

SILVA FENNICA

1986 Vol. 20 N:o 3

Sisällys
Contents

- KIMMO KILJUNEN: Growth of third world forest industry: 159–179
possible impact on Finland
Seloste: Kehitysmaiden metsäteollisuuden kasvu ja sen vaikutukset Suomessa
- ALLI MANNINEN, JUHANI KANGAS, ILKKA MONONEN, 181–188
PENTTI HEIKKINEN, TAPIO KLEN & KAJ HUSMAN: Kloora-
tuille fenoksihapoille altistumisen vaikutus metsurien terveydentilaan
vesakontorjuntatyössä
*Abstract: Effect of exposure to chlorinated phenoxy acid herbicides on the health of
Finnish forest workers in silvicultural clearing work*
- RAYMOND K. OMWAMI: A theory of stumpage appraisal 189–203
Tiivistelmä: Teoria kantohinnan määrittämisestä
- PERTTI HARI, PIRKKO HEIKINHEIMO, ANNIKKI MÄKE- 205–210
LÄ, LEO KAIPAINEN, EEVA KORPILAHTI & JUHA SAME-
LA: Trees as a water transport system
Tiivistelmä: Puun rakenne vedenkuljetusjärjestelmänä
- PIRKKO VELLING & GERARD NEPVEU: Männyn puuaineen 211–231
laadun ja tuotoksen vaihtelu suomalaisessa provenienssikoesarjassa
*Summary: Variation of wood quality and yield in a Finnish series of provenance
trials on Scots pine*
*Résumé: Variabilité de la qualité du bois et du rendement en matière sèche dans un
test multistationnel de provenances de pin sylvestre d'origine finlandaise*
- KARI HELIÖVAARA & RAUNO VÄISÄNEN: Parasitization in 233–236
Petrova resinella (Lepidoptera, Tortricidae) galls in relation to industri-
al air pollutants
*Tiivistelmä: Ilmansaastumisen vaikutus pihkakääriäisen äkämävaiheen loisin-
taan*
- KIRSI MAASALO: Pihlajan puuaineen ominaisuuksia 237–244
Abstract: Properties of the wood of the rowan tree (Sorbus aucuparia)
- PENG SHIKUI: A comparison of replacement strategies in conti- 245–250
nuous forest inventory
*Tiivistelmä: Koealojen korjausmenetelmien vertailu jatkuvassa metsien inventoin-
nissa*

SUOMEN METSÄTIETEELLINEN SEURA
SOCIETY OF FORESTRY IN FINLAND

Silva Fennica

A QUARTERLY JOURNAL FOR FOREST SCIENCE

PUBLISHER: THE SOCIETY OF FORESTRY IN FINLAND

OFFICE: Unioninkatu 40 B, SF-00170 HELSINKI 17, Finland

EDITOR: SEPPO OJA

EDITORIAL BOARD:

RIHKO HAARLAA (Chairman), TIINA HEINONEN, VEIKKO KOSKI, RISTO PÄIVINEN, JUHANI PÄIVÄNEN and MARKKU KANNINEN (Secretary).

Silva Fennica is published quarterly. It is sequel to the Series, vols. 1 (1926) – 120 (1966). Its annual subscription price is 220 Finnish marks. The Society of Forestry in Finland also publishes *Acta Forestalia Fennica*. This series appears at irregular intervals since the year 1913 (vol. 1).

Orders for back issues of the Society, and exchange inquiries can be addressed to the office. The subscriptions should be addressed to: Academic Bookstore, P.O. Box 128, SF-00101 Helsinki 10, Finland.

Silva Fennica

NELJÄNNESVUOSITTAIN ILMESTYVÄ METSÄTIETEELLINEN
AIKAKAUSKIRJA

JULKAISIJA: SUOMEN METSÄTIETEELLINEN SEURA

TOIMISTO: Unioninkatu 40 B, 00170 Helsinki 17

VASTAAVA TOIMITTAJA:
SEPPO OJA

TOIMITUSKUNTA:

RIHKO HAARLAA (Puheenjohtaja), TIINA HEINONEN, VEIKKO KOSKI,
RISTO PÄIVINEN, JUHANI PÄIVÄNEN ja MARKKU KANNINEN (Sihteeri).

Silva Fennica, joka vuosina 1926–66 ilmestyi sarjajulkaisuna (niteet 1–120), on vuoden 1967 alusta lähtien neljännesvuosittain ilmestynyt aikakauskirja. Suomen Metsätieteellinen Seura julkaisee myös *Acta Forestalia Fennica* -sarjaa vuodesta 1913 (nide 1) lähtien.

Tilauksia ja julkaisuja koskevat tiedustelut osoitetaan seuran toimistolle. *Silva Fennican* tilaushinta on 160 mk kotimaassa, ulkomaille 220 mk.

Growth of third world forest industry: possible impact on Finland

Kimmo Kiljunen

SELOSTE: KEHITYSMAIDEN METSÄTEOLLISUUDEN KASVU JA SEN VAIKUTUKSET SUOMESSA

Kiljunen, K. 1986. Growth of third world forest industry: possible impact on Finland. *Seloste: Kehitysmaiden metsäteollisuuden kasvu ja sen vaikutukset Suomessa*. *Silva Fennica* 20(3): 159–179.

Use of tropical forest resources is analysed as part of the world forest resources and global development of forest industry. Finland's role in the international division of labour of forest industry is investigated. Factors of competitiveness are analysed in order to differentiate specific adjustment constraints in Finland due to competition from developing countries.

Tutkimuksessa tarkastellaan trooppisten metsien hyödyntämistä osana maailmanlaajuisia metsävaroja ja globaalia metsäteollisuuden kehitystä. Tutkimuskohteena on Suomen rooli kansainvälisessä metsäteollisuuden työnjaossa. Siinä analysoidaan kilpailukykyyn vaikuttavia tekijöitä ja selvitetään Suomen metsäteollisuuden sopeutumispaineita trooppisten metsien teollisen hyödyntämisen asteittain laajetessa.

Keywords: forest resources, international division of labour, forest industry, developing countries
ODC 97+79+905.2+(1–77)
Author's address: University of Helsinki, Institute of Development Studies, Annankatu 42 D, 00100 Helsinki, Finland

Approved on 2. 10. 1986

1. Introduction

The starting point of this study is the gradual shift in the use of global forest resources and, subsequently, in the world forest industry due to the industrialisation process in less developed countries (LDCs). The overriding concern is how this phenomenon has changed and will change the external

economic conditions as regards to Finland's role in the international division of labour of the forest industry. The study is based on my doctorate thesis examining the overall industrialisation process in LDCs and consequent trade-related restructuring constraints in Finland. (Kiljunen 1985).

2. Forest resources of the world

The total forested area of the world is about 4 100 million ha., covering some 30 per cent of the world land area. However, a great share of it is not suitable for industrial use. There are wooded areas with only limited tree coverage as well as forests that are not operable for a variety of reasons, such as physical or economic inaccessibility, or different legal constraints designed to preserve the forests. The amount of operable or productive forest available for roundwood production amounts to slightly less than half of the total world forest area. Some 52 per cent of it is located in the Third World. The total growing stock, given as the bole volume of all trees, is estimated at about 270 000 million m³ for all the operable forests in the world, of which less developed countries (LDCs) together account for some 64 per cent (see Table 1).

Trends in forest resources have taken different courses in the developed and develop-

ing countries. In general, the growing stocks in Europe and North America have increased during the post-war period. This is primarily due to improved forest management, forest conservation policies and a better knowledge of the resource base. In contrast, the forest area and growing stock in the LDCs have drastically decreased. Tropical rain forests, the main type in the LDCs, have decreased in area from around 1 600 million ha. to about 950 million ha. It has been estimated that during the another 3.8 million ha. of other wooded land have been lost annually (Pöyry 1977, UNIDO 1983 c).

The forest use in LDCs is based on extractive exploitation. The forest exploitation has typically been uncontrolled, exceeding in many countries the sustainable capacity level. Moreover, bad logging practices have brought about erosion. Only a small fraction of LDC forests are properly managed and protected; in fact, nearly 90 per cent of the tropical forests have never been surveyed (UNIDO 1983). Vast forest areas are, hence, either neglected or receive scant attention, although in tropical areas the ecological balance is particularly fragile.

The main cause of deforestation has not, however, been industrial utilisation, but agriculture and fuel needs. Spontaneous shifting cultivation is considered to be responsible for about 35 per cent of the total deforestation in Latin America, 70 per cent in Africa and 50 per cent in Asia (UNIDO 1983 c). In particular, the still widely used practice of indiscriminate slash-and-burn agriculture is devastating for forest resources. Another important cause is the conversion of forest land to extensive grazing. Despite this alarming trend of deforestation, LDC forests still contain about two-thirds of all the growing stock in the world's forest representing a significant productive potentiality in terms of wood-based industrialisation.

Table 1. World's forest resources and global use of wood, 1981.

	Developed countries	LDCs
All forest area (million ha.)	1 910	2 215
Operable forest area (million ha.)	940	1 035
Growing stock in operable forests (milliard m ³)	96	174
Total roundwood production (million m ³)	1 314	1 828
of which industrial roundwood	1 069	315
fuelwood and charcoal	245	1 513
Roundwood utilisation per cent share of growing stock in operable forests	1.4	1.0
Industrial roundwood utilisation per cent share of growing stock	1.1	0.2

Sources: UNIDO (1983) Wood Resources and Their Use as Raw Material, and FAO, Yearbook of Forest Products 1970-1981

3. Use of forest resources

The world production of all roundwood reached some 3 100 million m³ in 1981, of which 58 per cent was produced in LDCs and 42 per cent in developed countries (Table 1). Hence, the overall distribution of global roundwood production corresponds roughly to the distribution of the forest resources. A major difference exists, however, in the type of wood use between regions. In LDCs the bias towards production of fuel wood is overwhelming. Nearly nine-tenths of the people in the Third World depend entirely on wood as their main source of fuel. Consequently, over four-fifths (83 per cent) of the wood cut down in LDC forests is used for energy as fuel wood and charcoal. Even though the pattern of wood use in developed countries - consisting primarily of roundwood production for industrial purposes - is the reverse, in global terms more than half (56 per cent) of the total wood consumption is used as fuel. (UNIDO 1983 c).

On the other hand, of the world production of industrial roundwood, only about one-fifth (23 per cent) is produced in the Third World. The foremost producer of industrial wood is North America, with about a third of the world total, followed by the Soviet Union and Europe with about a fifth each. The degree of industrial utilisation of the forests varies greatly by regions. Measured by the percentage ratio of industrial roundwood production to the volume of growing stock, a remarkable difference between developed and developing countries is revealed (Table 1). In the former about 1.1 per cent of the growing

stock is annually used as industrial raw material, whereas in the latter case the ratio is only 0.2 per cent.

Within LDCs the forests are clearly an under-used source for industrial production. Although in some parts of the Third World, like Southern Brazil, Mexico, some West African countries and the countries of Southeast Asia, forest resources are being used more and more intensively, in most parts the contribution of tropical forests to industrial development is negligible. The most extreme examples are the practically unlimited, but unused, forest resources of the Amazon and Congo river areas.

Typically, the forest industry in LDCs has in its initial stage concentrated on mechanical wood processing. Of all industrial roundwood production in LDCs, some 87 per cent is produced for the mechanical wood industry - and, hence, only 13 per cent as pulpwood - while in developed countries the corresponding figures are 69 per cent and 31 per cent, respectively.

The pattern of forest utilisation in the LDCs is thus fairly clear. In terms of forest resources, they have about 52 per cent of the world's operable forest areas and even more, 64 per cent, of the wood volume in these forests. Their share of global roundwood production is about 58 per cent, but they produce only about 23 per cent of the world's industrial wood. The unbalanced picture is accentuated by the fact that the proportion of LDCs in world pulpwood production is merely 11 per cent. While the relative importance

Table 2. Comparison of forest resources and roundwood production of developed and developing countries, 1961, 1971 and 1981 (per cent of world total).

	Developed countries			LDCs		
	1961	1971	1981	1961	1971	1981
Growing stock	35.6	64.4
Total roundwood production	55.6	47.3	41.8	44.4	52.7	58.2
Industrial roundwood production	86.5	83.5	77.2	13.5	16.5	22.8
Pulpwood production	97.6	95.2	89.2	2.4	4.8	10.8

Sources: FAO, Yearbook of Forest Products, 1961-1972 and 1970-1981.

of LDCs as suppliers of industrial wood has grown markedly during the last two decades, their contribution is still far from what it could be considering their vast forest resources (see Table 2).

There are several reasons – both economic

and technical – for the low intensity of the industrial use of the LDC forests. At present, wood processing is limited in LDCs, owing to input constraints such as capital and skill, the characteristics of the available raw material, and the lack of basic infrastructure.

4. New possibilities for utilising tropical forests

There are two major factors – technological progress in pulp making and the plantation programmes – that have started to reshape the global structure of the forest industry by making tropical forest areas increasingly available as raw material sources.

In the early 1950's, the modern process for bleaching sulphate pulp was developed. A short-fibre bleached hardwood pulp was introduced. Hence, forest areas – such as subtropical and tropical forests – with little or no coniferous species became potential raw material sources for pulping and paper making.

Another development that has influenced the raw material availability of tropical forests is expanding use of plantation programmes. Since the 1950's forest plantations have expansively been used in several LDCs to stop deforestation and to provide fuel wood for urban areas, but, particularly during the course of the 1970's fast-growing plantations

have increasingly been established for industrial purposes. Under favourable conditions the annual growth of eucalyptus may be 43 to 55 m³ per hectare, and that of pine 20 to 45 m³ per hectare, compared, for example, to the average growth of 4 to 6 m³ per hectare a year that can be reached in southern Finland. Hence, the tropical forest plantations require rotation ages of only 17 to 20 years for eucalyptus and 20 to 25 years for pine after the initial plantation work, instead of the 50-to-80-year rotations required for the natural forests in temperate zones. (Pöyry 1982, UNITAR 1974) The cheap wood raw material potentiality is a permanent competitive advantage for many LDCs.

In the LDCs of the tropical zone, the total area of plantations existing in 1980 is about 11.5 million ha. The fact that 40 per cent of all these plantations were established over the last five year period, 1976–1980, illustrates the rapid increase of this afforestation effort.

Table 3. Established and planned forest plantations in tropical LDCs, 1980 (million ha.).

	Established plantations		Planned plantations (annual rate of formation 1981–85)	
	industrial	all	industrial	all
Tropical America	2.6	4.6	0.28	0.53
Tropical Africa	1.0	1.8	0.06	0.13
Tropical Asia	3.5	5.1	0.23	0.44
Total	7.1	11.5	0.58	1.10

Source: UNIDO (1983) Wood Resources and Their Use as Raw Material. Table 1.7 and 1.8.

Some 60 per cent of all plantations are used for the production of industrial wood. On a regional basis Latin America, tropical Africa and tropical Asia account for 40, 15 and 45 per cent, respectively, of the total plantations (Table 3).

However, the industrial plantations in particular are quite concentrated in large countries. In Latin America, Brazil alone accounts for about 77 per cent of all the industrial plantations, and in tropical Asia some 85 per cent is concentrated in India and Indonesia. Nevertheless, in recent years the establishment of forest plantations has expanded rapidly all over the tropical countries, where some 1 million ha. are established annually. This should, however, be compared with the annual deforestation of over 7 million ha

(UNIDO 1983 c).

Once established, the potential contribution of fast-growing plantations to forest industry development is obviously great. They can supply a uniform raw material instead of the existing mixed tropical hardwood forests. The plantations already contribute 40 per cent of the industrial roundwood production in tropical America, but still only 5 per cent in Africa and Asia. (UNIDO, 1983 c) In the short term, until the 1990's, their influence on the global forest industry development and trade balance will remain rather limited, since the area devoted to such ventures is still quite small, but after that many LDCs may follow Brazil's example as an important power in forestry and the forest industries.

5. Development of the forest industry

Over the last quarter of a century, the world forest industry has grown steadily, although the overall growth of demand has not been so intense as in many other industrial sectors. In spite of the relatively moderate growth rate, the world consumption of forest products is still expected to increase (FAO 1982). The demand will grow fastest in the Third World, due to the low starting level, economic growth and urbanisation as well as spreading

literacy. There the production of the forest industries has also grown fastest in relative terms during the past two decades. The global share of LDCs has increased both in the mechanical and chemical forest industry sectors. The growth has been particularly intense in the production of wood-based panels and wood pulp, in which the global share of LDCs has increased threefold during the period of 1961 to 1981 (Table 4). Obviously,

Table 4. Production of forest industries by Finland and major regions share of world total, 1961, 1971 and 1981 (per cent).

	Finland			DMEs*			SOCs**			LDCs		
	1961	1971	1981	1961	1971	1981	1961	1971	1981	1961	1971	1981
Roundwood	2.5	1.6	1.4	32.7	28.4	26.4	20.4	17.3	14.0	44.4	52.7	58.2
Sawn wood	2.4	1.7	2.0	50.3	51.7	49.8	36.6	33.7	28.5	10.7	12.9	19.7
Wood-based panels	3.2	2.1	1.6	79.0	75.4	64.6	13.0	13.4	16.8	4.8	9.1	17.0
Wood pulp	6.9	5.9	5.8	82.0	80.8	77.1	8.6	9.7	9.6	2.4	3.7	7.4
Paper and board	3.1	3.4	3.5	82.2	79.8	75.9	7.8	8.5	8.0	6.8	8.4	12.6

* Developed Market Economies (DMEs)

**Socialist Countries (SOCs)

Source: FAO, Yearbook of Forest Products 1972 and 1970–1981.

the developed countries still dominate the world forest industry production, but the continuation of such a growth rate in LDCs could lead gradually to considerable changes in the geographical composition of production. At present, about a fifth of the world mechanical wood processing takes place in LDCs, but still only a tenth of the chemical wood processing.

The Finnish share in the global forest industry has declined slightly in every sector except paper and paper board. The most dramatic decline has been experienced in wood-based panels – the sector with the highest growth rate in LDCs. The lack of raw material has started to prevent the expansion of the base industry in Finland; hence, the only way to grow has been to concentrate on end products – such as different paper grades – with a high value-added content. They do not have a cost structure dominated by wood costs.

Regional shifts in the production capacity of the world forest industry are not necessarily reflected in the global trade structure, since the sector in global terms is very strongly home-market oriented. About 80 to 85 per cent of all forest industry production in the world is directed toward domestic markets. In Finland the situation is, hence, exceptional since about two-thirds of its forest industry products are exported and in paper products the share is above 80 per cent. In the LDCs the share of exports in total production has been below average, except in the sectors of wood-based panels and, in recent years, wood pulp (see Table 5). This indicates that the forest industry in most LDC cases is predo-

Table 5. Share of exports in total production of forest products by Finland and by major regions 1961, 1971 and 1981 (per cent).

	Finland	DMEs*	SOCs	LDCs	World
Roundwood					
1961	12.0	2.7	1.9	1.5	2.0
1971	2.6	4.1	3.9	2.9	3.4
1981	6.2	5.6	4.8	1.9	3.3
Sawn wood					
1961	64.2	16.7	6.5	9.3	12.2
1971	64.0	18.1	8.2	11.0	13.9
1981	65.1	24.6	8.4	11.2	17.4
Wood-based panels					
1961	70.0	11.3	7.1	27.6	11.4
1971	62.5	10.7	10.5	47.2	14.1
1981	62.5	13.7	9.9	29.9	16.3
Wood pulp					
1961	37.2	17.0	6.0	3.6	15.6
1971	25.0	15.8	5.6	9.9	14.6
1981	23.3	17.4	7.4	18.0	16.4
Paper and paper-board					
1961	83.3	18.6	5.0	2.8	16.5
1971	81.1	20.5	10.0	2.8	18.1
1981	80.3	23.6	12.5	4.8	20.4

Note: *Including Finland

Sources: FAO, Yearbook of Forest Products, 1961–1972 and 1970–1981.

minantly home-market oriented and in its initial stage primarily represents an import-substitution type of industrialisation. Obviously, country variations in this respect are great (Table 5).

6. International division of labour in forest industry

The world economy can be divided into forestry product exporting areas and importing areas. Table 6 show the supply and demand pattern in the international economy based on this division. As described earlier, there are some inherently wood-rich and wood-poor countries in the world, the first being the potential exporters and the latter the poten-

tial importers. Furthermore, among the exporters there is a distinct division of labour, which is affected by the degree of development and industrialisation of a particular country.

On a world basis, there are, and will continue to be, differences regionally between the production and consumption of forest pro-

Table 6. Trade balance of forest products by regions, 1961 and 1981.

	Roundwood (million m ³)		Sawn wood (million m ³)		Wood based panels (million m ³)		Pulp (million tons)		Paper (million tons)	
	1961	1981	1961	1981	1961	1981	1961	1981	1961	1981
DMEs										
Finland	5.6	-1.4	5.2	5.4	0.7	1.0	1.6	1.7	2.0	4.8
Western Europe	-13.8	-16.9	-11.9	-13.1	-0.5	-3.1	-1.9	-5.1	-1.2	-1.9
North America	0.9	17.6	3.3	9.0	-0.6	-0.9	1.4	6.3	1.6	5.5
other DMEs	-9.2	-35.1	-1.8	-4.5	0.4	-0.1	-0.2	-0.8	-0.4	-0.1
subtotal	-16.5	-35.8	-5.2	-3.2	0.0	-3.1	0.9	2.1	2.0	8.3
SOCs										
Soviet Union	5.3	15.1	4.9	6.6	0.0	0.9	0.2	0.5	-0.1	0.2
Eastern Europe	-0.6	2.7	0.8	0.4	0.1	-0.3	-0.3	-0.9	0.0	-0.4
subtotal	4.7	17.8	5.7	7.0	0.1	0.6	-0.1	-0.4	-0.1	-0.2
LDCs										
Africa	4.6	5.0	0.0	-0.3	0.1	-0.1	0.0	0.2	-0.2	-0.6
Latin America	0.3	0.4	0.2	-0.8	0.0	0.1	-0.5	0.7	-0.9	-1.9
Near East	-0.4	-0.7	-1.0	-4.2	-0.1	-1.1	0.0	-0.1	-0.3	-1.1
Far East	6.3	14.4	0.9	4.0	0.1	3.3	-0.3	-1.2	-0.6	-2.5
subtotal	10.8	19.1	0.1	-1.3	0.1	2.2	-0.8	-0.4	-2.0	-6.1

Source: FAO, Yearbook of Forest Products, 1970–81.

ducts. The wood-poor areas in the Middle East and North Africa have consumed more wood products than they produce, but so have both Eastern and Western Europe as well as Japan. The major excess production regions have been North America, the Soviet Union and the Nordic countries as well as the Far East, with smaller surpluses coming from Latin America and Africa. Although the production in LDCs has increased substantially in the last two decades, the balance between production and consumption has remained quite stable due to a parallel increase in their consumption of wood products.

Altogether, in global terms the share of exports has gradually increased in every forest industry sector. In Finland, though, outward orientation has slightly decreased, particularly in pulp production, where upgrading in favour of paper products has taken place.

In fact, net imports of forest products are generally a relatively small proportion of consumption. The demand is primarily satisfied by domestic production, even in the main importing areas of the world. Notable exceptions are the Near Eastern countries, which must supplement domestic production with substantial imports, because of a lack of natural forests. Obviously, all major exporters have large indigenous supplies of natural raw materials. There are, however, a few countries in which the forest industry is dependent on significant imports of sawlogs. Japan, South Korea, Singapore and Taiwan are major exporters of wood products that base their industries on imported raw materials. Half of these raw material imports originate in North America and the other half in the ASEAN countries. For example, imports of raw wood account for an estimated 73 per cent of the value of gross output of wood

products in South Korea and in Japan the share is 24 per cent (UNIDO 1983 b).

The balance between production and consumption of forest products significantly varies regionally by sectors. These variations reflect the pattern of the international division of labour in the world forest industry. While the LDCs are net exporters of forest products as a whole, their sectoral trade balance is positive only in production of roundwood and of wood-based panels. Particularly in paper products, all of them are net importers. As far as regions within LDCs are concerned, the Near East is a net import area – and increasingly so – in every sector of the forest industry. The Far East is a major export area in mechanical wood processing, but a net import area in chemical wood processing. In Latin America the forest industry is primarily directed toward home markets, while Africa's role in international trade has been a source of tropical roundwood.

The pattern is the opposite in the developed market economies (DMEs). The higher the value-added content of a sector, the better the representation of that particular sector in the DMEs. Western Europe and Japan are the world's leading importers of roundwood and of sawn wood, while their dependence on imports is distinctly less as far as more processed wood products are concerned. Finland, too, is a net importer of roundwood today, while in other sectors it is a major net exporter, the most rapid expansion taking place in exports of paper products. This global division of labour in the trade of forest products is highlighted in Table 7 and Figure 1.

The forest product export composition varies distinctly by regions. In the DME exports, the mechanical wood industry is represented below and the chemical wood industry above the world average, while in the exports of

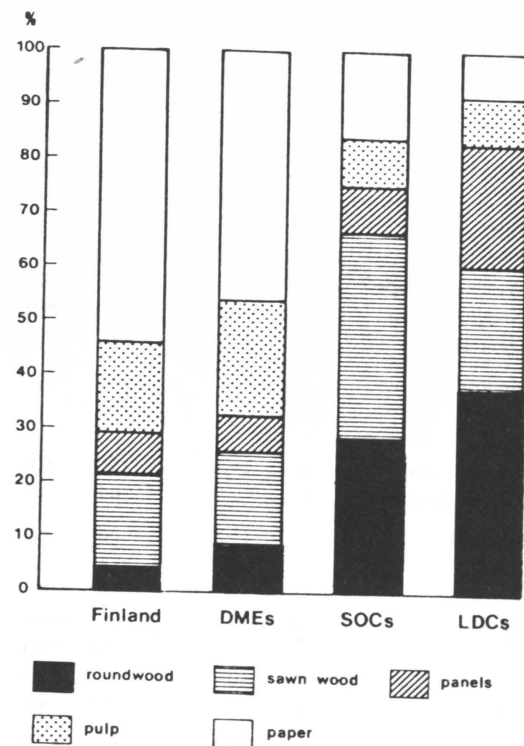


Figure 1. Forest product export composition of Finland and major regions, 1981.

Socialist countries and LDCs these relations are reversed. In fact, around two-thirds of the forest product exports of the latter country groups are comprised of basic raw material: roundwood and sawn wood. The corresponding share in the DME exports is only about 25 per cent. On the other end of the production chain, paper and paper board account for about 46 per cent of DME exports, while only for 8 per cent of LDC exports. The pattern of the international division of labour is thus fairly clear.

Table 7. Composition of forest product exports of Finland and major regions, 1981 (per cent).

	Finland	DMEs	SOCs	LDCs	of which		World total
					Latin America	Far East	
Roundwood	3.6	8.1	28.5	37.6	2.4	46.8	13.5
Sawn wood	18.3	17.7	38.1	22.6	25.9	25.0	19.9
plywood	5.9	3.8	4.5	21.6	8.9	23.3	6.8
particle board	1.0	2.2	1.5	0.4	0.8	0.1	1.8
fibre board	0.6	0.8	2.3	0.9	4.4	0.1	0.9
Wood-based panels	7.5	6.8	8.3	22.9	14.1	23.5	9.5
mechanical pulp	0.1	0.7	—	0.0	0.1	—	0.5
chemical pulp	16.4	20.5	8.9	8.7	35.9	0.0	17.5
Wood pulp	16.5	21.2	8.9	8.7	36.0	0.0	18.0
newsprint	13.8	14.2	3.7	2.4	10.2	0.6	11.7
printing, writing paper	19.2	11.6	2.4	2.0	3.2	1.6	10.3
household, sanitary paper	1.1	0.9	0.6	0.2	0.5	0.1	0.8
wrap., pack. paper, paper board	8.9	12.0	4.7	1.8	1.5	1.4	9.6
special paper	11.0	7.4	4.7	1.7	6.0	0.8	6.7
Paper and paperboard	54.0	46.1	16.1	8.1	21.4	4.5	39.1
Total forest products	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (million \$)	4 987.6	34 927.0	3 807.8	7 603.6	1 525.9	4 404.5	51 326.0

Source: FAO, Yearbook of Forest Products, 1970–81.

7. The pattern of specialisation in LDCs

The LDCs have tended to specialise in a rather narrow range of forest products. A low level of diversification is a typical feature in their production and export pattern. In fact, besides roundwood and sawn wood, only the shares of plywood and, on a smaller scale, of veneer products in LDC exports are above the world average figures. Regionally, the high product concentration of LDC exports is even more pronounced. In the Far East – representing about 58 per cent of the total LDC forest industry exports – some 95 per

cent of exports are composed of either roundwood or sawn wood and plywood. In the other major LDC export area, Latin America, the wood processing is one step more advanced. Roundwood exports have a meagre share, while all grades of wood-based panels – except particle board – and chemical pulp have a share distinctly above the world average. These are also products with rather low value-added content, for which the wood cost is the dominant cost factor.

Altogether, the large discrepancy between

processed wood and unprocessed wood in the LDC exports underlines the argument that there is great potential for expansion in the LDC forest industry. So far, their production and export pattern is predominantly complementary to that of the DMEs – and particularly to that of Finland, whose exports are primarily composed of high-yield products, such as different paper grades. Hence, the new supply of forest products from LDCs does not, in its present composition, threaten to undermine the base of the forest industry structure in Finland or in DMEs as a whole.

As well as a high degree of product concentration, there is also a strong country concentration in LDC forest product exports. In fact, only a handful of countries have been responsible for it. The three leading countries – Malaysia, Indonesia and Brazil – accounted for almost a half and the twelve leading countries for some 87 per cent of the total LDC forest product exports in 1981 (see Table 8). Regionally, the leading exporters are concentrated in four areas: South-East Asian insular, East Asia, West Africa and Latin America. Moreover, there are some other major LDC producers like Mexico, India and China, but their forest industries are predominantly home-market oriented.

Developed countries are, however, the leading forest product exporters in the world. Canada and the United States, with their large resources, have been the world leaders, followed by Sweden, Finland, the Soviet Union and West Germany. The top LDC – namely, Malaysia – does not appear until the seventh position of the world ranking order.

Nevertheless, since LDCs have specialised in exports of basic forest products, their prominence is more accentuated in those sectors. Malaysia is the world's second largest exporter of roundwood, and two other South-East Asian countries, Indonesia and the Philippines, as well as two West African countries, the Ivory Coast and Gabon, are among the twelve leading roundwood exporters. Also, in the exports of sawn wood, three South-East Asian countries and Brazil are among the top twelve exporters of the world (see Table 9).

In the exports of wood-based panels, the position of LDCs has been the most prominent. In particular, the Far Eastern plywood industry, as the most important sub-sector of

Table 8. Twelve leading LDC exporters of forest products, 1981.

	Value (million US \$)	Per cent share
1. Malaysia	1 713.0	22.5
2. Indonesia	1 020.3	13.4
3. Brazil	945.2	12.4
4. South Korea	550.5	7.2
5. Taiwan	502.4	6.6
6. Singapore	441.4	5.8
7. Philippines	421.5	5.5
8. Chile	344.7	4.5
9. Ivory Coast	300.2	3.9
10. Gabon	178.5	2.3
11. Burma	111.0	1.5
12. Cameroon	104.5	1.4
All above	6 676.8	87.2
Total LDCs	7 603.6	100.0

Source: FAO, Yearbook of Forest Products, 1970–1981.

wood-based panels, has represented one of the most expansive sectors within the world forest industry during the past thirty years. First Japan developed a major plywood industry during the 1950's, and soon, in the course of the 1960's, it was followed by South Korea, Taiwan and, a bit later, by Singapore. Today, South Korea and Taiwan are, in fact, the world leaders in the exports of wood-based panels.

Most plywood production in the Far East is, however, based upon logs purchased from the South-East Asian countries. Within the last few years a change has occurred in this division of labour. The roundwood suppliers have moved to restrict the exports of logs and to insist that wood-based panels be manufactured in the country of the log source. Hence, it is possible that in the coming ten years Malaysia, Indonesia and the Philippines may assume the production and export roles filled so far by the Far Eastern countries (UNCTAD 1982, UNIDO 1983 c).

As far as chemical wood processing is concerned, the LDCs have not been able to penetrate into world export markets on a similar scale as they have done in the

Table 9. Twelve leading exporters of forest products by sectors, 1981 (per cent share of world total).

Roundwood	Sawn wood	Wood-based panels	Wood pulp	Paper and paperboard
United States	23.0 Canada	25.0 South Korea	8.2 Canada	34.5 Canada
Malaysia	15.7 Sweden	10.1 Taiwan	8.0 United States	17.9 Finland
Soviet Union	11.9 Soviet Union	9.3 Finland	7.9 Sweden	14.5 Sweden
Indonesia	10.3 United States	9.1 United States	7.2 Finland	8.9 United States
Ivory Coast	3.4 Finland	9.0 West Germany	6.2 Brazil	4.0 West Germany
Australia	2.8 Austria	6.0 Belgium	6.2 Soviet Union	3.4 United Kingdom
France	2.7 Malaysia	4.6 France	5.0 Norway	2.6 Japan
Finland	2.6 Romania	2.3 Singapore	4.4 Portugal	2.2 Netherlands
West Germany	2.5 Brazil	2.1 Soviet Union	4.1 Chile	2.0 France
Canada	2.3 Indonesia	1.9 Canada	4.0 New Zealand	1.5 Austria
Philippines	2.3 Yugoslavia	1.8 Malaysia	3.2 Austria	1.3 Norway
Gabon	2.3 Singapore	1.8 Austria	3.0 South Africa	1.3 Italy
				2.5

Source: Appendix Table 2.

mechanical forest industry. So far, not a single LDC has succeeded in coming up to join the twelve leading exporters of paper and paper board products. By contrast, two Latin American countries – Brazil and Chile – have emerged among the top twelve wood pulp exporters of the world during the 1970's (see Table 9). Their examples may reflect the potential for LDC expansion in the future global trade of the chemical forest industry. This expansion will be primarily based on

fast growing plantation forests. What kind of effect the spreading industrial use of LDC forest resources has had and will have on Finland's role in the world forest product trade is still an open question. (Very few studies have been made about the structural development of the Finnish forest industry in relation to the increasing competitiveness of LDC producers. In this respect see Seppälä etc. 1980, Jaakko Pöyry Consulting 1979, Raumolin 1984, Aaltonen etc. 1983).

8. Finland's global market shares

Finland has for a long time been among the leading countries in the international trade of forest products. In the long run, its global market shares have, however, gradually declined. In particular Finland has lost markets in Western Europe. Primarily North American but also LDC producers are efficiently penetrating into the traditional market area of the Nordic forest industries. At the same time, however, during the last quarter of a century, a substantial change has taken place in the composition of Finnish forest product exports. International specialisation within the Finnish forest industry has shifted it away

from basic products towards end products with a high value-added content.

At the beginning of the 1960's, Finland was the leading roundwood exporter in the world, accounting for 13 per cent of the world total. Furthermore, together with Japan and Sweden it was the leading of wood-based panels at that time. In fact, at the beginning of the fifties, Finland accounted for nearly a half of world plywood exports. Over the course of the following thirty years, though, the situation changed drastically.

In roundwood exports Finland has lost ground, in particular, to the United States

Table 10. Share of Finland and major regions in world exports of forest products by sectors, 1961, 1971 and 1981 (per cent).

	Finland			DMEs			SOCs			LDCs		
	1961	1971	1981	1961	1971	1981	1961	1971	1981	1961	1971	1981
Roundwood	13.0	1.1	2.6	29.3	34.5	40.8	15.4	17.4	15.4	42.3	47.0	41.2
Sawn wood	12.2	8.0	9.0	57.2	60.5	60.4	20.3	19.0	13.9	10.3	12.4	16.7
plywood	13.7	10.5	8.6	63.8	43.7	39.2	8.3	6.0	4.9	14.2	39.8	47.3
particle board	12.0	8.0	5.7	76.4	80.9	85.2	4.9	9.6	6.1	6.8	1.5	3.1
fibre board	14.7	10.3	6.8	82.7	71.8	58.7	1.6	12.1	19.0	1.0	5.8	15.4
Wood-based panels	13.8	10.2	7.9	68.1	51.7	49.7	6.8	7.2	6.5	11.3	30.9	36.0
mechanical pulp	11.0	2.6	2.0	89.0	96.5	97.6	-	-	-	0.0	0.9	0.3
chemical pulp	15.2	10.1	9.1	80.7	83.8	79.9	3.5	3.8	3.7	0.7	2.3	7.3
Wood pulp	14.9	9.8	8.9	81.2	84.2	80.4	3.2	3.7	3.6	0.6	2.3	7.1
newsprint	10.6	10.2	11.5	86.6	86.0	83.1	1.9	3.0	2.3	1.0	0.8	3.1
print., writ.paper	13.2	14.6	18.2	79.7	80.8	77.2	4.5	3.3	1.7	2.7	1.3	2.9
other paper and board	17.6	14.7	11.7	78.2	78.3	79.4	3.0	5.3	5.1	1.2	1.7	3.8
Paper and board	13.7	13.2	13.3	82.4	81.4	79.9	2.6	4.1	3.4	1.3	1.3	3.3
Total forest products	13.4	9.3	9.7	68.2	67.3	68.0	9.3	9.7	7.4	9.1	13.7	14.8

Sources: FAO, Yearbook of Forest Products, 1961-1981.

(due to increased exports of coniferous logs from the US West Coast to the Far East) and to LDCs. The Finnish global share dropped to 2.6 per cent in 1981. Similarly, in the exports of wood-based panels, the Finnish share decreased between 1961 and 1981 from 13.8 per cent to 7.9 per cent, and also in sawn wood from 12.2 per cent to 9.0 per cent of global exports (see Table 10 and Figure 2).

The LDCs have taken over Nordic countries' and Japan's position as the dominant exporters of wood-based panels. In fact, Japan and Sweden are no longer among the twelve leading exporters in the world, and although Finland is still the third, its global market shares have steadily declined in every sub-sector of wood-based panels. At present, South Korea and Taiwan are the leading exporters of plywood - the most established and conventional wood-based panel product - in the world, followed by Finland and Singapore. The present LDC dominance in the plywood exports is accentuated by the fact

that among the eight leading countries six are LDCs (in addition to the above mentioned, this includes Malaysia, the Philippines and Indonesia). Also in the fibre board exports, LDCs have emerged as important market powers, Brazil being the world's leading exporter today. The global market share of LDCs has increased from a mere 1 per cent in 1961 up to 15 per cent in 1981. With regard to wood-based panels, only in the exports of particle board - being of the most recent origin and having appeared in production only within the last thirty years - have the DMEs so far maintained their position as the principal exporters.

Also in the exports of wood pulp Finland's as well as Sweden's global market shares have gradually declined. This is primarily due to increasing integration of pulp and paper manufacturing operations aimed at better wood utilisation and economy-of-scale benefits as well as the upgrading of the end product. North America has overtaken the

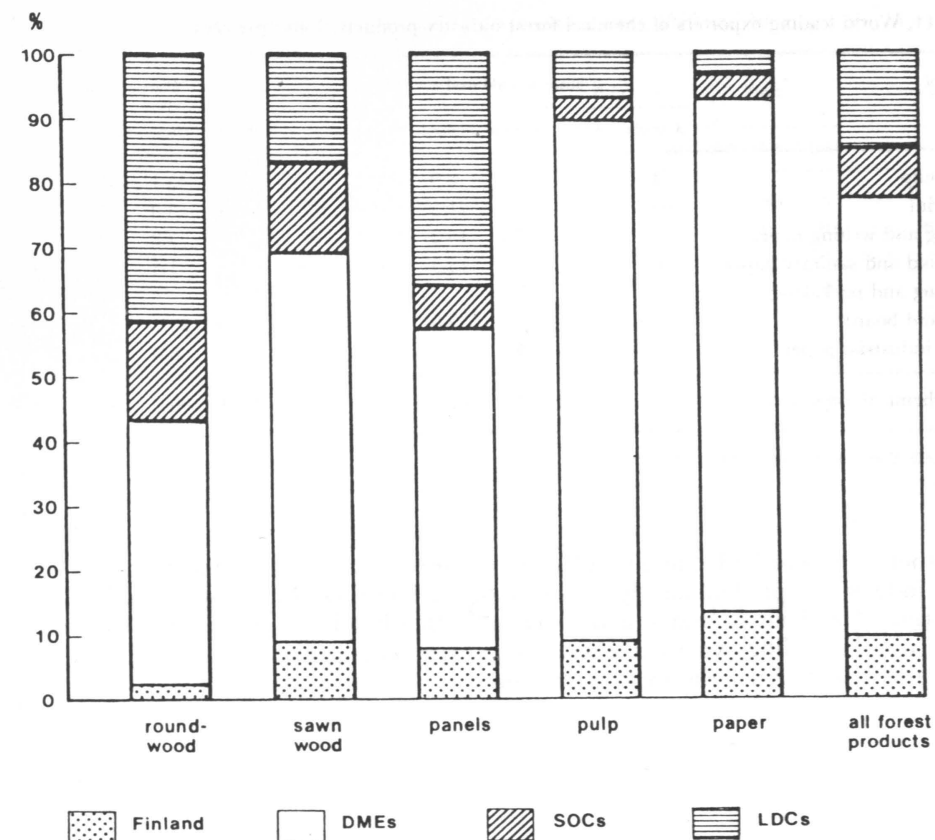


Figure 2. Share of Finland and major regions in world exports of forest products, 1981.

Nordic countries as the leading exporting area. Another expanding source of wood pulp - particularly chemical pulp - has been some of the Latin American countries, namely, Brazil and Chile. Mechanical pulp is produced from coniferous species for special paper grades; hence, in its exports the role of LDCs has been negligible. Altogether, however, the share of LDCs in the total world pulp exports has grown significantly, moving from 0.6 per cent to 7.1 per cent between 1961 and 1981.

In the exports of paper products, LDCs have not so far been able to penetrate into world markets to any considerable extent. Finland, though, has succeeded in maintaining its global market share in this sector, despite the declining shares in every other forest industry sector (Table 10). Already

over two decades, Finland has been the world's second largest paper exporter after Canada. Within specific paper grades the Finnish position is even more prominent. It has been the world's leading exporter of printing and writing papers for quite a time. Moreover, in recent years Finland has overtaken Sweden as the world's principal exporter of household and sanitary papers as well as of special industrial papers (see Table 11). Hence, Finland has quite successfully substituted exports of specialised high-yield paper products for exports of basic wood products.

The Finnish success is even more pronounced when compared with the other leading forest product exporters. More so than Finland, they have concentrated on relatively low-yield, standard products such as pulp and newsprint as well as wrapping and pack-

Table 11. World leading exporters of chemical forest industry products, 1981 (per cent).

Exports of	Share of world total					Share of country total				
	Canada	USA	Sweden	Finland	World	Canada	USA	Sweden	Finland	World
	wood pulp	34.5	17.9	14.5	8.9	100.0	42.7	45.1	33.9	23.4
newsprint	60.3	2.3	10.0	11.5	100.0	48.3	3.8	15.2	19.7	20.4
printing and writing paper	5.8	5.4	7.1	18.2	100.0	4.1	7.8	9.4	27.2	18.0
household and sanitary paper	8.6	12.1	12.7	13.5	100.0	0.5	1.3	1.3	1.5	1.3
wrapping and packaking										
paper and board	5.4	24.6	22.1	9.0	100.0	3.6	33.2	27.7	12.6	16.9
special industrial paper	1.8	9.4	14.4	16.0	100.0	0.8	8.8	12.5	15.6	11.7
Total chemical forest industry	25.4	12.5	13.4	12.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: FAO, Yearbook of Forest Products, 1970-1981.

ing paper and board (Table 11). Canada's paper industry is predominantly producing newsprint. The United States and Sweden are the world's leading exporters of wrapping paper and board. Also, the exports of pulp

are relatively prominent in the exports of each of these three countries. Finland, on the other hand, has specialised relatively more in special paper grades.

9. Finnish exports by destination

The major export markets for the Finnish forest industry have traditionally been in Central Europe, particularly the United Kingdom. As it is Finland's major export industry, the trade network has been well-established and quite steady; hence, drastic shifts in export destinations have been rare and rather anticipated. In the long run, however, a quite substantial change is taking place in the regional structure of Finnish forest product exports. The country composition has gradually widened along with the diversification and upgrading of the export structure. In particular, the dominance of the United Kingdom as the principal market outlet has diminished. In 1960 its share still accounted for 29 per cent of Finnish forest product exports, while in 1981 the share was 19 per cent. The composition of trade with the United Kingdom has changed very sub-

stantially, since the British share in Finnish paper has increased markedly, while in other sectors the decline has been very notable (Table 12). Another major decline is the almost total disappearance of the United States as an export market for Finnish wood manufactures and paper products.

Major increases in the shares of Finnish exports have been recorded by the Soviet Union and the LDCs. The Soviet trade has offered a new market outlet, particularly for the chemical forest industry, while the growth of LDC trade is primarily due to increased exports of the mechanical wood industry to the Near East. The latter growth is partly related to construction projects increasingly carried out by Finnish contractors in Middle Eastern oil-producing countries during the 1970's. At the same time as the Finnish forest industry exports have extended into new

Table 12. Finnish forest product exports by major country destinations, 1960, 1970 and 1981 (per cent of total).

	Total forest products			Sawn wood			Wood manufactures			Pulp			Paper			Furniture		
	1960	1970	1981	1960	1970	1981	1960	1970	1981	1960	1970	1981	1960	1970	1981	1960	1970	1981
	United Kingdom	28.8	25.3	18.8	39.0	34.8	17.9	53.3	44.4	16.0	30.8	25.9	15.8	12.6	18.3	20.5	0.4	3.3
Soviet Union	5.7	7.8	15.6	2.0	0.0	0.1	1.9	1.0	8.3	4.9	6.7	14.2	10.2	12.1	21.0	72.0	25.1	33.7
West Germany	12.5	12.5	12.9	13.4	11.3	11.0	4.5	7.8	14.7	7.4	8.8	19.8	16.6	15.7	11.0	16.5	10.2	11.7
France	5.8	5.8	7.0	6.1	7.5	9.0	0.3	2.2	4.3	9.8	8.9	8.9	4.2	4.5	6.1	1.0	1.2	2.3
Sweden	2.3	3.8	5.5	5.2	3.6	10.0	3.7	12.9	11.8	-	0.1	0.5	0.6	2.9	3.0	1.7	33.8	26.4
Netherlands	7.4	6.6	4.3	10.5	12.3	8.1	5.8	2.3	4.2	7.1	8.3	4.3	4.9	4.5	2.9	1.7	1.2	1.7
Denmark	4.1	4.2	3.3	4.8	6.5	4.7	4.7	2.7	2.5	2.0	1.4	1.2	4.8	4.9	3.5	0.1	4.6	1.6
Italy	2.5	2.9	2.8	1.2	0.4	3.8	0.2	0.3	2.0	5.2	10.7	9.5	2.4	0.8	0.7	0.5	0.3	0.5
Belgium	4.0	2.9	2.1	5.0	5.4	3.9	2.6	0.7	2.3	2.9	3.2	2.5	3.9	2.4	1.3	1.2	0.7	0.5
Australia	1.4	1.3	1.9	0.3	0.2	0.1	1.1	0.5	-	1.7	1.4	0.6	2.4	1.9	3.2	0.0	0.1	0.4
United States	5.6	5.1	1.5	0.0	0.0	-	9.2	11.6	2.3	6.5	2.0	0.8	9.9	7.1	2.1	2.7	8.1	2.2
Subtotal	74.5	73.1	74.2	87.5	82.0	68.6	78.1	74.8	66.1	71.8	75.4	77.3	62.6	68.0	67.7	95.1	80.5	81.4
LDCs	8.6	7.3	14.1	1.7	3.4	19.4	4.3	3.7	20.8	8.3	4.1	7.0	16.7	11.2	13.0	0.2	0.7	5.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total (mil.mk)	2385.8	5453.0	23660.6	841.6	1006.6	4713.6	165.3	518.8	2010.8	542.7	1218.2	3557.9	828.8	2632.2	13218.9	7.4	77.1	699.7

Sources: Official Foreign Trade Statistics, 1960, 1970 and 1981.

markets, its overwhelming dominance in the Finnish trade with the traditional export destinations has gradually decreased.

Nevertheless, excluding trade with the Soviet Union and Sweden, the Finnish export structure is still quite undiversified. As regards the major trade partners, forest products cover some 70 per cent of the Finnish exports to the United Kingdom and France and 55 per cent to West Germany. These shares were, however, considerably higher twenty years ago, as shown in Table 13.

The lack of diversification in the commodity structure of Finnish exports has made the overall economic development in the country vulnerable to changes in the major export markets. The demand for forest products has grown more slowly than the average overall demand, although its growth is expected to be quite persistent over the longer run. Moreover, fluctuations in forest industry exports are usually much larger than variations in world trade in general. There are two reasons for this.

Table 13. Share of forest products in total Finnish exports to major country destinations, 1960, 1970 and 1981 (per cent).

	1960	1970	1981	Forest product exports 1981 (milj. mk)
United Kingdom	91.0	81.7	69.4	4 458.2
Soviet Union	30.4	35.7	24.8	3 693.7
West Germany	81.6	66.9	55.4	3 054.0
France	94.4	86.9	69.5	1 653.8
Sweden	40.0	14.1	16.3	1 311.2
Netherlands	94.0	80.1	49.7	1 019.8
Denmark	89.9	58.2	39.6	791.2
Italy	87.5	65.2	56.4	659.7
Belgium	80.9	87.7	54.7	498.2
United States	84.9	61.0	16.3	363.2
Australia	98.2	87.6	82.3	459.4
World total	75.4	56.3	39.2	17 599.0

Sources: Official Foreign Trade Statistics, 1960, 1970 and 1981.

First, the mechanical wood industry, in particular, is very sensitive to general economic trends and especially to the level of construction activities. It is estimated that construction – which is usually most strongly affected by cyclical variations – accounted for about 60 per cent of all sawn wood and for 50 per cent of all wood-based panels used in developed countries during the 1970's (UNIDO 1983 c).

Secondly, since the world forest industry is predominantly homemarket oriented and imports are conventionally a supplement to domestic production, shifts in demand are first and foremost met through import reductions.

10. Factors of competitiveness in forest industry

The forest industry is characterised by slow technical development. Although considerable evolution has occurred in sizes of production units and their technical details, there have been very few revolutionary changes in technology. The manufacturing technology is based on well-known principles and universally readily available machinery. Most products are bulk or semi-bulk types of standardised commodities. Products from different sources are typically interchangeable, hence, the main means of competition is price. Particularly in the competitiveness of capital-intensive chemical wood processing, differences in raw material costs are paramount. Also in the mechanical forest industry, wood cost is typically the dominant cost factor. Hence, the global structure of the forest industry tends to be determined by the availability of suitable raw material.

The Nordic countries, the traditional external suppliers of forest products in the Western European markets, have two main advantages: their wood resources are of good quality, and they are nearer to the main market than their overseas competitors. However, their wood resources are now fully utilised; hence, the wood cost is high. During the last two decades the Nordic countries have gradually lost their price leadership in the European market to overseas suppliers. Especially

As a result, for example, in Finland, the annual fluctuations in the export volume of sawn wood were as high as 40 per cent during the most unstable years of the 1970's. Moreover, since instability is caused by shifts in demand and, subsequently, export prices, and since volumes move in the same direction, export income fluctuations are even further aggravated. (Kunnas 1981, Torvi 1980, UNCTAD 1978) Hence, in Finland international cyclical variations normally reach the economy after a time-lag, but their effects tend to be more pronounced than usually in DMEs (Bingham 1976).

North American but also some LDC producers have increased their market shares in Western Europe. They can benefit from cheap wood raw material, particularly by utilising fast-growing plantations.

The high wood cost is especially disadvantageous in low-yield standard products such as sawn wood, wood-based panels, pulp and linerboard. In particular, pulp and different panel products can also use a wide range of wood raw materials; hence, it is, for example, possible to utilise more effectively the diversity of material available from mixed tropical forests. To stay competitive, the Finnish forest industry has to concentrate more and more on end products which do not have a cost structure dominated by wood cost. This would imply a trend away from primary wood products into secondary wood manufactures, such as pre-fabricated houses, furniture and joinery, and from pulp into paper making and further into converted paper products. These products are competing primarily in terms on their high quality or specific design.

Furthermore, wood has the potential to become an increasingly important raw material for the chemical industry. Chemical feedstock derived from wood as by-products of pulp making are used in the production of turpentine, alcohol, adhesives and coatings as

Table 14. Total research and development expenditure and R & D expenditure of paper industry in some DMEs, 1979 (per cent).

	Total R & D share of GNP	Paper industry R & D share of gross value
United States	2.4	0.8
West Germany	2.3	0.5
Sweden	1.9	0.9
France	1.8	1.0
Finland	1.1	0.6
Canada	0.9	0.4

Sources: Official Statistics of Finland, Research Activity 1981 and Marja Korpivaara.

(Kemiallisen metsäteollisuuden tutkimuspanokset vuoteen 2000 (Research input of chemical forest industry until 2000). The Finnish Pulp and Paper Research Institute, Espoo 1983.)

well as of viscose rayon and other synthetic fibres processed conventionally by the petrochemical industry. It is also technically possible to produce food for livestock as well as producer gas and even oil out of wood. As energy prices are increasing, the production of fuels, such as alcohol and producer gas, could become a more widespread use of the forest biomass. These opportunities have, however, been beyond the scope of the conventional forest industry to date.

In order to upgrade the industrial structure as well as to innovate new products or processes, substantial research and development efforts are demanded. Typically, the forest industry has been a non-science-based, already standardised, low-technology field compared with most other industries. Therefore, the relative research input has remained quite low, as highlighted in Table 14.

Altogether, Finland has devoted relatively modest resources to research and development. Total R & D expenditures in recent years have amounted to only slightly more than one per cent of the GNP, placing Finland on the same level as the other semi-peripheral economies of Europe. As a result, Finnish industrial development has been dependent on the importation of technology. Foreign technology inputs have mainly originated from West Germany, Sweden and the United States.

Nevertheless, in some specific fields, particularly in the wood processing industry, Finland has been able to reach notable technological self-sufficiency. Based on foreign basic technology adaptations, Finnish industry is today capable of producing its own machinery and equipment and of developing automated systems of production for wood processing sectors. In 1981 some 92 per cent of the domestic demand for pulp and paper making machinery was domestically satisfied, and some 24 per cent of the production of these machines was exported. A corresponding degree of self-sufficiency does not exist in any other sector of capital goods production except ship-building and on a minor scale lifting, construction and mining machinery. Finland has thus been able to become an important producer of paper machinery, challenging the domination of the traditional core producers. It is, in fact, estimated that over the past two decades a quarter of the world's total forest machinery deliveries have come from Finland (Raumolin 1984).

The Finnish forest industry and the forest equipment suppliers are closely integrated, not only by mutual commercial transactions, but also by ownership structure. Dominant wood-processing companies have extended their involvement into metal, electro-technical and also chemical industries and have thus become large multi-sectoral conglomerates. Some examples are Rauma-Repola, Ahlström, Kymmene-Strömberg, Nokia and Tampella. This successful diversification from traditional wood processing towards forest machinery production and other industrial spill-over effects have been facilitated by the system of national control which has reserved industrial development in the forest sector for domestic enterprises. In contrast, for instance in Canada, where control over forest industry is to a marked extent in foreign (mainly US) hands, the industry has not been able to create backward and forward linkages with the domestic economy on a similar scale to that in Finland. Canadian forest industry is heavily dependent on importation as far as capital goods and R & D inputs are concerned (Hayter 1984).

Furthermore, during the last two decades, big specialised forest sector consulting companies have also emerged in Finland, and they have rapidly internationalised their ac-

tivities. Jaakko Pöyry and Ekono are the biggest Finnish consulting companies in the forest sector. The Jaakko Pöyry Group, for example, has expanded rapidly and has today eleven subsidiary companies abroad, of which three are in the Third World.

During the last decade, heavy investments have been made in the Finnish forest industry in order to modernise the production capacity and to expand plant size and, hence, to strengthen the international competitiveness of the industry. At present, with its processing technology, machinery and production direction systems, the Finnish forest industry is very advanced in international comparisons. Similarly, the product coverage of the sector has widened and the value-added content increased. The semi-peripheral economy has quite successfully focused its industrialisation efforts as well as export expansion on this resource-based sector. (See more general presentation Kiljunen 1985.)

In the long run, however, there are two

11. Adjustment constraints due to LDC competition

The worldwide potential competitiveness of the new, low-cost raw material sources of LDCs has gradually started to reshape the global structure of the forest industry. During the last two decades, LDCs have been able to increase their global market shares in every forest industry sector. Particularly striking has been the expansion in the exports of wood-based panels. Also in sawn wood and pulp production LDCs have shown strong potential. This development is obviously creating notable adjustment constraints on the dominant export sector of Finland. In the short run, however, the competitive threat of the LDC forest industry is rather limited in the traditional export markets of Finland. First, the new LDC wood processing industry is primarily directed toward home markets rather than exports. Secondly, Finland enjoys freer access to European markets than LDCs due to its preferential trade agreements with EFTA and the EEC countries. The international trade in wood and wood products is

major factors which are restricting the growth potentiality of the Finnish forest industry: first, tightened resource constraints and, second, competitive shifts in external markets due to new sources of production. Finland has already reached its wood producing limit on a sustained yield basis, and as wood has become a scarce resource, its price has tended to rise. Forest industry products compete primarily by price; hence, low-cost wood sources have gradually become more and more competitive. Technological advances in the use of short-fibre raw materials for pulp and paper making and programmes of establishing fast-growing plantations have opened up new vistas, particularly for the utilisation of tropical forest areas. At present, there is a great imbalance with regard to the distribution of forest resources and the processing of these resources between developed and developing countries. The vast potential of the tropical forests is practically unutilised.*

regulated by means of not only tariffs but also various nontariff measures. Trade barriers particularly discriminate against processed products. While logs, sawn wood and pulp are admitted free of duty in DMEs, wood manufactures and paper products face high tariff rates, which in some cases are nearly prohibitive (UNCTAD 1982). These trade restrictions offer a distinct advantage to Finland as opposed to its LDC competitors.

Third, at the initial stage, the LDC forest industry production and export pattern is predominantly complementary to that of Finland. LDC exporters are concentrated mainly in low-yield standard products such as sawn wood, wood-based panels and, on a limited scale, pulp, while Finnish competitiveness is based more on high-yield paper products, for which the wood cost is not the dominant cost factor.

Although the new supply of forest products from LDCs does not threaten to undermine the base of the Finnish forest industry struc-

ture in the near future, in the longer run, however, it has the potential to reshape the global structure of the wood-processing industry. The way for the Finnish forest industry to adjust – both in mechanical and chemical wood processing – is to further upgrade its industrial structure in favour of end products with higher value-added and special qualities. More R & D inputs are needed, particularly for advancing chemical processes in the

forest industry and thus for widening the use of the forest biomass. There are some possibilities of increasing the domestic raw material supply by utilising trees more fully to reduce forest residues as well as by recycling waste paper more efficiently. The only other alternative in efforts to solve resource constraints is to rely on external raw material supplies either by increasing imports or by internationalising manufacturing operations.

12. Summary

In the forest industry Finland has for a long time been among the world's leading exporters. In the long run its global market shares have, however, gradually declined, particularly in Western Europe, due primarily to North American but also to LDC producers. At the same time, during the last quarter of a century, the composition of Finnish forest product exports has been substantially upgraded.

In the long run there are two major factors which are restricting the growth potentiality of the Finnish forest industry: first, tightened resource constraints and second, competitive shifts in external markets due to new sources of production. Finland has already reached its wood-producing limit on a sustained yield basis, and as wood has become a scarce resource, its price has tended to rise. Forest industry products compete primarily by price, and hence low-cost wood sources have gradually become more and more competitive. Technological advances in the use of short-fibre raw materials for pulp and paper making, as well as in making programmes for establishing fast-growing plantations, have

facilitated the utilisation of tropical forest areas.

In the short term, however, the competitive threat from LDC wood-processing industry is primarily directed to home markets rather than to exports. Secondly, Finland enjoys freer access to European markets than LDC due to its preferential trade agreements with EFTA and EEC countries. Third, at the initial stage, the LDC forest industry production and export pattern is predominantly complementary to that of Finland. LDC exporters are concentrating mainly on low-yield standard products such as sawn wood, wood-based panels and, on a limited scale, pulp, while Finnish competitiveness is based more on high-yield paper products, for which the wood cost is a relatively less important cost factor. Although the new supply of forest products from LDC does not threaten to undermine the basis of the Finnish forest industry structure in the near future, in the long run it has the potential of reshaping the global structure of the wood-processing industry.

References

- Aaltonen, K., Heikkilä, I. & Ketolainen, A. 1983. Suomen metsä- ja puutalouden teknologian viesti kehitysmaihin 1970-luvulla. (Technology transfers from Finnish forestry sector to developing countries during the 1970's). Institute of Development Studies, University of Helsinki.
- Bingham, T. R. G. 1976. Structural Change in the Post-War Finnish Economy. A thesis for the D.Phil. degree, University of Oxford.
- Eklund, R. 1974. The Role of Scandinavia in the World Forest Economy: Gradual Decline or New Prospect? JP-Publication 36. Helsinki.
- FAO 1982. World Forest Products-Demands and Supply 1990 and 2000. FAO Forestry Paper 29. Rome.
- Hayter, R. 1984. The Evolution and Structure of the Canadian Forest Product Sector: An Assessment of the Role of Foreign Ownership and Control. Paper presented at a symposium of "Natural Resources Economic Development and Political Regulation in Finland and Canada". Helsinki.
- Jaakko Pöyry Consulting. 1979. Suomen metsäteollisuuden kansainvälisen kilpailukykyyn kehittäminen. (Promotion of international competitiveness of Finnish forest industry). Helsinki.
- Kiljunen, K. 1985. Industrialisation in Developing Countries and Consequent Trade-Related Restructuring Constraints in Finland. Labour Institute for Economic Research. Research Report 11. Helsinki.
- Kunnas, H. 1981. Suomen sahateollisuus kehitysvuosina 1965-1981 sekä kehitysnäkymiä 1980-luvulle. (Finnish saw mill industry development during 1965-81 and prospects during the 1980's). Industrialisation Fund of Finland, A:12. Helsinki.
- Pöyry, J. 1977. The Changing World Forest Industry Environment. JP-Publication 50. Helsinki.
- 1982. Export Prospects for the Brazilian Forest Industries. Paper presented at Brazil seminar. Helsinki.
- Raumolin, J. 1982. The relationship of forest sector to rural development, some reflections on the theory and practice of forest-based development. The Research Institute of Northern Finland, University of Oulu, Research Report 24.
- 1983. The formation of the sustained yield forestry system in Finland. In: Steen, H. K. (ed.) History of Sustained Yield Forestry. Western Forestry Center, Portland, Oregon.
- 1984. The world economy of forest products and the comparative study of the development impact of the forest sector. Yearbook of the Finnish Society for Economic Research 1983/84.
- Ryti, N. 1981. Trends and Likely Structural Changes in the Forest Industry World Wide. JP-Publication 80. Helsinki.
- Seppälä, H., Kuuluvainen, J. & Seppälä, R. 1980. Suomen metsäsektori tienhaarassa. (Finnish forest sector at a crossroads). Finnish Forest Research Institute, Folia Forestalia 434. Helsinki.
- Torvi, K. 1980. Metsäteollisuustuotteiden hintaproblematiikka Suomen ulkomaankaupassa. (Prices of forest products in Finnish foreign trade). Economic Planning Centre, Special Report 1. Helsinki.
- UNCTAD1978. Instability in Tropical Timber Markets. TD/B/IPC/TIMBER/21. Geneva.
- 1980. The Present Status of Tropical Forest Resources. TD/B/IPC/TIMBER/28. Geneva.
- 1982. Prospects for the Expansion of Timber Processing Activities in Developing Countries. TD/B/IPC/TIMBER/37. Geneva.
- UNIDO 1983 a. First Worldwide Study of the Wood and Wood Processing Industries. IS. 398.
- 1983 b. Industry in a Changing World, Special Issue of the Industrial Development Survey for the Fourth General Conference of UNIDO. ID/304. New York.
- 1983 c. Wood Resources and Their Use as Raw Material. IS. 399.
- UNITAR 1974. The Transfer of Technology to Developing Countries. The Pulp and Paper Industry, Research Report 19. New York.

Total of 23 references

Seloste

KEHITYSMAIDEN METSÄTEOLLISUUDEN KASVU JA SEN AIHEUTTAMAT SOPEUTUMISPAINEEET SUOMESSA

Suomi on yksi maailman johtavimmista puunjalostusteollisuuden tuotteiden viejistä. Pitkällä jänneväälillä Suomi on kuitenkin menettänyt kansainvälisiä markkinaosuuksiaan erityisesti päämarkkina-alueillaan Länsi-Euroopassa. Syynä on ollut kasvava kilpailu ennen kaikkea Pohjois-Amerikasta, mutta myös kehitysmaista. Samanaikaisesti viimeisen neljännesvuosisadan kuluessa Suomen puunjalostusteollisuustuotteiden jalostusaste on voimakkaasti kohonnut.

Pitkällä aikavälillä Suomen metsäteollisuuden kasvua rajoittaa kaksi perustekijää: a) raaka-ainepula ja b) kasvava kilpailu perinteisillä vientimarkkinoilla. Suomen metsien teollinen hyötykäyttö on lähes optimisissaan, jolloin puuraaka-aineen saatavuus rajoittaa perustuotannon kasvua ja on kohottanut kantohintoja. Metsäteollisuustuotteet kilpailevat ensi sijassa hinnalla ja siten alhaisen puuraaka-ainehinnan omaavilla mailla on selvä kilpailuetu. Teknologinen kehitys on mahdollistanut lyhytkuituisen puuraaka-aineen käytön sellun- ja paperinvalmistuksessa ja toisaalta istutusmetsäohjelmat trooppi-

silla alueilla ovat mahdollistaneet kehitysmaiden metsäpotentiaalin kasvavan teollisen käytön.

Lyhyellä aikavälillä kehitysmaiden muodostama kilpailu-uhka Suomen metsäteollisuudelle on kuitenkin vähäinen. Ensinnäkin kehitysmaiden tuotanto tulee valtaosaltaan tyydyttämään kasvavaa paikallista kysyntää. Toiseksi Suomen teollisuuden nauttima preferenssikohtelu Euroopan markkinoilla vapaakauppasopimusten muodossa tarjoaa kilpailuedun kehitysmaihin nähden. Kolmanneksi kehitysmaiden puunjalostusteollisuus on rakenteeltaan pikemminkin täydentävää kuin kilpailevaa Suomeen verrattuna. Kehitysmaissa tuotanto on keskitynyt alhaisen jalostusasteen tuotteisiin, kun taas Suomessa kilpailukyky perustuu yhä suuremmissa määrin korkean jalostusasteen omaaviin erikoistuotteisiin, jolloin raaka-aineen hinnan merkitys on suhteessa vähäisempi. Aikaa myöten on kuitenkin odotettavissa, että kehitysmaiden merkitys kansainvälisessä kilpailussa tulee asteittain kasvamaan.