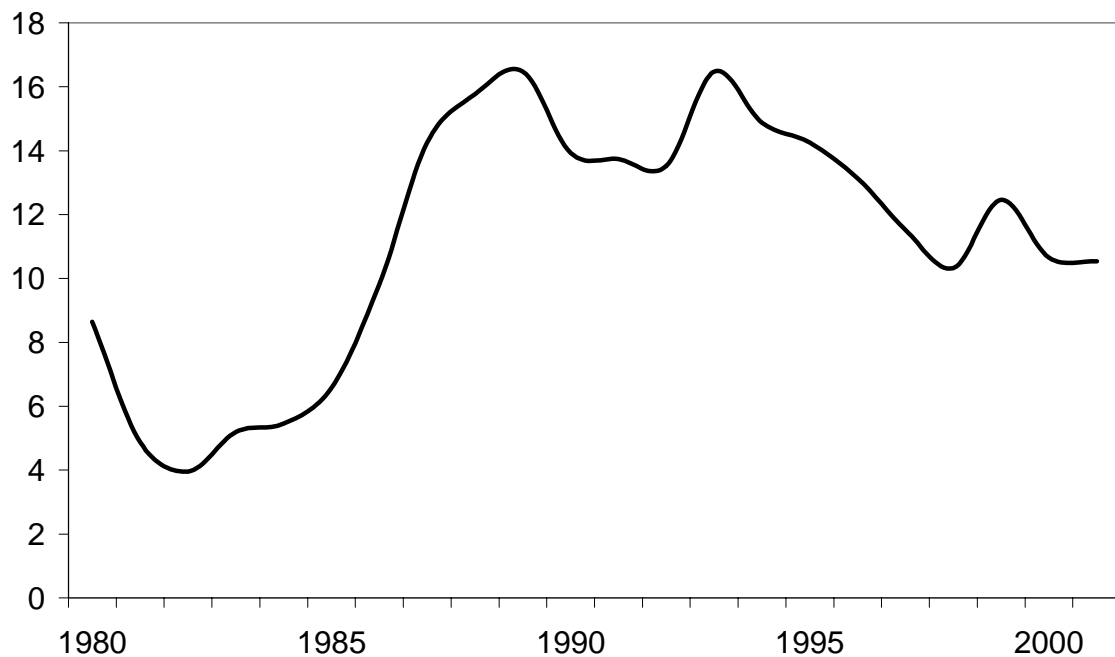


Source: same as in Figure 1

Indirect job creation is even greater. The Ministry of Manpower estimates that for each job created in forestry, 1.18 jobs are created indirectly. The Ministry predicts that saw milling and plywood manufacturing has an even higher multiplier of 1.47, while paper and pulp production's multiplier is 2.06. It is estimated that the sustainable development of wood and non-wood products will create an additional six to eight million jobs by the year 2000.

The share of Indonesia's exports of wood products in total exports rose significantly, from 4% in 1980 to 16% in 1993, before declining to 10% in 2001. The share in manufacturing exports rose from a mere 8% in 1975, to 25% in 1985. By 1990 the share of timber-based manufacturing exports had risen further to 42% in 1985 (50% in 1987). Since then until just before the crisis, wood products were the largest contributor of manufacturing exports. During 1991-1993 wood products' rank was dislodged by the textile and garments industry. During the crisis the wood processing industry together with textiles, garment and electronics remained Indonesia's most important source of non-oil/gas export revenues.

Figure 3: Share of wood-based exports in total exports



Source: author's calculations, based on BPS

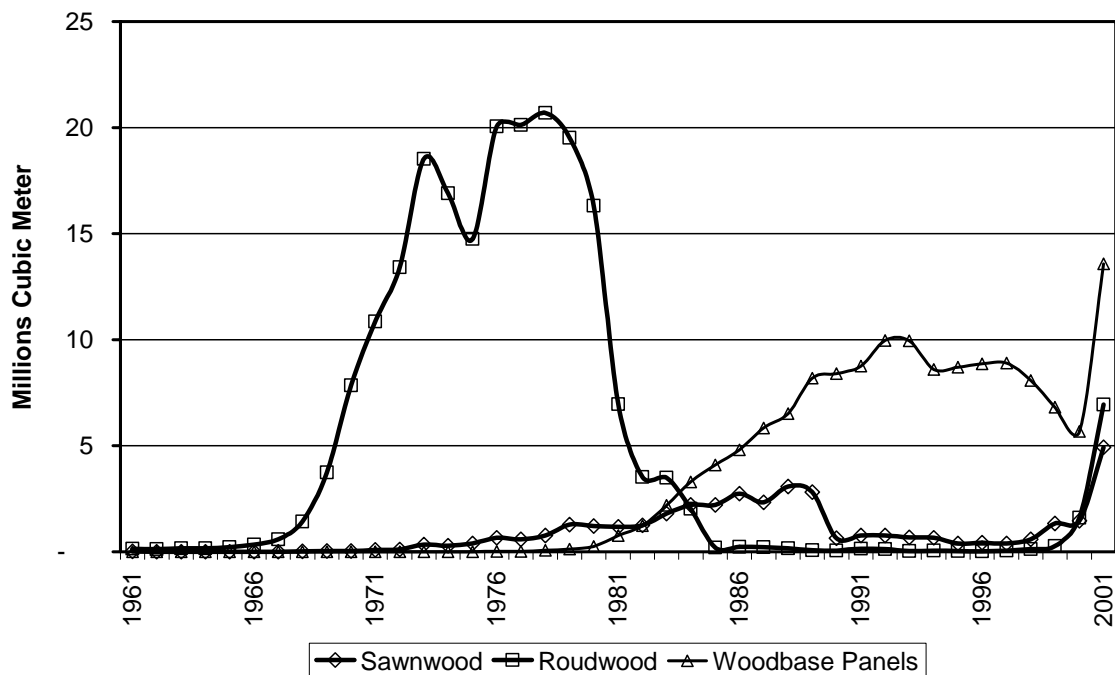
Given the importance of the Industry in Indonesian economy, it is important to assess the competitiveness of Indonesia's forest product export. The first part of the paper provides the background of the study. It describes the policy episodes, the impact on Indonesia's forest product export structure, and the brief welfare impacts of the policies. The second part of the paper assesses the competitiveness of Indonesia forest product exports using constant market share analysis.

1. Transformation and Structural Change in the Indonesian Forestry Sector

Since 1965, there have been four-development phases in the forestry sector. The first of these was the timber boom era of 1965-1980. In 1967 the government promulgated the Basic Forestry Law (BFL) and created the Ministry of Forestry to govern Indonesia's public forestland. Under the BFL, an investor needed to secure a concession from the Ministry of Forestry in order to exploit a forest. The concession granted by the government allows the concessionaire to exploit the forests for twenty years with an option to extend up to thirty-five years.

The strong potential comparative advantage in wood products was only converted into commercial industry in the 1970s. The promulgation of the Foreign Investment Law in 1967 and the Domestic Investment Law in 1968 paved the way for foreign and domestic investors eager to exploit Indonesia's strong comparative advantage in wood products. Due to the lack of infrastructure, industrial sophistication, and direct need for external revenue, investment in forest industry was initially directed toward the extraction and export of logs. With the assistance of foreign direct investment log exports grew tremendously (see Figure 4). In fact, during the period of 1978-80 Indonesia became the world's largest exporter of tropical hardwood, with an export volume of 20 million m³ and 21% of total world exports in 1978.

Figure 4: Selected wood exports



Source: BPS

The second phase was the plywood boom era of 1980-1990. Recognising the value-added and employment government revenue generating potential of forests, the Government initiated a programme at the gradual reduction of log export. In 1978 the government increased the export tax from ten to twenty percent. The movement toward downstream industries was particularly rapid after the mid 1980s as a result of deliberate policies to boost private investment in downstream wood products industries. These included linking the continued ownership of concessions with

increased processing into plywood, and tight restrictions on the export of unprocessed logs, which culminated in an outright ban on log exports in 1985. The ban was lifted in mid-1992, and was replaced by a prohibitive export tax.

These policies created the tremendous growth of the downstream wood products industry since 1980. The plywood industry, for example, which in 1972 consisted of only two operational mills with a (severely under-utilized) total capacity of 10,000-15,000 cubic metres per year, had grown to include 122 operational mills with a combined annual capacity of more than 12.7 million cubic metres by 1996. Indonesia shifted from a status as one of the world's largest exporters of logs in the 1970's and early 1980's to one of the largest plywood exporters in the mid 1980's. With export volume of around 10 millions m³ of wood based panels, Indonesia was the largest exporter of wood based panels in 1992 seizing around a third of world wood based panel's market.

The third phase was the decline of the plywood industry and the rise of the pulp and paper industry. Since 1992, wood based panel export decline considerably from around 10 million m³ in 1992 to 6.4 million m³ in 2000. At the same period, Indonesia embarked on a program of massive expansion of its pulp and paper industry. The number of pulp and paper mills increased from 22 in 1975 to 38 in 1989. Production of paper rose 24% a year from 403 thousand tons in 1984 to around 7 millions ton in 2000. Pulp production grew by 27 % a year on average since 1992 to reach 3 millions ton in just before the crisis. After experiencing a slump for two years, production started to pick up again to reach 5.5 millions ton in 2001. Pulp and paper export volume also grew tremendously since the early 1990s. Wood pulp exports increased from 124 thousand metric ton in 1994 to 1.7 million metric ton in 1998. Paper and Paperboard exports soared from 166 thousand metric ton in 1990 to 2.6 million metric ton in 1999.

2. The Economic Impact of Forestry Policies

It is clear from the previous discussion that the growth and structural change of the forestry sector has been directly affected by government policy, especially the ban of log export, and overall demand conditions. According to economic theory, a log export ban should reduce competition for logs and depress domestic log prices,

thereby reducing the stumpage value of standing trees in the forest and in turn reducing government revenue from forest resources.

The general thrust of research in this area is that Indonesia might have been better off by allowing the export of logs even if it had caused plywood and sawn wood production to expand more slowly. Simple calculation by Thompson (1996) suggests that increased fees from standing timber from \$22 to \$33 would have increased government revenues from forests from US\$ 550 million to 1,815 million. Fitzgerald (1986) estimated that the drop in export revenues for the government from diverting log export was not compensated by any gain in value-added in saw milling, resulting in a loss of US\$ 15 /m³ at world prices. Using the 1981-1984 data, Fitzgerald estimated that over 1981-84 period government had lost its revenue by US\$ 2.9-3.4 billion or approximately US\$ 725-850 million annually. Fitzgerald also estimated additional losses due to selling plywood below production costs, which amounted to US\$ 956 million over the 1981-94 period. Similarly, Byron and Quintos (1988) calculated that logs which could have been exported for US\$ 200 have been sold as plywood at \$150. A more recent and accurate estimate by Manurung and Buongiorno (1997) suggest that during the 1981-1989 period, Indonesia has lost US\$ 2.5 billion in export revenues due to the log export ban policy.

The above mentioned calculation is a short run effect since it does not take into consideration the inefficiency impact of the log export ban due to the artificially low price of domestic log. According to Manurung and Buongiorno (1997) the stumpage value was reduced by 33% under the log export ban policy. A low stumpage value also increased domestic value added artificially, since the export prices of the products decreased only slightly while the domestic price of logs were kept artificially low. As mentioned earlier, calculated at international prices, the value added would be negative.

It is often argued that the log export ban would reduce the rate of deforestation. Deacon (1995), for example, argue that taxes on timber and log export bans reduce log prices, which leads to less logging and lower deforestation. However, this argument fails to capture the full effects of log ban on deforestation. First, basic economics of renewable resource theory suggests that for slow growing resources such as tropical forest, it is optimal in the eye of concessionaires to harvest the forests

when the rate of growth of the timber equals the rate of return from processing the timber. Higher rate of return from timber processing would induce the concessionaires to harvest the forest as quickly as possible, increasing the rate of deforestation.

A low stumpage value would also induce the concessionaires to use logs inefficiently, to build excessive new capacity and to waste the raw materials during harvesting as well as processing. To reduce inefficiency and to prevent early cutting, the government introduced a system of selective cutting in 1967, under which a concessionaire could harvest only 1/12 of the concession per year. Moreover, the government forbade companies from cutting down trees less than sixty centimetres in diameter. The government also hoped to increase its revenue by imposing a ten percent tax on all logs exported.

In theory, these requirements seem to constitute good forest management and guarantee sustainable forest exploitation. If the regulation were strictly implemented than it is in the interest of the concessionaires to reforest the area in order to secure supplies. Secondly, by cutting only one-twentieth of the concession per year, the concessionaires would not harm the rest of the forest and permit the remaining area of forest to remain untouched or to regenerate. Unfortunately, the concessionaires rarely comply with these regulations, harvesting far more than one-twentieth of their concessions per year, cutting down young trees smaller than sixty centimetres diameter, failing to pay the export tax, and exploiting the government policy of offering a tax holiday for the first four to six years of their project.

Finally, the low stumpage value created disincentives for adopting resource saving technology in Indonesia. At the same time, the log export ban creates international scarcity in international market of log inducing foreign wood processing industries to substitute away from the use of virgin wood and invest in wood saving technology. For example, producing newsprint using recycled technology instead of old technology will save 0.05 ton of wood per ton of newsprint consumption. The utilization of recycled technology in the US has saved the equivalent of 2 million m³ of pulpwood during 1989-93 period Similarly the substitution of oriented strand board (OSB) for plywood technology will save the use of wood by 0.15 m³ per cubic meter production of structural panel.

2.1. Wood Intensity

One way to conserve forest resource while at the same time reaping benefits is by increasing the productivity in the use of the resource. Economic development and population pressures increase the consumption of forest resources. This should be matched by increasingly rapid growth of wood and wood products industry. The growth, in turn, can be achieved by simply using more and more timber. Alternatively, rapid output growth can also be achieved by using the same amount of inputs more productively, through better management or more efficient production techniques. Therefore, the concern was how to increase output without utilizing more forest resources.

Table 1 provides the value added share of four wood intensive sectors since 1975. According to input-output table 1975-1995, those wood intensive sectors are wood and wood products, construction, logging and sawmilling, and paper and paper products. They used, on average, 95% of total supply of log during 1975-1995.

Those four wood intensive sectors grew rapidly during 1975-1995. Average growth rate of wood and wood products during 1975-1995 was 19%, almost three times overall economic growth rate. Similarly, construction, and paper and paper products grew by 11% and 15%. Overall, those four sectors grew at the rate of 11% during 1975-1995. As a result, the share of those four sectors in the economy almost doubled, from 6% in 1975 to 12% in 1995.

Table 1: Value added share of selected wood industries

	1975	1980	1985	1990	1995
Real Value Added (billion Rp)					
<i>Wood & Wood Products</i>	217	760	1,795	5,134	6,652
<i>Construction</i>	3,695	7,475	11,755	14,390	30,935
<i>Logging & Sawmilling</i>	1,655	3,643	2,758	3,420	5,636
<i>Paper, Paper Products & Printing</i>	305	286	607	2,012	4,946
<i>Total</i>	5,873	12,165	16,914	24,957	48,170
<i>Total VA</i>	99,088	142,394	185,173	264,617	452,232
Value Added Share (%)					
<i>Wood & Wood Products</i>	0.2	0.5	1.0	1.9	1.5
<i>Construction</i>	3.7	5.2	6.3	5.4	6.8
<i>Logging & Sawmilling</i>	1.7	2.6	1.5	1.3	1.2
<i>Paper, Paper Products & Printing</i>	0.3	0.2	0.3	0.8	1.1
<i>Total</i>	5.9	8.5	9.1	9.4	10.7
Annual Growth					
<i>Wood & Wood Products</i>		28.4	18.7	23.4	5.3
<i>Construction</i>		15.1	9.5	4.1	16.5
<i>Logging & Sawmilling</i>		17.1	-5.4	4.4	10.5
<i>Paper, Paper Products & Printing</i>		-1.3	16.2	27.1	19.7
<i>Total</i>		15.7	6.8	8.1	14.1
<i>Total VA</i>		7.5	5.4	7.4	11.3

Source: author's calculation, BPS

The real value of logs used by those four sectors can be seen in Table 2. As mentioned earlier, these sectors used around 95% of total supply of log. Wood and wood products, and construction alone used 94% of logs in 1995. The real value of log used by these sectors increased more than six fold during 1975-1995. As a result the share of logs used in these sectors increased by almost 12 percentage points, from 86% in 1975 to 99 percent in 1995.

Table 2: Real value of logs used (billion Rp)

	1975	1980	1985	1990	1995
Real Value of Log Used (billion Rp)					
<i>Wood & Wood Products</i>	183	479	1,538	2,758	4,513
<i>Construction</i>	562	947	832	745	1,434
<i>Logging & Sawmilling</i>	193	129	16	18	135
<i>Paper, Paper Products & Printing</i>	1	1	3	18	130
<i>Total</i>	939	1,556	2,389	3,539	6,212
 <i>Total Value</i>	 1,089	 1,659	 2,485	 3,634	 6,290
Share (%)					
<i>Wood & Wood Products</i>	16.8	28.9	61.9	75.9	71.7
<i>Construction</i>	51.6	57.1	33.5	20.5	22.8
<i>Logging & Sawmilling</i>	17.8	7.8	0.6	0.5	2.1
<i>Paper, Paper Products & Printing</i>	0.1	0.1	0.1	0.5	2.1
<i>Total</i>	86.3	93.8	96.1	97.4	98.8
Growth (%)					
<i>Wood & Wood Products</i>		21.2	26.3	12.4	10.3
<i>Construction</i>		11.0	-2.5	-2.2	14.0
<i>Logging & Sawmilling</i>		-7.8	-34.3	2.1	50.3
<i>Paper, Paper Products & Printing</i>		6.5	25.8	45.8	48.6
<i>Total</i>		10.6	9.0	8.2	11.9
 <i>Overall Economy</i>		 8.8	 8.4	 7.9	 11.6

Source: same as in Table 2

Analogous to labour productivity, the use of forest resource can be measured by using the ratio of value added to the use of input from forest resource. Table 3 provides Indonesia's overall wood intensity. Over the 1975-1998 period, there has been little improvement in the productivity of the use of forest resources. The efficiency of the wood and wood products, the most wood intensive industry, increased by 1.5 points during 1975-1995. Paper and paper products even experienced a declining productivity during 1975-1995. During the plywood boom of 1980-1985 the productivity of wood and wood products declined from 1.6 in 1980 to 1.2 in 1985. Despite improvements in the productivity of construction and sawmilling industries, other wood intensive industry could not compensate for the declining productivity of wood products and paper industry. As a result total productivity of these four sectors declined during 1980-1990.

Table 3: Efficiency in wood industry

	1975	1980	1985	1990	1995
<i>Wood & Wood Products</i>	1.2	1.6	1.2	1.9	1.5
<i>Construction</i>	6.6	7.9	14.1	19.3	21.6
<i>Logging & Sawmilling</i>	8.6	28.2	174.0	194.2	41.7
<i>Paper, Paper Products</i>	483.4	331.1	223.1	112.2	38.1
<i>Total</i>	6.3	7.8	7.1	7.1	7.8
<i>Total Economy</i>	91.0	85.8	74.5	72.8	71.9

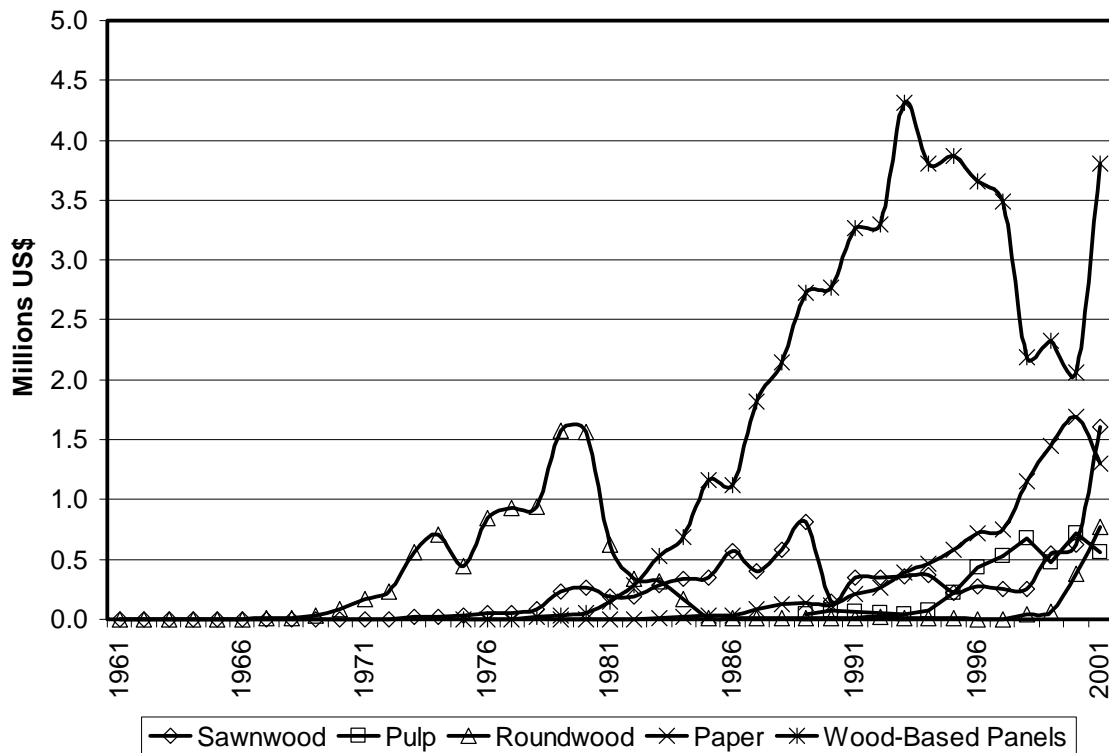
Source: author's calculation

2.2. Competitiveness of Indonesia's Wood Product

The previous assessment on policy and structural change shows that the tremendous growth of production and export has been made possible through heavy subsidies resulting inefficiencies in harvesting and production. Moreover, subsidies created an incentive to delay the use of cost saving technology in general and wood saving technology in particular.

Figure 5 shows Indonesian exports value of wood based panels expanded at rapid pace over 1982-93 and then slowed in the mid-1990s. The slow down was then replaced by fair growth of paper products from early 1990s, followed by rapid expansion of pulp and paper since mid 1990s.

Figure 5: Exports of wood based panels



Source: author's calculation, BPS

However, the question remains whether the decline was due to the decline in world demand for forest products or changes in international competitiveness. This question can be addressed by decomposing a country's value of export growth into demand and competitiveness effect. The influence of demand for forest products is measured by the change in total value of this trade. Specifically, if D_{0j} and D_{tj} represent world trade in product j , at time period 0 and t respectively, the change in exports attributed solely to demand (E_{dj}) is

$$\Delta E_{d,i} = \sum (s_{0j}) \times (D_{t,j} - D_{0,j}) \dots \dots \dots (1)$$

where s_{0j} is the share of Indonesia in world imports of product j in the base period 0, and the summation is total wood products exported. Equation (1), therefore, shows the change in Indonesia's exports that would have occurred if only demand changes took place.

The change in the competitive position of Indonesia is measured by the difference between the exports that would have occurred in period t if the country's initial market share had not changed and those exports that were realised:

$$\Delta Ec,i = \sum(st,j - so,j)(Dt,j) \dots\dots\dots (2)$$

where st_j is the share of Indonesia in world imports of product j in period t . Equation (2) shows how much exports changed, above or below the level associated with pure demand changes, due to changes in a country's market share. The residual, i.e. any differences between changes in a country's total exports and those two factors is due to product diversification.

Equation (1) and (2) were applied to FAO forestry statistics for Indonesia's exports of forest products.

Table 4 provides the decomposition of Indonesia's forest products exports into demand and competitive factors.

Table 4: Change of wood-based products due to demand and competitiveness effects

Commodities	Value of Exports			Demand Factor		Competitive Factor	
	1980	1993	2000	1980-1993	1993-2000	1980-1993	1993-2000
Industrial Roundwood	1,559	9	376	76	(0)	(1,626)	367
Sawnwood	260	363	608	187	34	(84)	210
Wood Based Panel	56	4,312	2,094	87	1,727	4,169	(3,945)
Plywood	56	4,227	1,996	110	(698)	4,062	(1,533)
Veneer Sheets	-	24	25	-	12	24	(12)
Particle Board	-	39	31	-	72	39	(80)
Fibreboard	-	21	42	-	25	21	(4)
Wood Pulp	-	41	728	-	35	41	652
Chemical Wood Pulp	-	36	721	-	33	36	652
Dissolving Wood Pulp	-	-	3	-	-	-	3
Mechanical Wood Pulp	-	1	3	-	0	1	1
Semi-Chemical Wood Pulp	-	-	-	-	-	-	-
Other Fibre Pulp	-	3	1	-	1	3	(3)
Paper & Paperboard	0	395	1,734	0	241	394	1,097
Newsprint	-	44	170	-	9	44	117
Printing+Writing Paper	0	275	1,245	1	223	274	747
Other Paper+Paperboard	-	72	315	-	40	72	203
Recovered Paper	-	4	3	-	6	4	(7)
Wood	1,875	4,683	3,077	350	1,761	2,458	(3,367)
Pulp and Paper	0	436	2,462	0	276	435	1,749
Total	1,876	5,119	5,539	350	2,038	2,893	(1,618)

Source: author's calculation, based on FAO data

The table shows the total value of exports in 1980, 1993, and 2000 along with the decomposition of change in exports into demand and competitive factors. During 1980-1993, Indonesia's exports of forest products increased from \$ 1.9 billion to \$5.1 billion, or a rise by \$3.2 billion. Indonesia's capability to boost exports of forest products during the period was mainly due to competitiveness effect. Only 10% (\$ 0.35 billion) of Indonesia's change in exports of forest products was due to the demand factors. The remaining 90% (\$2.9 billion) was due to the competitiveness factor.

Looking at a more detail commodities, almost all of exports gain was due to raising competitiveness of plywood exports, while industrial round wood and sawn wood lose their competitiveness. Pulp and paper exports also gain competitiveness during the period, although at much more smaller scale.

The period 1993-2000 saw a declining competitiveness of Indonesia's forest products exports. Indonesia's lessened ability to compete in wood products resulted in a loss of \$3.4 billion in potential exports of wood products during the period. The loss of export potential in wood products is less then compensated by competitiveness gain in pulp and paper exports (\$1.75 billion dollar) resulting in a net loss of export potential by \$1.7 billion.

The loss in export potential was concentrated in wood based panel. All sub-sector in wood based panel category were losing competitiveness with the biggest loser being plywood industry. In contrast, almost all of pulp and paper products, with the exception of other fibre pulp and recovered paper gain competitiveness.

An interesting question with regard to the prospect of Indonesia's forest product exports was whether Indonesia lost competitiveness in the fast or slow growing markets. The following table combines the competitiveness analysis above with the growth of world forest exports.

Table 5 summarises the result when the growth of world exports are matched with Indonesia's competitiveness. Instead of using the growth of world export value we use the growth of commodity share in world exports. By doing so, we can access directly the growth potential of a product – positive/negative number indicate that the product is in the fast/slow growing market.

Table 5: Indonesia's share in world market of wood – based industries

Commodities	World	Indonesia	
	%Change in share	Share	Competitive factor
Particle Board	0.67	0.6	-80
Semi-Chemical Wood Pulp	0.59	0.0	0
Recovered Paper	0.56	0.1	-7
Fibreboard	0.41	0.8	-4
Chemical Wood Pulp	0.28	13.0	652
Printing+Writing Paper	0.22	22.5	747
Other Paper+Paperboard	0.08	5.7	203
Veneer Sheets	0.05	0.4	-12
Other Fibre Pulp	-0.05	0.0	-3
Dissolving Wood Pulp	-0.09	0.1	3
Newsprint	-0.19	3.1	117
Sawnwood	-0.28	11.0	210
Mechanical Wood Pulp	-0.32	0.0	1
Industrial Roundwood	-0.39	6.8	367
Plywood	-0.55	36.0	-1533
Wood	-0.21	55.6	-3367
Pulp and Paper	0.14	44.4	1749
Total	0.00	100.0	-1618

Source: author's calculation

The general message that can be inferred from the table is the need for the restructuring the industry toward fast growing industry. Wood product, especially plywood, is slow growing industry, and Indonesia is losing competitiveness in this industry. We may expect a growing demand for protections and/or subsidies. However, these measures will hinder efficiency-enhancing effort by the industry, and more importantly, prevent restructuring of the industry in line with the trend in world demand.

Pulp and paper industries, on the other hand, are competitive in the fast growing markets. Further restructuring of forest product industry in favour of pulp and paper industry with proper environmental management is the right policy direction.

Indonesia is left behind in the race of seizing fast growing markets. The top four of the fast growing industries, namely particleboard, semi chemical wood pulp, recovered paper, and fibre board occupy only less than 2% of Indonesia's exports of forest products. These industries seem to use wood-saving technology, e.g plywood vs. particleboard Moreover, in all of these four product the competitive factors are either zero or negative, indicating loss of competitiveness.

Conclusion

An assessment on policy and structural changes in the Indonesian wood-based industries shows that the tremendous growth of production and export has been made possible through heavy subsidy, resulting in inefficiencies in harvesting and production. Moreover, the subsidy created an incentive to delay the use of cost saving technology in general and wood saving technology in particular. Moreover, constant market share analysis revealed that competitiveness of forest product exports declined during the period 1993-2003, and could only be partially compensated by an increased shift towards pulp and paper exports.

Overall, there is the need for the restructuring the industry toward fast growing industries. Indonesia is losing competitiveness slow growing industries like wood products, especially plywood. Thus, one could expect a growing demand for protections and/or subsidies. However, these measures will impede efforts to improve the efficiency efforts by the industry, and more importantly, prevents restructuring of the industry in line with the trend in world demand. Pulp and paper industry, on the other hand, is an industry that is competitive in the fast growing market. Further restructuring of forest product industry in favour of pulp and paper industry with proper environmental management is the right policy direction. However, there are also concerns that huge demand for timber by the industry is already exceeding sustainable harvest levels (Barr 2001).

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