TECHNICAL SERIES

36

LEVELING THE PLAYING FIELD

Options for boosting the competitiveness of tropical hardwoods against substitute products

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ITTO

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

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OPTIONS FOR BOOSTING THE COMPETITIVENESS OF TROPICAL HARDWOODS AGAINST SUBSTITUTE PRODUCTS

ITTO TECHNICAL SERIES #36

INTERNATIONAL TROPICAL TIMBER ORGANIZATION

Leveling the playing field

Options for boosting the competitiveness of tropical hardwoods against substitute products

ITTO Technical Series No 36

by Rupert Oliver and Ben Donkor

The International Tropical Timber Organization (ITTO) is an intergovernmental organization promoting the conservation and sustainable management, use and trade of tropical forest resources. Its 60 members represent about 80% of the world's tropical forests and 90% of the global tropical timber trade. ITTO develops internationally agreed policy documents to promote sustainable forest management and forest conservation and assists tropical member countries to adapt such policies to local circumstances and to implement them in the field through projects. In addition, ITTO collects, analyzes and disseminates data on the production and trade of tropical timber and funds projects and other actions aimed at developing industries at both community and industrial scales. All projects are funded by voluntary contributions, mostly from consumer member countries. Since it became operational in 1987, ITTO has funded close to 1000 projects, pre-projects and activities valued at nearly US$350 million. The major donors are the governments of Japan, Switzerland and the United States.

Front cover photos:
Left: Natural tropical forest in Peru.
Photo: H. Castro/CI

Right: Douglas fir forest in Washington, USA.
Photo: A. Sarre/ITTO

Back cover photo:
Mahogany sawnwood at port in Peru.
Photo: J. Blaser

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FOREWORD

International tropical timber markets are continually undergoing dynamic structural changes which threaten the competitive position of tropical timber products compared with other wood and non-wood products. Changes in factors such as price, product availability, technology, shipping and freight costs, manufacturing costs and consumer taste have been impacting on the relative competitiveness of tropical wood products. Substitution of tropical sawnwood in decking applications, for example, has occurred from both new wood-based products and plastics, and traditional tropical plywood has lost market share to more cost competitive "combi" plywood and softwood plywood. Market perceptions of the environmental credentials of tropical wood products and emerging public and private timber procurement policies also represent a major challenge for tropical timber exporters, impacting on their competitiveness in some markets.

ITTO has long recognised that tropical producer members need to regularly assess the competitive position of their products in export markets because this intelligence is vital to maintaining the production and trade of sustainably managed tropical timber products. In 2001, ITTO commissioned a report entitled "*The competitiveness of tropical timber and timber products vis-à-vis timber and non-timber substitutes"* which evaluated the competitive position of tropical timber products in selected exporting and importing countries. Recognizing that market conditions have changed considerably in the intervening period and that the sector was being threatened by a wide and increasing range of innovative alternative products, ITTO commissioned an updated evaluation of the competitive position of tropical wood products vis-à-vis other products (wood and non-wood) in selected markets. That analysis, which was presented to the International Tropical Timber Council in 2009, forms the basis of this report.

The current study has combined an analysis of global trends impacting on the relative competitiveness of tropical wood products with more detailed analysis of several major tropical wood supply chains drawing on a combination of primary and secondary sources. A major aim of the study was to provide much of the information necessary for tropical wood producers to build more effective market development strategies. The study suggests that there are opportunities for the tropical timber sector to build on the considerable technical, aesthetic and environmental strengths of tropical hardwoods to enhance access to high-value markets. It concludes with a series of recommendations for ITTO, ITTO member governments, and for the tropical wood industry. An important recommendation encourages ITTO to facilitate efforts at the international level to bring together producer country governments, large corporations dealing in tropical wood products and trade associations to develop an industry-wide generic marketing campaign for tropical wood products. Producer member countries should also take heed of the recommendation to governments to undertake more detailed reviews of the global positioning and competitiveness of their national tropical wood products industries with a view to developing realistic long-term market development strategies.

I commend this excellent and informative study to anyone with an interest in the tropical timber sector.

Emmanuel Ze Meka
Executive Director
International Tropical Timber Organization (ITTO)
Yokohama, October, 2010

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ACRONYMS

AHEC	American Hardwood Export Council
AIMEX	Para State Timber Exporters Association
ANSI	American National Standards Institute
ASEAN	Association of South East Asian Nations
ATIBT	Association Technique Internationale des Bois Tropicaux
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
CARB	California Air Resources Board
CASBEE	Japan's Comprehensive Assessment System for Building Environmental Efficiency
CCA	copper chromium arsenic
CE	Conformité Européene
CEI-Bois	European Confederation of Woodworking Industries
CIF	cost, insurance, freight
CIFOR	Center for International Forestry Research
CIRAD	Center for International Research into Agriculture and Development
COMIFAC	Central African Forestry Commission
CPL	continuous pressure laminate
CSR	corporate social responsibility
DBI	Doing Business in 2009 Index (as per World Bank)
DGNB	German Sustainable Building Certification
DIY	do-it-yourself
EAA	European Aluminium Association
EC	European Commission
EN	European Norm
EU	European Union
EWP	engineered wood product
FAO	Food and Agriculture Organization of the United Nations
FCBA	Wood Research Institute of France (l'Institut Technologique Forêt Cellulose Bois-construction Ameublement)
FEP	European Parquet Industry Federation
FII	Forest Industries Intelligence Limited
FLEG	forest law enforcement and governance
FLEGT	Forest Law Enforcement, Governance and Trade
FOB	free on board
FSC	Forest Stewardship Council
GBI	green building initiative
GCI	Global Competitiveness Index (World Economic Forum)
GDP	gross domestic product
GSP	Generalized System of Preferences
HPC	high-performance coating
HPL	high-pressure laminate
HPVA	Hardwood Plywood and Veneer Association (United States)
HQE	Haute Qualité Environnementale (High Quality Environmental standard)
IFRG	International Furniture Research Group
ISO	International Organization for Standardization
ITTO	International Tropical Timber Organization
IWPA	International Wood Products Association
JAS	Japan Standards Association
JFSQ	Joint Forest Sector Questionnaire
JFWIA	Japan Federation of Wood Industry Associations
K	Kelvin
LCA	life cycle assessment
LDC	less-developed country
LEED	Leadership in Environmental Design
LSCI	Liner Shipping Connectivity Index
LVL	laminated veneered lumber
MDC	more-developed country
MDF	medium-density fiberboard
MEFI	Maritime Economics Freight Index
MTCS	Malaysian Timber Certification System
NGO	non-governmental organization
OSB	oriented strand board
OSL	oriented strand lumber
PEFC	Programme for the Endorsement of Forest Certification
POP	persistent organic pollutant
PSL	parallel strand lumber
REDD	reduced emissions from deforestation and forest degradation
SFM	sustainable forest management
SME	small or medium-sized enterprise
SWOT	strengths, weaknesses, opportunities, threats
TFM	thermally fused melamine
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
uPVC	unplasticized poly-vinyl chloride
US$	United States dollar(s)
VOC	volatile organic compound
VPA	voluntary partnership agreement
WEF	World Economic Forum
WPC	wood–plastics composite

EXECUTIVE SUMMARY

This study evaluates the competitive position of tropical hardwood sawlogs, veneer logs, sawnwood, panels and their value-added derivatives vis-à-vis other products (wood and non-wood) in selected markets. It also considers substitution trends in selected market sectors that are affecting the consumption of tropical hardwood products. The study, which draws on a combination of primary and secondary sources, combines an analysis of global trends affecting the relative competitiveness of tropical hardwood products with a more detailed analysis of several major tropical wood supply chains.

The study builds on and broadens a previous ITTO study on competitiveness undertaken in 2001. This earlier study indicated that many tropical-wood-producing companies are not well informed about why consumers choose to use or avoid their products. It also suggested that many importing and distributing companies in major wood-consuming regions have little interest in promoting the many strengths of tropical hardwoods to their customers. Ultimately it is up to wood-product suppliers in tropical countries, with the support of their national governments, to develop the marketing strategies and innovative new products required to ensure continued growth in market demand for sustainably produced tropical hardwood products.

A major aim of this study is to provide much of the information necessary for tropical hardwood producers to build more effective market development strategies. It concludes with a series of recommendations for ITTO, ITTO member governments, and the tropical wood industry.

Tropical forests in the context of global forest resources

An analysis of global forest resource data suggests that, in general, both the availability and quality of large-diameter tropical hardwood logs of primary wood species are declining and that this trend is set to continue. In contrast, the forest resources of the temperate zones are generally either stable or increasing. The forests of the temperate zone also offer higher levels of productivity per unit area and are attracting more investment to increase productivity and for the establishment of plantations. Overall this implies a continuing loss of competitiveness for tropical hardwoods compared to wood products produced in temperate forests.

In 2005 there were 1.63 billion hectares of tropical forests, which was 42% of all forests globally. World forest area declined by 7.3 million hectares between 2000 and 2005: a loss of 9 million hectares in tropical regions was partly offset by an increase of 1.7 million hectares in temperate and boreal forest regions. Of the estimated global growing stock of 433 billion m^3 in 2005, 182 billion m^3 (42%) were in the tropics and 251 billion m^3 (58%) were in temperate regions.

Natural tropical forests have certain natural advantages when it comes to the production of high-quality wood – straight tall boles, fewer natural defects and large diameters. As a result, tropical hardwoods from natural forests generally support higher processing yields per tree.

On the other hand, tropical forests tend to produce significantly lower volumes of saleable wood per hectare per year compared to temperate forests. The volume of wood produced sustainably in a tropical forest is generally extremely low, often as little as 1.5 m^3 per hectare per year. This compares to typical yields in semi-natural temperate hardwood forests of 4.75 m^3 per hectare per year for oak and 7 m^3 per hectare per year for beech, and even higher yields for softwood and plantation forests. In addition to the low overall yield of natural tropical forests, there is also a gap between the species that natural tropical forests are capable of producing in commercial volumes and the market demand for particular wood types.

Relatively low yields of saleable wood are matched by low projections of financial yield from the sustainable management of natural tropical forests for wood production. This provides a serious disincentive for investment in tropical forests managed for wood production and a strong incentive for their conversion to other, more profitable land uses.

There is huge variation in the situation across tropical regions. Some countries, notably Brazil and those in the Congo Basin, still have large areas of relatively undisturbed forest. Wood extraction

in these areas remains heavily constrained by limited infrastructure and the sheer distance from populated areas. In many parts of the tropics, however, forests are threatened by population pressure, illegal logging, over-harvesting, and conversion to alternative land uses, notably commercial cash crops.

ITTO's *Status of Tropical Forest Management 2005* estimated that the area of sustainably managed natural production forest in ITTO producer countries in 2005 was 25.2 million hectares, which was around 7% of the total natural production forest area. This was a notable increase compared to a previous ITTO survey conducted in 1988. Nevertheless, a significant proportion of tropical wood continued to derive from forests that were harvested unsustainably.

Based on their studies of global forest resources and of regional forest sector outlook, a 2009 report by the Food and Agriculture Organization of the United Nations (FAO) concluded that efforts to improve forestry practices and reverse the decline in tropical forest resources were constrained in many regions by an unfavorable investment climate; severe institutional, financial and technical difficulties; and illegal activities and corruption. In most areas, forests are harvested selectively, but little attention is paid to post-harvest silviculture, while unregulated harvesting is leading to further degradation.

In general, domestic and regional consumption of wood products in tropical regions is expected to increase, driven by strong population growth and rising per-capita consumption. New demand is also being generated in emerging markets. In China, a massive wood supply–demand gap is forecast, particularly for decorative hardwoods from large-diameter logs.

Plantations

Due to their high yield, plantations make a disproportionately large contribution to global wood fiber supply. While plantations accounted for only about 5% of global forest cover in 2000 they provided an estimated 35% of global roundwood production. Plantations typically yield 20–30 m^3 per hectare per year, although some species (notably *Eucalyptus* spp.) can yield much more than that.

Some tropical countries have ambitious programs to expand their plantation estates. The high yields and (therefore) relatively rapid economic returns of plantations suggest that plantations have the potential to offset declining wood supplies from natural tropical forests. However, the wood supplied by plantations is not directly comparable to that supplied by natural forests. The further development of plantations in tropical regions requires, therefore, a significant reorientation of national wood industries to enable the harvesting and processing of larger volumes of small-dimension and low-density material.

An analysis of current trends indicates that tropical regions have fallen well behind other regions in plantation development. Only 15.6 million hectares (14%) of the world's plantations are in countries fully located in the tropics, the vast majority of which is in Southeast Asia. During the 1990s, most new plantations were established in temperate regions. Since 2000 the vast majority of new plantations have been established in China.

Share of tropical wood in global wood production and trade

Overall, there has been a decline in the share of tropical logs in global sawlog and veneer log supply from around 16% in 1992 to 12% in 2007. During this period the volume of sawn lumber produced annually in tropical countries generally declined, from around 55 million m^3 to 40 million m^3, while plywood and veneer production in tropical countries remained broadly flat, at around 16 million m^3 and 3 million m^3, respectively. The contribution of tropical countries to the global production of these commodities has become relatively less significant. While, in 1992, tropical countries accounted for 45%, 32% and 13% of world production of veneer, plywood and sawnwood, respectively, by 2007 these proportions had fallen to 30%, 21% and 9%, respectively.

This fall in the share of tropical countries in global plywood and veneer production is due largely to the rapid emergence of China as a large producer of these commodities. From the early 1990s to 2007, China's share of global plywood production increased from 6% to 42%, while its share of global veneer production increased from 1% to 27%, despite a significant decrease in China's domestic sawlog and veneer log production from a peak of

38 million m^3 in 1998 to 33 million m^3 in 2007. The log-supply gap was plugged entirely by rising levels of imports.

The fact that China is so reliant on imported products, together with the comparatively small domestic markets in tropical countries, explains why tropical hardwoods continue to make up a large proportion of internationally traded primary and secondary wood products. Despite a fall in recent years, tropical hardwoods still contributed 38% of total plywood volume exported by all ITTO members in 2008. Between 2004 and 2008 the share (by volume) of tropical hardwoods in international trade increased from 12% to 14% for sawnwood and from 30% to 39% for veneer, while the share of tropical logs remained stable at around 23%.

Certification

The certification of tropical forests continues to lag well behind that of temperate forests. More than 50% of the European forest area and nearly 40% of the North American forest area are certified, but only a tiny proportion of forests in Latin America, Africa and Asia is certified. Over 97% of the world's production of industrial roundwood certified by the Forest Stewardship Council (FSC) or the Programme for the Endorsement of Forest Certification (PEFC) is estimated to derive from forests in North America and Europe.

Certification challenges are not unique to the tropical forest sector. Due mainly to fragmented forest ownership, only a relatively small proportion of temperate hardwood forest is certified. However, the negative environmental image attached to tropical hardwoods means that a lack of certification is a more significant competitive weakness for them than it is for temperate hardwoods. It is also a missed opportunity, since consumer survey evidence suggests that certification can successfully overcome barriers to the market acceptance of tropical wood. There also tends to be greater willingness to pay premiums for high-quality and specialist assortments of certified tropical hardwood than there is for commodity softwoods and composite panels.

Tropical hardwood applications

Prices for hardwood logs are significantly higher – in most cases several orders of magnitude higher – than those for softwood logs. While in some cases this may be compensated by the higher yields that can be achieved from high-quality hardwood logs, the higher prices suggest that, in general, the marketing of hardwoods should aim for higher-value niche markets than softwoods. Seeking to compete in large-volume, low-value commodity markets – where softwoods dominate – is unlikely to be a sustainable long-term strategy.

To a significant extent, applications for individual tropical hardwood species are dependent on their combination of natural durability, density and aesthetics. Based on this combination of factors, tropical hardwoods may be very broadly divided into three (not necessarily mutually exclusive) groups: high-density woods used mainly in construction (e.g. keruing, greenheart, ekki and iroko); low-to-medium-density utility woods used mainly for external joinery, shop fitting, and mid-priced furniture (e.g. *Shorea* spp., limba, niangon and rubberwood); and decorative woods used for quality furniture, interior joinery and flooring (e.g. teak, *Khaya* spp., *Dalbergia* spp., *Aningeria* spp., makore, sapele, walnut, iroko, utile, merbau and jatoba).

Due to the relative abundance of temperate and boreal wood species that are suitable for structural and joinery applications and that have benefited from innovation to extend their range of applications, the use of tropical hardwoods in the large wood-consuming markets of industrialized countries has focused increasingly on either decorative applications or high-exposure applications.

Innovations impacting on the competitiveness of wood products

There are ongoing forestry research programs with potential to boost the competitiveness of tropical hardwoods in relation to other wood products. Program areas that could contribute to the improved competitiveness of tropical hardwoods include the integration of environmental, social and economic objectives in line with sustainability principles; the techniques and economics of reduced impact logging; and technologies expediting the analysis of spatial and temporal data and timber-tracking. Matching the technical properties of species to applications has been given particular emphasis in tropical wood research with the aim of increasing the use of lesser-known species.

Efforts have also been made, notably in Southeast Asia, to use modern technology to improve the range of applications and quality of smaller-dimension, less-durable or FSC-certified tropical wood derived from both plantations and natural forests. Malaysian and Indonesian manufacturers, for example, have adopted finger-jointing and lamination technologies to produce engineered window scantlings. Thermally treated FSC-certified West African limba/frake has just been introduced to the west European market, primarily targeting cladding applications in the public sector. Research has been undertaken in Thailand into thermal treatment of plantation teak and rubberwood to improve durability. Malaysia is engaged in efforts to develop bio-composite materials from wood residues and other natural fibers.

However, there are clear signs that the tropical wood sector is falling significantly behind other sections of the international wood industry in research and development. Based on a review of international forest research, FAO (2009) suggested that there has been a significant shift in the research agenda away from the development of improved silvicultural systems in natural tropical forests and product development for natural tropical woods in favor of plantation forestry. Many of the new wood-treatment technologies being developed are more likely to threaten rather than enhance the current market position of tropical hardwoods. The work undertaken to date on the technical performance of tropical hardwoods has had limitations. For many tropical species the level of testing has been insufficient to provide comprehensive information on the design properties of particular species and has often been based on tests of a limited number of small sizes of mostly clear wood. Much of the research in this area has been in response to new regulations or standards in an effort to avoid loss of market share, rather than innovative work designed to extend market share.

A major competitive threat for tropical hardwoods is ongoing efforts to modify the characteristics of temperate hardwoods and softwoods to improve their performance, sometimes with the specific intent of mimicking the aesthetic qualities, durability and strength of tropical hardwoods. Examples of wood-modification processes and products are proliferating. Other competitive threats have emerged from the development of entirely new products comprised of small-diameter wood, woodchips and even sawdust. Many of these alternative products are sold with FSC or PEFC certification to increase their marketability, particularly in the public sectors of northwestern Europe and North America. Examples of wood modification processes include:

- **Engineered wood products (EWPs):** A variety of EWPs, including glulam (glue-laminated timber), laminated veneered lumber, I-joists and oriented strand board (OSB), are greatly extending applications for softwoods and temperate hardwoods, including small-dimension material, mainly for interior structural applications and some interior joinery and furniture. OSB has been a particularly significant competitor of tropical hardwood plywood in some applications. Global OSB production was 26 million m^3 in 2007 and it is projected to reach 38 million m^3 by 2012. Eighty-five percent of OSB capacity is in North America, but strong future growth is expected in China, Russia and South America.
- **Heat treatment:** The Scandinavian companies Finnforest and Stora Enso are producing Thermowood, a heat-treated product made by steam-heating softwood to temperatures above 200°C, which drives out moisture and resin to enhance durability and stability. Plato Wood is an equivalent product produced in the Netherlands. Kebony is produced in Norway by a similar process, except that 'tropical-wood color' is added to the candidate softwood by impregnating it with furfuryl (a byproduct of sugar-making) before intense heating. These products are being marketed for decking, garden furniture and external cladding. European production capacity of thermally treated wood is now at least 160 000 m^3 per year.
- **Acetylation:** Acetylation involves the use of naturally occurring acetic acid to alter the molecular structure of wood. The treated timber is more durable and stable and the treatment does not have a marked effect on visual appearance. Titan Wood's Accoya is probably the most well-known brand of this material and is being marketed for exterior joinery applications, particularly windows, doors, conservatories and cladding. Accoya claims a service life of 50 years and an initial

maintenance-free period (i.e. no painting or other coatings required) of twelve years.

- **Impregnation:** Various impregnation processes have been developed in New Zealand, originally intended to improve the qualities of radiata pine. These have proved to be a profitable mechanism for producing highly durable and color-fast products, particularly for flooring, out of a low-density, fast-grown material. Efforts are now being made to extend the new impregnation technologies to a wider range of timbers and applications in other parts of the world. Major brands are Osmose's Indurite and Fibre7's Lignia.
- **Surface technologies:** Surfacing with real wood veneer is now just one of a wide range of approaches used to give composite panels the appearance of natural wood. Improvements in the dimensional accuracy and surface properties of composite panels have greatly enhanced the range of surfacing options. So too has the development of high-performance coatings (HPCs) that significantly improve durability, wear and mechanical properties. Examples of such technologies include high-pressure laminate, continuous pressure laminate, thermally fused melamine, decorative paper-based foils, decorative vinyls/3-D laminates, and direct printing. The costs of these products vary widely, but the cheapest are generally offered at a significantly lower price than even the cheapest wood products. Production has expanded very rapidly in Europe, North America and East Asia.
- **Wood plastics composites (WPCs):** WPCs take the concept of combining the properties of plastics and wood into a single product one step further. They are composed of wood from recovered sawdust, other cellulose-based fibers and a wide range of virgin or waste plastics. WPCs can be extruded or moulded like plastics but they also behave like wood and can be shaped using conventional woodworking tools. WPCs made early progress in North America, and production capacity is now expanding in Europe. Overall global capacity is estimated to be at least 1.12 million tons, including 900 000 tons in North America, 100 000 tons in Europe, 75 000 tons in China, and 50 000 tons in Japan. WPC decking is believed to account for around 14% of the United States decking market, compared to around 80% for wood. In Europe, WPC market share in the decking sector is estimated to be around 6%. Recent market reports indicate that the trend towards rising production capacity in Europe and China is set to continue.

Product innovation and the development of production capacity in these new processes is costly. As a result, prices of some of these new products can be high. Kebony, for example, is between US$4000 and US$14000 per m^3, depending on quality; it is targeted specifically at the high-end teak market. Moreover, these technical innovations have yet to fully close the gap to the extent that alternative wood and non-wood products can match all aspects of tropical hardwood performance. WPCs, for example, look relatively bland and lifeless. OSB lacks the durability and look of tropical hardwood plywood. Composite panels tend to be heavier than tropical plywood. Artificial surfaces may look like wood but don't necessarily feel or smell like it. Heat-treated products can suffer from excess brittleness and their manufacture requires considerable energy.

On the other hand, significant resources are now being devoted by large corporations in industrialized countries to improve these processes and extend capacity. A lack of equivalent levels of access to new technology in developing countries is likely to become a more significant threat to the competitiveness of tropical hardwood in the future, particularly as high-tech and capital-intensive areas of research, such as biotechnology, nanotechnology and information and communication technologies, have an increasing impact on the performance of materials.

Market position in relation to non-wood materials

The competitive position of tropical hardwoods cannot be defined solely in relation to other wood products. A host of non-wood materials available to consumers, specifiers and designers may be directly substituted for wood products. Key among them are cement/concrete products; steel; aluminium; plastics; and (to a lesser extent) ceramic tiles, glass, gypsum and natural stone. Innovation in these alternative materials sectors implies that opportunities to substitute tropical hardwoods are

rising. The wide range of applications in which non-wood materials are in competition with tropical hardwoods include:

- construction (building frames, partitions, roof members, roof cover, window frames, door frames, civil works)
- interior (quality furniture, flooring, skirting, ceilings, staircases, handrails, balusters, doors, windows, quality joinery, paneling, architraves, kitchen joinery and worktops)
- exterior (garden furniture, door, window, decking and baluster, cladding, storefront frames, staircases)
- industrial (floors, partitions, acoustic barriers, sea defense, transport, fencing, tool handles).

The value of global materials consumption rose strongly between 2000 and 2008, a period characterized by strong growth in construction activity in many parts of the world, particularly China and the United States. Overall, wood is estimated to have held a 12% share of the value of world building material consumption (excluding plastics) in 2008, a slight erosion of its share of 13% at the start of the decade. Over the same period, cement and concrete products increased their share of global building material consumption from 46% to 49%, while metals, tiles and glass all maintained their shares at 12%, 20% and 8%, respectively. PlasticsEurope indicates that there has been very strong growth in the global production of plastics suitable for construction applications over recent years.

An analysis of price trends for competing wood and non-wood commodities over the last decade indicates that all commodities, with the exception of cement, have exhibited high levels of price volatility. Products such as aluminium, steel and plastic, which all require high levels of energy during manufacture, experienced particularly dramatic price rises before and during the energy crisis in mid 2008. In contrast, cement benefited from relatively stable and very low pricing. Low prices, wide availability and simple application explain cement's huge and growing popularity in the global construction market. Overall, wood, particularly tropical wood, is a relatively highly priced commodity compared to key non-wood substitutes in the construction sector. A very sharp decline in commodity prices for plastic, aluminium and steel in the second half of 2008 (which was even more dramatic than the fall in wood prices in the same period), suggests a renewed challenge to wood's overall position in the market.

All wood products have certain technical and performance constraints compared to other materials. An analysis of wood's technical properties that drew on research at the University of Cambridge indicates that wood cannot match the toughness of steel or composites, lacks the strength-to-weight ratio of aluminium, is more difficult to recycle than most metals, and cannot be extruded or moulded. On the other hand, wood performs particularly well on issues of energy content, aesthetics, thermal insulation and health. Indeed, a whole range of environmental issues undermines the competitiveness of most alternative materials compared to wood.

Another major strength of tropical hardwoods is their durability. As generally applied within the wood sector, the concept of durability – simply, the ability to withstand bio-degradation – is much narrower than the concept applied by contemporary designers. The latter also takes into account the concept of adaptability, the extent to which a material can cope with changes in lifestyle and fashion, and the ability of materials to maintain social integration and aesthetic values. This broader concept of durability plays even more to the strengths of tropical hardwood.

External factors impacting on the competitiveness of tropical wood

The study reviews a range of key external factors impacting on the relative competitiveness of tropical wood. These factors are discussed below.

Global population and GDP growth

There is projected to be a very large absolute increase in the size of the global population over the coming decades, from around 6.7 billion people in 2008 to 9.4 billion in 2050, with particularly strong growth in less-developed countries (LDCs). Economic data indicate that a growing proportion of growth in gross domestic product (GDP) is concentrated in tropical countries and other emerging markets. In the early 1990s the LDCs accounted for less than 20% of global GDP. On current trends this figure could hit 40% within the next decade. In terms of purchasing power parity,

developing countries already account for around 50% of GDP.

These trends imply significant underlying growth in global demand for all commodities, including all types of wood, and that an increasing proportion of tropical wood consumption will be in domestic and regional markets. Just as temperate wood-product suppliers currently benefit from proximity to consumers in western markets, tropical suppliers will benefit in future from proximity to consumers in their domestic markets. On the downside, without successful moves to significantly increase the economic returns from tropical forests, growing populations in LDCs also imply increasing pressure to convert these resources to other uses.

Increasing urbanization

The world population is now evenly divided between urban and rural areas. By 2050, urban residents are likely to make up 70% of the world's population. This implies an increase in demand for materials for high-density construction. Wood has traditionally faired poorly against concrete and steel in urban construction, but this is changing rapidly with the development of new engineered products and modern wood-based building systems.

Political and macroeconomic environment in tropical supply countries

Most tropical wood-supplying countries rank low on international competitiveness indices, indicating that they are relatively difficult places in which to do business and that they are lacking in factors such as macroeconomic stability, health and education, labor market efficiency and innovation. However, Malaysia and Thailand stand out for achieving relatively high global rankings across a wide range of competitiveness criteria. Both countries are global players in the wood-furniture sector and important suppliers of primary wood products and both compete well against major furniture-manufacturing locations in the developed world.

The strategies required to enhance the competitiveness of tropical wood industries will vary widely between countries. Countries that are relatively low in competitiveness ranking are likely to benefit from efforts to develop robust institutions, improve transport and other infrastructure, promote a more stable macroeconomic framework, and improve the health and literacy of the workforce. In those countries, international competitiveness in the short to medium term is likely to lie in the supply of unprocessed or only partly processed wood products. Countries that rank relatively highly for competitiveness are likely to benefit from measures to increase labor productivity, diversify products, improve the quality of further processing, encourage innovation, and develop own-brand furniture.

Emergence of China and Viet Nam as major wood-processing hubs

On one level, the emergence of China and Viet Nam as major processing hubs may be seen as undermining the efforts of tropical wood-producing countries to develop their own downstream processing industries. On the other hand it may equally be argued that both countries have contributed to the increased competitiveness of tropical hardwood products. For example, the recent massive expansion of China's wood-flooring sector has made a wider range of wood-flooring products, including those based on tropical hardwoods, available to consumers in many areas of the world at highly competitive prices. This has been a significant factor in boosting wood's overall market share in the global flooring market. Viet Nam has played a similar role in the market for garden furniture.

Freight rates

While, overall, sea freight rates have become a less important factor in the commodity trade, the combined cost of land and sea transport remains a major competitiveness factor for many tropical hardwood producers that are located in isolated areas at considerable distances from ports, such as in the Congo Basin and the Amazon. It is also proportionally more significant when dealing with bulky and comparatively lower-value primary commodities such as logs and rough-sawn wood. For example, when exporting logs and sawnwood from the Central African Republic, trucking prices from forest to the port of export account, on average, for between 32% and 38% of the total cost, insurance, freight (CIF) Europe price of the product. Moreover, short-term fluctuations in freight rates can be very disruptive to trade and there are reasons to believe that the wood industry, due to its relatively high fragmentation and associated lack of leverage with major shipping lines, is particularly susceptible to such disruption.

Shipping time and international connectedness

The cost of freight is a significantly less important factor in relative competitiveness than shipping reliability and time. The Liner Shipping Connectivity Index of the United Nations Conference on Trade and Development indicates that China is now the world's most 'connected' country, a factor contributing considerably to its recent strong growth as a wood-processing hub. While Malaysia scores well on this measure, most other tropical supplying countries perform poorly, falling well behind suppliers of alternative wood products.

Industry consolidation

Consolidation can provide critical competitive advantages, such as increased efficiency; asset, product, or geographic diversification; and lower capital costs. Larger companies are generally more able to attract capital for innovative investment, dictate terms to suppliers, and influence the purchasing practices of customers. Smaller numbers of large companies tend to be better placed than large networks of small companies to coordinate financing for research and development, marketing and political lobbying. The process of certifying against technical and environmental standards also tends to be simpler and less costly for larger companies.

Analysis shows that the wood industry as a whole suffers from high levels of fragmentation compared to other commodity sectors. It also shows that, within the wood industry, the hardwood sector (both tropical and temperate) exhibit particularly high levels of fragmentation.

While fragmentation generally reduces competitiveness there are also benefits that flow from it: for example, wealth accrues locally, local environmental accountability can be strengthened, and 'cultural' products can be developed for niche markets; moreover, small and medium-sized enterprises in developing countries can help encourage the spread of entrepreneurship. Fragmentation, therefore, can be a source of strength. The key is to ensure that the activities of the various players are organized and coordinated effectively, for example through the development of effective trade associations and marketing cooperatives.

Energy efficiency in the construction sector

Mounting concerns about energy security and global warming combined with national commitments to Kyoto targets have led to numerous policy initiatives to improve energy efficiency in the built environment. This can help wood's overall competitiveness in the door and window sectors. Wood is a good natural insulator and, unlike metals, it does not suffer from thermal bridging. If the correct species is used, wood is sufficiently strong to be combined with triple glazing without modification. As a result, wood windows – including tropical hardwood windows– are capable of achieving relatively high U-values (i.e. the overall heat transfer coefficient) without adding significant cost. On the other hand, other materials sectors have made significant progress in this area through the development of new techniques and products. In the United Kingdom (UK), for example, unplasticized poly-vinyl chloride (uPVC) external doors with a U-value of 1.8 w/m^2 Kelvin were being offered in mid 2009 at prices comparable to equivalent tropical hardwood external doors with a U-value of 1.905 w/m^2 Kelvin.

Green building initiatives and life cycle assessment

Energy efficiency standards in construction are often linked to green building initiatives (GBIs), which attempt to provide a broader measure of the environmental performance of whole buildings. GBIs include Leadership in Environmental Design (LEED) and Green Globes in North America, the Building Research Establishment Environmental Assessment Method (BREEAM) in the UK, Japan's Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), Haute Qualité Environnementale (HQE) in France, and German Sustainable Building Certification (DGNB). GBIs are making significant headway in the United States and UK, but most other markets are still some way behind them.

GBIs have significant potential to improve the overall competitiveness of wood products. Independent life cycle analyses (LCAs) regularly score wood more highly than alternative building materials on a wide range of environmental criteria. However, very few LCA studies have been undertaken that consider the full cradle-to-grave environmental impact of tropical hardwood.

Those that have been undertaken generally draw positive conclusions, but they have not been widely publicized.

Nor has the wood industry been particularly adept at lobbying GBIs, which are now proving to be a mixed blessing for (particularly tropical) wood products. Discrimination against wood can be built into GBI standards because wood is often the only material required to demonstrate responsible sourcing. At present the LEED standard only credits FSC-certified wood, helping to drive demand for the FSC brand potentially at the expense of a wider appreciation of the environmental merits of wood. The Japanese CASBEE system credits wood from sustainably managed forests, but the guidance includes a presumption against tropical hardwood (considered unsustainable) in favor of softwoods (considered sustainable, particularly if produced locally).

REDD initiatives and carbon markets

By placing a value on a key environmental attribute of standing forests, REDD ['reduced emissions from deforestation and forest degradation'] initiatives have significant potential to alter the economics of tropical land management. Studies have shown that, on a purely financial basis, liquidation logging and subsequent conversion to agriculture is often many times more profitable than sustainable forestry. Inevitably, this has been a major driver of deforestation in tropical regions, which are typically characterized by rapid population growth, short time horizons and associated high discount rates.

It is questionable, however, whether the international community will come up with resources sufficient to finance REDD initiatives to the extent necessary to discourage forest conversion. According to one estimate, close to US$30 billion per year would be required to halve the rate of forest loss and its associated impacts on climate change, far beyond the level of financing produced by the international community to date. At the project level, research has shown that even if REDD credits were priced at the level of carbon credits traded in existing compliance markets, the profits from forest protection for carbon sequestration would fall short of the profits derived from conversion to oil-palm agriculture in Southeast Asia.

This highlights the importance of maximizing payments for a wide range of environmental services in addition to carbon, including forest-derived goods and services that benefit local and regional economies. A good example of how this can work is provided by Precious Woods, an FSC-certified company operating in the Amazon. Between 2005 and 2006, Precious Woods introduced a product diversification strategy supplementing income from wood with revenues from carbon credits, essential oils, the sustainable extraction of orchids, and the sale of renewable energy from its biofuel investments. Overall, Precious Woods' revenues increased by 50% in 2006 and profits tripled.

Carbon footprinting

Rising interest in the carbon footprint of products has the potential to be a strong marketing opportunity for tropical hardwood products, given research to acquire appropriate data. The opportunity is likely to be particularly strong for products based on local wood raw materials that are finished or semi-finished in tropical countries prior to export. It is, however, less likely to favor tropical hardwood products such as garden furniture if these are manufactured at a considerable distance both from the raw material source and the customer – as is often the case in Southeast Asia.

FLEG initiatives

ITTO documentation for its Thematic Programme on Forest Law Enforcement, Governance and Trade notes that "there is a common perception that illegal operations are widespread in the tropical wood sector, which taints its image in major import markets". Moreover, various modeling studies have indicated that the presence of significant volumes of illegal wood in international trade, mainly from tropical sources, depresses prices for products derived from legitimate sources.

At a very basic level, therefore, the emergence of a concerted international response to the problem of illegal logging has significant potential to increase the competitiveness of legally sourced tropical wood by removing cheaper illegal products from the market and by tackling a major factor that undermines the reputation of tropical wood and acts as a constant drag on marketing. Some forest law enforcement and governance (FLEG) policy measures have clear potential to boost the competitiveness of tropical wood in a very direct

way. For example, many bilateral development programs (such as the Forest Law Enforcement, Governance and Trade – FLEGT – process for the development of voluntary partnership agreements – VPAs – between the European Union – EU – and producer countries) contribute resources to developing countries to assist them to strengthen forest governance.

On the other hand, poorly conceived and disproportionate policy measures to tackle illegal logging that add costs to legitimate forestry operations may have a detrimental effect on the international competitiveness of tropical wood. Effective FLEG initiatives are not only about improved control: they should also entail forest law reform, a process that might involve appropriate deregulation and efforts to simplify forest legislation, combined with a more structured approach to enforcement, a clearer definition of rights and responsibilities, and the strengthening of social contracts.

Legislation targeting illegal wood imports

The Lacey Act amendment in the United States and proposed due-diligence legislation in the EU is expected to encourage importers to seek further assurances – typically backed by independent third parties – that, in areas or regions where the risk of illegal logging is judged to be high, wood has been obtained from legal sources, while imposing few extra demands on wood suppliers in regions where the risk of illegal logging is judged to be low. Since illegal logging is widely perceived to be a more serious issue in tropical countries, the new requirements are likely to fall most heavily on suppliers of tropical wood products. In the absence of clear guidance on appropriate forms of evidence, there is a risk that tropical wood products that are not either third-party-certified or legally licensed in accordance with the FLEGT VPA framework will be excluded from these markets. The lack of equivalent requirements for the legal sourcing of non-wood products implies that, where they apply, these laws will undermine the overall competitiveness of tropical wood.

On the other hand, these laws also provide an opportunity to create new markets for legally verified and sustainably certified tropical wood. Wood-product manufacturers in countries that are heavily dependent on wood imports of indeterminate origin and complex supply lines are more likely to struggle to comply with the requirements of these laws than are manufacturers close to the resource base in tropical countries. There is also now a window of opportunity for tropical countries to help shape the discussion on the most appropriate forms of evidence that wood is low-risk with respect to illegal logging.

Public-sector procurement policies

The development of public-sector wood-procurement policies in consumer countries is generally detrimental to the competitiveness of wood products, particularly imported hardwood products, relative to non-wood products. A common failing of public-sector requirements for wood procurement (e.g. that wood is 'legal and sustainable') is that they are rarely matched by the imposition of equivalent controls on the procurement of alternative materials. Since the requirements for wood may be complicated and convoluted, wood-procurement policies have the potential to act as a strong incentive to avoid wood and to use other materials instead.

Participation in stakeholder consultations surrounding public-sector wood-procurement criteria is inevitably driven by domestic interests. Concern for accommodating the views of domestic stakeholders in consumer countries often overrides the real needs of sustainable forestry in supplier countries. Generally, national timber-importers associations are expected to represent and articulate the interests of suppliers and forest managers in all supplier countries. However, these associations are often influenced most by the views of dominant softwood and composite-panel interests and tend to pay little heed to smaller, more fragmented tropical hardwood interests.

Nevertheless, tropical hardwood producers that achieve forest certification can benefit from these policies where public-procurement officials demonstrate willingness to pay premium prices for certified tropical hardwood products.

Corporate social responsibility

Corporate social responsibility (CSR) is an increasingly important component of global business strategies. The United Nations Global Compact, which is used as the basis of the CSR policies of many of the world's largest companies, encompasses principles on human rights, labor standards, the environment and anti-corruption.

According to surveys by KPMG, the proportion of the world's largest companies that include these CSR factors in their reporting jumped from 50% in 2005 to 80% in 2008.

At one level the emergence of CSR activities among larger companies may be seen as detrimental to the international competitiveness of the tropical hardwood industry. Requirements for higher labor and environmental standards and moves to avoid areas perceived to suffer from high levels of corruption may simply lead to further discrimination in favor of products from developed countries at the expense of developing countries. There is potential for CSR activities to be hijacked by protectionist interests in developed countries to deny developing countries their comparative advantage in low labor costs.

But the move to CSR also offers opportunities for the tropical hardwood industry. Good CSR implies corporate adoption of a comprehensive life cycle philosophy and implies that companies spend the time to improve their knowledge of underlying issues and to develop realistic programs of action. Tropical hardwoods have suffered considerably more than most other commodity sectors from simplistic single-issue campaigns. Moves to a more rational and informed approach that balances the impacts of different materials and takes broader issues such as rural development into account could be beneficial.

Waste disposal and recycling

Rising consumption, interest in sustainability and limited new sites for landfill is increasing concern for waste disposal in many consumer countries. The metal industry regards this issue as a potentially strong area of competitive advantage, helping to boost its claims of 'sustainability'. The World Steel Association claims that 25–30% of all steel manufactured today is from recycled sources. The equivalent claim of the International Aluminium Institute for aluminium is 33%.

This issue has potential to be a competitive advantage for tropical wood products in relation to preservative-treated softwoods, plastics and composites, which all tend to be more difficult to dispose of. Exploiting this opportunity, however, requires the development of systems and procedures in wood-consuming regions to facilitate recycling. The wood industry is again lagging behind, while the plastics industry has been very active in establishing systems for recycling. For example, one company now claims to recycle over 50% of available uPVC waste in the UK.

Global design trends

Product and building design trends are critically important to the future competitiveness of the tropical hardwood industry and offer both opportunities and threats. Very strong interest in sustainability in the design profession, combined with designers' lack of knowledge of tropical forest issues, often results in strong prejudices against the use of tropical hardwoods. Growing interest in the mixing of materials is undermining the competitiveness of tropical hardwoods in sectors where they have been dominant in the past, such as garden furniture. On the other hand, moves towards 'natural', 'timeless', 'authentic', 'minimalist' and 'individual' products in the interiors sector could be turned to the benefit of tropical hardwoods – with appropriate marketing.

Exploiting these opportunities will be very challenging for the tropical hardwood industry. Global design trends tend to be led by large corporations and high-profile designers in industrialized nations who are more familiar with temperate wood products. In the absence of a strong cadre of influential designers in tropical countries, there is a threat of progressive loss of market share.

Designer perceptions

Surveys of architect perceptions indicate that preconceptions about wood's fire behavior, durability and strength, coupled with its image as an old-fashioned material, are significantly undermining wood's competitive position relative to other materials. Only on one issue – that of environmental friendliness – do wood products typically outperform non-wood competitors in the minds of many architects.

Existing surveys, however, have their limitations. Most have focused heavily on structural uses of wood in Western markets, which are much less relevant for many types of tropical hardwood than the finishing and furniture sectors. The structural sector is renowned for being relatively risk-averse and conservative compared to the finishing sectors, where there is more room for experimentation and a greater focus on aesthetics, versatility, ease

of use, and naturalness. Interviews with interior and furniture designers undertaken in 2009 for the current study suggest that, compared to softwoods that are the main focus of past surveys, tropical hardwoods tend to be viewed more positively on some issues (e.g. natural technical performance and aesthetic qualities) and worse on others (notably environmental attributes).

Consumer perceptions

Surveys in industrialized countries reveal a strong cultural attachment to wood of all types. While there are often significant concerns in relation to wood's performance in structural applications, there is a strong preference for wood in furniture and in other interior applications where it can be seen. Wood's qualities of warmth, naturalness and beauty are widely appreciated. Awareness of this among other (competing) sectors is evident from the huge resources they devote to mimicking these qualities in non-wood products. The obvious popularity and visibility of santos palisander at the Milan furniture show in 2009, and the apparent determination to use only the real wood product, suggests that there is continuing willingness to show off the aesthetic qualities of tropical hardwoods in the most influential section of the European furniture industry.

On the other hand, surveys also show that many consumers have very clear and negative opinions about tropical hardwoods, formed largely on the basis of limited knowledge. Long-term market access continues to be significantly threatened by limited awareness and understanding among consumers of the concept of sustainable forest management in tropical countries and of the positive role that the tropical hardwood industry can play in contributing to rural development and in acting as a disincentive to forest conversion.

Surveys suggest that consumers do not regard certified wood products in general as significantly better or more environmentally friendly than wood products without a label. However, these findings differ for tropical wood, for which labels have a more positive influence.

Market development initiatives

A large number of trade associations and other organizations are now engaged in wood promotion. Some campaigns are large and well-funded: for example, the North American Wood Promotion Network, a coalition of more than 330 wood-sector organizations, has an annual budget in excess of US$10 million. However, most initiatives aim to improve the market position of wood from northern temperate forests in relation to non-wood competitors and do not engage in efforts to improve understanding of tropical-forest issues. At the same time, large marketing networks for competing materials have been established that are seeking to expropriate the strong environmental and other advantages of wood through supposed product improvements, impressive exhibitions, advertising and modern methods of viral marketing.

Other than individual companies, only a few organizations are engaged in developing markets for tropical hardwoods in large consumer countries: they include the Malaysian Timber Council (with offices in Europe, Dubai and Shanghai), the International Wood Products Association in the United States, the Inter-African Forest Industry Association (now becoming more vocal in support of the African hardwood industry in the European market), and the Ghanaian Timber Industry Development Division (which has an office in London).

In 2007 the United Nations Economic Commission for Europe Timber Committee and FAO jointly noted that "The forest products industry has not been very successful in communicating with the public … The major environmental activist organizations are focusing on forests, biodiversity and climate change. They work to make people feel guilty about using wood. Meanwhile, the substitute product industries (metals, plastics and cement) are capitalizing on these negative perceptions to gain market share. These twin threats to the forest products industry work in concert. The forest products industry has long been plagued by negative public perceptions".

These weaknesses are particularly apparent in the tropical hardwood sector, which lacks a single coordinated generic promotional campaign. As a result, any positive messages arising from efforts to improve tropical forestry practices, the contribution of tropical wood industries to rural development, or the potential LCA benefits of using tropical wood tend to be swamped by single-issue environmentalist campaigns focused on high levels of illegal logging or continuing deforestation.

Tropical wood's competitiveness in major market niches

Drawing on interviews at trade shows, the analysis of trade and price data, and various other secondary sources, the study assessed the competitiveness of specific tropical wood products in major market sectors. Conclusions from this assessment are summarized below.

Tropical hardwood plywood for the European and United States markets

In the past, the competitiveness of tropical hardwood plywood in the EU and United States markets was based heavily on the manufacturer's ready access to large-dimension logs at relatively low prices. As raw materials have become scarce and log prices have risen, and as temperate manufacturers have become adept at producing higher-value composite panels from domestic softwood resources, this competitiveness has declined. The introduction of a new low-priced product from China that bears a passing resemblance to tropical hardwood plywood and is capable of performing a range of utilitarian tasks has hastened this decline.

However, a new situation is now developing that could again open up opportunities for tropical hardwood plywood. The competitiveness of Chinese combi-product is under threat: costs in China have risen and concerns over quality have mounted – new formaldehyde emissions standards have been introduced and there are demands for legality verification.

Tropical hardwood plywood producers supplying the United States and EU markets need to focus now on higher-quality niche market products; look at diversifying into a range of specialist plywood products similar to those developed for birch (e.g. heavy-duty grip flooring panels or a fire-retardant-throughout panel); and emphasize adherence to emerging quality and environmental standards.

Southeast Asian plywood in Japan

The Japanese market for panel products is now very mature and highly differentiated, so there is less direct competition between tropical hardwood plywood, softwood plywood and composite panels. Significant volumes of tropical hardwood plywood continue to be absorbed by specialist sections of the market, notably flooring and interior finishing. The Japanese market is generally favorably disposed towards the continuing use of wood products. Increased concerns about the health impact of buildings and the need for strong performance during earthquakes, combined with improvements in fire-retardant treatments, are all creating new opportunities for wood products.

On the other hand, significant threats are emerging in the remaining market niches occupied by tropical hardwood plywood. These include the low price expectations in the concrete-formwork market, rising concern over the volatility of prices for tropical hardwood plywood, and intensifying competition from medium-density fiberboard and particleboard in the flooring sector. Major emerging issues include concern for the carbon footprint, which is being used to bolster the position of domestic products over imported products, and the need to demonstrate that wood products are derived from legal sources.

Southeast Asian garden-furniture sector

Southeast Asian countries have built a formidable reputation within the garden-furniture industry as the world's best low-cost production area capable of manufacturing the full range of garden-furniture items – from high-quality designer brands to high-volume, low-cost items sold under the retailers' own brands. Nevertheless, there are factors that act to undermine overall industry competitiveness, particularly the heavy focus on a volume-driven rather than a product-and-design-driven industrial strategy. Moreover, there are very significant obstacles to the continued use of tropical hardwoods within the Southeast Asian garden furniture sector. Mounting supply difficulties, environmental concerns and changing consumer tastes in favor of light, low-maintenance products that may be used both indoors and outdoors are driving a shift away from tropical wood in favor of non-wood products such as plastic, wicker and bamboo. Meanwhile, garden-furniture manufacturers looking for ways of maintaining profitability are increasingly moving into the interior-furniture sector where they can exploit the greater availability and popularity of temperate hardwoods, particularly from North America.

The trend away from tropical hardwoods in the garden-furniture sector may be addressed through a design-led marketing initiative to return it to fashionable status. This needs to target both western and Japanese designers, who are influential in

global design, and up-and-coming Southeast Asian designers, who can act as ambassadors to promote new regional styles based on locally derived tropical hardwoods. The success of such an initiative will depend on measures to improve the availability and surety of supply and, above all, on consistent, affordable pricing.

Sapele and meranti sawnwood in the European window-frame sector

Overall the European window sector is becoming a more challenging one for sales of tropical hardwoods. Although wood windows are beginning to reclaim market share lost to uPVC earlier this decade, most of these gains are expected to be achieved by softwoods and EWPs manufactured in northern European countries. Wood–plastic composites also have the potential to help close the significant price gap that still exists between wood and uPVC. Key challenges for tropical hardwoods are the large and expanding price gap with other wood products and the continuing constraints on the supply of certified tropical hardwood products.

Nevertheless, there is a small but significant number of manufacturers and end-users who favor the look of tropical hardwoods and who appreciate their qualities of natural durability and stability. If sufficient resources are committed to proactive marketing, there is potential to maintain and even extend this market; for example, marketing coupled with a rising availability of certified sustainable products could focus on the whole life cost benefits of tropical hardwoods.

Tropical hardwood veneers in the European interiors sector

The rapid progress and expansion of non-wood substitutes in high-volume, low-end sectors of the European market for surface materials suggests that there are negligible opportunities for the expansion of markets for standard tropical hardwood veneers in these sectors. There may once have been some potential to expand lower-end markets for veneers in the southern European door sector, but the recent economic downturns in Spain, Portugal and Italy and the mounting competitive pressure from non-wood substitutes suggest that this is no longer a viable option.

Maintaining and increasing the access of real wood veneers to relatively high-volume markets in Europe is likely to be heavily dependent on the success of innovative new products such as Danzer's 'Vinterio' and Alpi's 'Alpilignum'. The latter, which includes ayous in the mix of wood species used as a substrate, suggests that there could be a role for some higher-volume tropical hardwoods in these innovative products. However, this will require further technical development work in association with large veneer companies and will also be dependent on reliable environmental certification.

Even at the upper end of the market there is no doubt that competitive pressure from non-wood substitutes will continue to intensify for real wood veneers – technical developments are improving the look and feel of these substitutes.

The industry can build on the fact that the desire for the look of wood is strong and there are indications that consumers and designers at the high end of the market are still seeking the naturalness, sustainability, warmth and performance of real wood. But this can't be taken for granted and there is a critical need for active engagement with the European design community to maintain and rebuild market share.

SWOT analysis

Overall the prognosis is not a positive one for tropical hardwoods, which are threatened in key market niches by a wide and increasing range of innovative products, suffer from declining price expectations and falling raw-material quality, have a very significant image problem, and are being squeezed by a whole host of policy measures. Nevertheless, the tropical wood industry and tropical hardwood products have significant strengths and many policy initiatives offer opportunities as well as threats. The table below summarizes a SWOT [strengths, weaknesses, opportunities and threats] analysis conducted into the tropical wood industry as part of the study.

SUPPLY	INDUSTRIAL STRUCTURE	PRODUCT MARKETING
Strengths		
Tropical wood has superior natural qualities of durability, clear grain and aesthetic appeal Competing forest resources lack the range of decorative species Some tropical wood products are standard stock items in major consumer markets Programs are in place (e.g. ITTO, FLEG) to tackle forestry problems Models examples of sustainable forest management exist Combining income from a range of natural forest services is profitable Physical environment offers potential for high-yielding plantations In some areas there is progress to develop certification and legality verification	A few tropical countries are high in competitiveness rankings Wages are low in most tropical countries Southeast Asia has a strong reputation in the global furniture industry There are strengths associated with small enterprises Large tropical concession holders can benefit from economies of scale not available to temperate hardwood producers (e.g. in forest certification)	Prices are no higher than some competing products Technical innovations have yet to fully close the gap on the performance of tropical hardwoods Tropical hardwood retains a presence in high-value niche markets Tropical hardwood can be a very low-maintenance product There is a huge range of species and looks Tropical hardwoods have desirable qualities shared by all wood products (i.e. energy-efficiency, naturalness, biodegradability and carbon sequestration) Consumer surveys suggest people like natural wood for interiors and furniture Wood has strong environmental credentials across the product life cycle Wood is perceived to have a better environmental performance than plastic Malaysian Timber Certification Scheme/PEFC certification in Malaysia, FSC in the Congo Basin and parts of Amazonia, FSC-certified plantations in Central America, Southeast Asia Examples of more effective tropical wood marketing and lobbying activities exist (e.g. Malaysian Timber Council, International Wood Products Association, and the Inter-African Forest Industries Association)
Weaknesses		
There is a heavy dependence on unsustainable resources The productivity of marketable wood is relatively low in natural tropical forests Tropical forestry has a low financial yield There are weak prospects for improved tropical forest management Forestry regimes in some tropical countries require reform Plantations have been mainly established outside the tropics The tropical hardwood industry has high transport costs and long lead times There is a relative lack of certified tropical forest products compared to other wood products	Many producer countries have a poor socioeconomic environment Tropical wood-processing industries are inefficient Challenges of converting tropical plantation wood There is a high level of fragmentation in the wood-processing sector Labor standards are lower in developing countries There is a lack of own-brand furniture-manufacturing There are low levels of investment in research and development	The prices for tropical woods are high compared with softwoods and most non-wood substitutes New products such as plastics, composite panels and combi-products have lowered price expectations in key market niches The pricing of tropical hardwoods is volatile Wood has technical constraints compared with other materials (e.g. it lacks the toughness of steel and the strength-to-weight ratio of aluminium) Architects and consumers perceive that wood performs poorly in construction applications Influential designers, architects and manufacturers are unfamiliar with tropical hardwoods There is a lack of information on the characteristics of tropical species there is a lack of access to knowledge in tropical countries There is a lack of diversity and volume in product supply and there is over-dependence on a few standard items There is a lack of data on the carbon implications of sustainable tropical forest management for wood production There are consumer misconceptions about sustainable forest management Illegal logging and tropical deforestation have created a negative impression There is a lack of data on LCA There is a lack of information on market perceptions of tropical hardwoods

SUPPLY	INDUSTRIAL STRUCTURE	PRODUCT MARKETING
Opportunities		
Tropical forest issues have a high political profile and there is potential to prioritize action on sustainable forest management There is potential for an influx of new finance for tropical forest conservation and management to meet climate-change objectives There is potential for the recognition of the carbon-sequestration benefits of harvested tropical wood products There is potential to further develop tropical plantation resources New technologies to improve performance of temperate and plantation wood may be applied to tropical wood Ongoing forest research into sustainable forest management, geographic information systems and wood tracking is improving the potential for forest certification	Globalization: wood processing in China/Viet Nam/India is increasing global consumer access to tropical products Consolidation in the importing sector in major consuming countries irons out supply and reduces price volatility Increased containerization reduces shipping times and allows for smaller mixed shipments There is potential to encourage the development of trade associations and other structures to increase the influence of small and medium-sized enterprises	The global consumption of all materials is expected to increase Increasing urbanization at the global level creates demand for natural materials to humanize space High-value niche markets have potential Real wood remains popular There is potential to exploit design trends favoring tropical hardwoods (e.g. interest in natural, durable materials and products with cultural narrative) There is potential for lesser-known species in the finishing and interiors sectors The value in species diversity can be exploited – there are numerous niches, and many species could be attractive to designers Programmes could be initiated to promote sustainable construction in LDCs to boost domestic wood demand Energy-efficiency measures create new opportunities for wood in the windows and doors sector The increasing focus on quality standards in many countries could particularly benefit larger tropical suppliers at the expense of Chinese suppliers of lower-quality products Tropical wood should perform well in LCAs GBIs present an opportunity to exploit tropical wood's strong LCA performance Carbon footprinting benefits products manufactured in tropical countries prior to export Emerging interest in whole-life costing can benefit tropical hardwoods because their high durability offsets higher up-front costs With appropriate organization, tropical wood can be readily recycled, and it is also easily disposed of because it is non-toxic and biodegradable Legislation and procurement policies targeting illegal wood imports have the potential to help remove illegal competitors and boost sales and premiums for certified tropical wood Certification can overcome barriers to tropical wood market access The marketing potential of the FLEGT VPA initiative gives rise to the prospect of building a marketing program around a common system The CSR policies of large consuming corporations offer opportunities to develop a rational dialogue and to move away from single issues

SUPPLY	INDUSTRIAL STRUCTURE	PRODUCT MARKETING
Threats		
The availability and quality of tropical wood are declining The continuing conversion of forests threatens the security of the resource There is an inability to meet certification requirements The rowing focus on the carbon role of tropical forests may reduce the focus on sustainable forest management Heavy-handed responses to illegal logging could add costs to legitimate operators without providing market benefits The need for rapid delivery and turnaround times favors alternative products; this is becoming more of an issue in the recession	Wood processing in China/ Viet Nam/India threatens nascent value-added industries in tropical countries Dominant corporations and leading designers in industrialized countries increasingly shift global markets away from tropical hardwood	There are widespread negative perceptions among specifiers, designers and consumer of tropical wood's environmental credentials There is widespread ignorance among specifiers, designers and consumers of the concept of sustainable forest management There is increasing competition from modified temperate wood products, engineered and composite wood products, modern surface technologies, other wood fibers and non-wood products The sector has lost share in some sectors to even lower-maintenance or no-maintenance products Products from plastics recycling are specifically targeted at tropical hardwoods There is a loss of share to abundant and more familiar species, particularly oak Chinese combi-plywood reduced price expectations in key product markets Tropical countries suffer from a relative lack of access to certification and testing facilities The diversity of quality and certification standards creates confusion and adds to the costs of tropical suppliers Moves to pre-fabrication favor tightly specified products and undermine traditional markets that preferred tropical wood for its 'flexibility' The effects of the global financial crisis hit some traditional markets very hard – e.g. veneers in southern Europe Low price expectations, tighter margins and the falling quality of the raw material are undermining tropical wood's reputation for quality Some design trends are encouraging a move away from tropical wood – e.g. the interest in sustainability The marketing and lobbying of temperate wood product suppliers are generally more effective than that of tropical wood suppliers – it often pays to denigrate tropical wood The large, high-profile marketing campaigns of other materials sectors expropriate wood's environmental credentials and denigrate tropical wood Public-sector procurement policies can actively discriminate against wood as the only material required to demonstrate sustainability; imported hardwoods are disadvantaged compared with other wood Legislation targeting illegal wood imports may fall more heavily on tropical than temperate suppliers The CSR policies of large consuming corporations may threaten the market position of tropical hardwoods Carbon footprinting threatens some tropical wood-product manufacturers, such as Southeast Asian furniture manufacturers with long supply lines

Improving the competitive position of tropical wood products

Recommendations for ITTO

ITTO could undertake the following actions to improve the competitive position of tropical wood products:

- Facilitate efforts at the international level to bring ITTO producer governments, large corporations dealing in tropical hardwoods, trade associations and other bodies representing smaller enterprises in producer countries together with a view to developing an industry-wide, design-led generic marketing campaign for tropical hardwoods.
- Promote further research and development into tropical forest management regimes that combine sustainable wood production with income from a wide range of environmental services.
- Promote the increased use of more readily available but lesser-known tropical hardwoods by: facilitating the development and distribution of more comprehensive guides to their structural and design properties; and encouraging efforts to promote tropical hardwoods by product application rather than by species.
- Promote further research and development into high-yielding plantations.
- Continue to facilitate efforts by tropical hardwood producers to achieve internationally recognized forest certification standards.
- Facilitate cooperation between ITTO producer and consumer member countries to avoid possible adverse impacts of unilaterally imposed market requirements.
- Facilitate research into the carbon implications of sustainable tropical forest management for wood production.
- Facilitate further research into the environmental impact of tropical hardwood products across their full life cycle and of the carbon footprints of tropical hardwood products.
- Facilitate more detailed wood-market research in emerging markets with potential to provide major new outlets for tropical hardwood products in the future.

Recommendations for ITTO producer countries

Building on research in this document, ITTO producer countries are encouraged to undertake more detailed reviews of the global positioning and competitiveness of their national tropical wood-product industries with a view to developing realistic long-term strategies. In the development of these strategies, it is recommended that particular attention is paid to the following:

- The most appropriate competitiveness strategy given a country's prevailing socioeconomic conditions.
- The appropriate positioning of national wood-products industries in relation to major emerging markets and wood processing hubs, notably China.
- The appropriate positioning of national wood-products industries in relation to larger corporations in industrialized nations with access to market knowledge, technical and design skills and product innovations of potential value to tropical wood producers. While the scale and market dominance of these companies threatens the competitiveness of tropical wood industries, there may be opportunities to use the leverage of access to wood raw materials and abundant labor to encourage technology transfer and training.
- The need for forest law reform, a process that might involve appropriate deregulation and efforts to simplify forest legislation, combined with a more structured approach to enforcement, the clearer definition of rights and responsibilities, and the strengthening of social contracts.
- Measures to foster the development of organizational structures at the national level, including forestry cooperatives and trade associations, that enable small enterprises to work together.
- The further development of domestic markets for wood products, particularly as outlets for wood products from smaller enterprises and community forests. Consideration should be given to opportunities for linkages with programs promoting higher-quality and sustainable construction in domestic markets.

- The provision of tax and other incentives for the development of high-yielding plantation forests on degraded land.
- Engagement with large private corporations and investment organizations in industrialized countries that are becoming more important in the provision of financing for plantation development.
- Improving the efficiency of wood-processing operations and the level of knowledge of wood handling.
- Encouraging a more positive environment for innovation and for research and development.
- Facilitating the development of and providing finance for national wood-marketing initiatives guided by the private sector. There may also be opportunities to coordinate these initiatives with other tropical wood suppliers. Consideration should be given to the potential to unite various national tropical wood-marketing initiatives around a core set of marketing messages and principles.
- Development of national infrastructure for legality verification and forest certification.

Recommendations for ITTO consumer countries

ITTO consumer countries are encouraged to:

- Ensure that the carbon role of tropical forests does not overshadow their role in the provision of wider economic, social and environmental goals. REDD initiatives should reward not only forests set aside as carbon stores but also forests maintained for a wider range of economic, social and environmental needs, including sustainable wood industries, particularly given their potential to substitute for alternative, less energy-efficient products.
- Work towards the increased harmonization of quality and environmental standards and of certification and testing procedures to help ensure a level playing field for all suppliers.
- Take steps to ensure that requirements for conformance with quality and environmental standards allow equivalent levels of access to testing and certification facilities for both domestic and international manufacturers.
- Work towards ensuring that green building and CSR initiatives and public-sector procurement policies are based on an objective and full LCA approach, so that tropical hardwood products are compared with other wood products and alternative materials on a level playing field. Fair and equitable access to the development of these initiatives should be encouraged for both domestic and international materials suppliers.
- Match demands for third-party legality-verified and certified tropical wood products in public-sector procurement policies with a willingness to pay the extra costs associated with supplying these products.
- Promote and develop the idea of whole-life costing.
- Actively engage tropical producer countries and suppliers in ongoing discussions on appropriate forms of evidence that wood is low-risk with respect to illegal logging.

Recommendations for tropical hardwood industries

Tropical hardwood industries are encouraged to focus on:

- Developing the opportunities that exist for tropical hardwoods in higher-value niche markets. Seeking to compete in large-volume, low-value commodity markets, where softwoods and other cheaper commodities dominate, is unlikely to be a sustainable long-term strategy.
- A commitment to full conformance with emerging quality, environmental and forest-certification standards. Long-term competitiveness, particularly in higher-value niche markets, is likely to lie in ensuring tight conformance with these standards and the supply of 'knowledge-based' products.
- Improving the regularity and consistency of wood supply through improved logistics, an increased dependence on resources managed for long-term sustained yield, including both plantations and managed natural forests, training in wood-handling, and other efforts to improve the efficiency of wood-processing operations.

- The development of tropical forest management regimes that combine sustainable wood production with income from a wide range of environmental services.
- Improving productivity, product diversification and innovation, and the development of a range of specialist product lines for specific market niches.

Elements of a design-led marketing initiative for the tropical wood industry

Given that the competitiveness of the tropical hardwood sector is declining relative to alternative wood and non-wood products in traditional market sectors, a key recommendation of this study is the desperate need for a unified generic design-led promotional campaign to protect the sector's current market position. Such a campaign is also needed to identify and develop demand in new niche markets. While challenging questions of how to acquire funding for and to organize such a campaign are not addressed here, the study provides insights into its potential role and scope. Specifically, it would:

- Need to acquire comprehensive information on market perceptions of tropical hardwoods through designer, manufacturer and consumer surveys, particularly outside Europe and North America where this information is very limited. This would allow more accurate targeting of communication messages and provide a baseline on which to assess progress.
- Mainly target designers and architects. A core objective would be to both influence architectural and design trends in industrialized countries and build a strong cadre of designers in tropical countries to act as ambassadors promoting new regional styles based on locally derived tropical hardwoods.
- Focus on providing information on the structural and design characteristics of tropical hardwoods, particularly through the development and distribution of design manuals and actual case studies of tropical hardwoods in use. It would need to engage in regular seminars for architects and product designers, a comprehensive public relations program targeting the design press, and regular participation in trade shows, and it would need to involve sponsorship of individual designers and of building and furniture design competitions in leading markets.
- Aim to both inform designers of the technical characteristics of tropical hardwoods and excite them with respect to the aesthetics and wider cultural narratives of tropical hardwoods. Key communication messages would be:
  - The natural design qualities of tropical hardwoods: warmth, health, beauty and exoticism and the huge diversity of colors, looks and textures.
  - The natural technical qualities of tropical hardwoods: stability, strength and low maintenance requirements, and their durability in high-exposure applications.
  - The value of choosing an authentic product over artificial alternatives.
  - Industry commitment and progress towards achieving forest certification.
  - The contribution of sustainable tropical forest management to rural development and poverty alleviation and its role as a disincentive for forest conversion.
  - The low carbon footprint and the emissions avoided by using tropical hardwoods in place of more energy-intensive products such as plastics, aluminium and steel.
- Participate in key standards-setting processes with potential for boosting market prospects for tropical hardwoods, such as processes governing forest certification, GBIs, carbon footprinting, CSR and LCAs.
- Engage in targeted political lobbying in wood-consuming countries in order to influence building laws and codes, the contents of public-sector procurement policies, and processes to develop legislation designed to remove illegal wood from trade.

1 INTRODUCTION

Objectives

This study evaluates the competitive position of tropical hardwood products vis-à-vis other products (wood and non-wood) in selected markets. It analyzes and reports on trends in the price and non-price competitiveness of tropical hardwood products from selected ITTO producer countries in Asia-Pacific, Africa and Latin America and the Caribbean to key export markets and consumer market sectors, including emerging markets.

The study considers substitution trends in selected consumer market sectors that are affecting the consumption of tropical hardwood products – such as the substitution by non-tropical wood products and other materials (such as plastics, aluminium and steel) – and the reasons for those trends.

The study determines and analyzes the key drivers of substitution in these consumer market sectors, and how they may impact on the market competitiveness of tropical hardwoods in the future.

Finally the report considers the opportunities and threats for the global market competitiveness of tropical hardwood products and recommends how ITTO producer countries can respond and adapt to emerging opportunities and threats in order to improve their competitive positions.

Scope

Drawing on the definitions in the Joint Forest Sector Questionnaire (JFSQ 2001), the scope of this project covers all tropical hardwood products derived from "sawlogs and veneer logs". It specifically excludes:

- wood fuel, which is mostly used domestically and hence has very limited reach into major tropical hardwood markets
- pulpwood, since relatively little tropical hardwood is used in pulp products.

According to JFSQ definitions, products derived from sawlogs and veneer logs are sawnwood, veneer and plywood (wood-based panels) and their various derivatives. The latter are taken to include a huge range of products, including mouldings, decking, wood furniture components, finished furniture, and builders joinery and carpentry products such as glulam, window and door frames and flooring products.

Methodology

Tropical hardwood products are a huge and heterogeneous group of products derived from varied forest types covering a significant proportion of global land area and sold into a wide range of end-using sectors in every corner of the world. The competitive pressures operating in each of these sectors vary widely. Time and budget constraints necessarily limited the opportunities for primary research. As a result, the data-gathering process was broken into two segments:

- **Desk research to identify global trends:** A broad overview of the global market position of tropical hardwoods in relation to their wood and non-wood competitors was prepared drawing on existing secondary sources. Key data sources included ITTO and FAO work on forest resources, wood trade, market access and competitiveness; market studies by other institutions; available consumer and other end-user surveys; and relevant organization policy and guidance documents in both the public and private sectors.
- **Research on specific tropical wood supply chains drawing on a combination of primary and secondary sources:** The competitiveness of tropical wood products was assessed in six key market sectors drawing on a combination of semi-structured interviews, observations at leading trade shows during the course of 2009, and a wide range of secondary sources. A key objective of this component of the research was to obtain feedback from well-informed commercial operators on: why different materials are chosen or excluded in the applications in question; and what steps may be taken to improve the competitiveness of tropical hardwoods.

Semi-structured interviews were based on a series of standard questions to identify and describe the interviewee and to guide discussion. The aim was to encourage a limited number of key decision-

makers in each supply chain to make expansive comments rather than to collect quantitative data from a large sample population. Unlike quantitative questionnaire surveys, such interviews place special demands on the interviewer, who must be familiar with the sectors under consideration and capable of taking detailed notes. Wherever possible, semi-structured interviews were undertaken during trade shows or via telephone.

Annex 1 contains a list of individuals and organizations interviewed for this study. The following trade shows were visited during the course of the research:

- Malaysian International Furniture Fair, Kuala Lumpur, 3–7 March 2009
- International Furniture Fair, Singapore, 9–12 March 2009
- Thailand International Furniture Fair, Bangkok, 11–15 March 2009
- Ecobuild, London, United Kingdom (UK), March 2009
- Milan International Furniture Show, 22–27 April 2009
- Dubai Wood Show, April 2009
- Interzum, Cologne, 13–19 May 2009.

Information derived from the two data-gathering components was brought together in a comprehensive SWOT [strengths, weaknesses, opportunities and threats] analysis. From this, a series of recommendations for improving the competitive position of tropical wood products was prepared.

Previous ITTO research

One aim of the study was to build on and update a 2001 ITTO report on the competitiveness of tropical wood and wood products vis-à-vis wood and non-wood substitutes which, based on a limited questionnaire survey of tropical-hardwood industry and trade participants in selected exporting and importing countries, evaluated perceptions of the competitive position of tropical hardwood products (Bolton and Cooper 2001 – see also Annex 2).

While that study provides useful insights into how the tropical hardwood industry and trade viewed its own competitive market position, it did not identify the sector's market threats and opportunities. The current study is significantly broader in scope. Rather than relying on interviews with the trade an effort is was to gather information on the current status of tropical hardwood products in relation to competing products and to identify their real strengths and weaknesses. An effort was also made to assess attitudes to various products in end-use sectors by reviewing existing consumer and specifier surveys and by speaking directly to designers and manufacturers.

A particularly telling conclusion of ITTO's earlier competitiveness study is that it is common for producers in exporting countries to identify their major competitors as tropical wood products from other countries. The study concluded that "interviewees in exporting countries were never specific about the growth or shrinkage of a market. Thus growth is attributed to 'strong demand from importers' for example. This inevitably raises doubts as to whether many companies are that well informed as why their end users in importing countries decide to buy or not to buy their products."

Even in isolation, this conclusion raises serious concerns about the competitiveness of the tropical hardwood industry. If producers are so poorly informed about the factors that ultimately drive demand for their products they will constantly be on the back foot, reacting to events as they arise rather than developing forward-looking strategies and innovations to expand market share.

Another, equally worrying conclusion of the ITTO's previous competitiveness study suggests that tropical producers cannot rely on distributors and the importing trade in major wood-consuming countries to do the work of market development for them. With respect to the market prospects for tropical wood in the United Kingdom (UK), the study reported that "nearly half the interviewees in the UK were gloomy and could name no strength which would help tropical timber products over the next 3 years." This suggests a remarkable level of passivity given the many obvious strengths of tropical hardwoods – both technical (e.g. durability and aesthetics) and social and environmental (e.g. carbon sequestration and support for rural development).

It is worth highlighting that while certain operators further down the supply chain in importing countries may be responsible for procuring very

large volumes of tropical hardwood products, their role is often largely to respond to market signals. Wholesalers, builders' merchants and retailers will stock whatever product the market demands if it provides a satisfactory margin. Although there are notable exceptions, these companies do not necessarily have a strong interest in working proactively to change the nature of demand, particularly in favor of a product that many customers, specifiers and green groups may be prejudiced against on environmental grounds.

Ultimately it is up to wood-product suppliers in tropical countries, with the support of their national governments, to develop the marketing strategies and innovative new products required to ensure the continued growth of market demand for sustainable tropical hardwood products. A key objective of this study was to bring together some of the information necessary to build these strategies and to guide the development of new products.

Report structure

The report is structured as follows:

- Chapter 2 examines the position of tropical wood in global wood supply, considering: the extent, nature and quality of tropical forests; their productivity compared to other forest resources; levels of sustainability and the availability of certified products; the share of plantation resources in tropical regions; recent changes in the share commanded by tropical hardwoods in global wood markets; an overview of price trends for tropical hardwoods and competing wood products; and technical innovations with potential to alter the relative competitiveness of different wood products.
- Chapter 3 provides an overview of key non-wood competitors to tropical hardwood products, identifying applications where tropical hardwood products are threatened by non-wood products. It considers the level of overall market share of non-wood products and identifies their relative strengths and weaknesses.
- Chapter 4 examines the wide range of external factors affecting the relative competitiveness of tropical hardwoods, such as: global demographic changes; the political and macroeconomic environments in tropical supply countries; relative levels of industry consolidation and the changing nature of supply chains; the impact of freight and relative international connectivity; climate change; green procurement; fashion and architectural trends; consumer perceptions; and marketing initiatives.
- Chapters 5–9 examine in detail the competitive position of tropical hardwoods in specific market sectors, as follows: tropical hardwood plywood in the United States and Europe; Southeast Asian plywood in Japan; Southeast Asian garden furniture in the United States and Europe; African sapele and Asian meranti sawn lumber in the European window sector; and African and Southeast Asian sliced veneer in the European interiors sector. Each chapter provides an overview of the current market position of tropical hardwoods in the sector; identifies and compares key competitors; and reviews the major competitiveness factors, including price, availability, quality and performance standards, and environmental standards.
- Drawing on the previous chapters, Chapter 10 identifies the key strengths and weaknesses of tropical hardwoods in relation to their competitors, and the opportunities and threats facing tropical hardwood products in the global market. Chapter 11 sets out a series of recommendations for ITTO, ITTO member governments, and the tropical hardwood industry.

2 THE POSITION OF TROPICAL WOOD IN GLOBAL SUPPLY

The current extent, nature and quality of tropical forests

Area and growing stock

Global forest cover was about 3.95 billion hectares in 2005 (FAO 2006), which was around 30% of the world's ice-free land area. Of this area, approximately 95% was natural forest and 5% was plantation forest. According to FAO, tropical forests are found between 10°N and 10°S latitudes at elevations below 1000 m (note that this definition differs from ITTO's definition, which encompasses all forests between the tropics of Cancer and Capricorn) in Central and South America and the Caribbean, West and Central Africa, and Asia and the Pacific.

In 2005 the forest resources in the tropical zone totaled 1.63 billion hectares, which was 42% of the global forest estate. Table 2.1 shows the change in forest area in the periods 1990–2000 and 2000–05; in the latter of these the world forest area declined by 7.3 million hectares. A loss of 9 million hectares in tropical regions was partly offset by an increase of 1.7 million hectares in temperate and boreal forest regions.

The data in FAO (2006) on growing stock are not comprehensive. For those countries where data are available, the average growing stock per hectare in 2005 was very similar for tropical and temperate countries –112 m^3 and 108 m^3, respectively. The implication is that of an estimated global growing stock of 433 billion m^3 in 2005, 182 billion m^3 (42%) was in tropical forests and 251 billion m^3 (58%) was in temperate forests.

Regional variations

There is huge variation in the forest situation across the tropics. A very broad summary of the current situation is as follows:

West Africa

- The ability of West African countries to supply commercial volumes of natural tropical hardwoods has deteriorated rapidly. Forests are under intense pressure from high and rising population levels and deforestation rates are high. Commercial logging in West Africa has been in excess of long-term sustainable levels for some time. The decline in West African supplies particularly affects the main commercial species of the region, including iroko, wawa, framire, khaya and niangon (FII 2004).
- Rapidly growing urban demand for wood fuel and increasing agricultural demand is likely to result in a continued reduction in forest cover (FAO 2009).
- Nevertheless, by virtue of their greater accessibility the two main West African wood-supply countries – Côte d'Ivoire and Ghana – have progressed further than most other African tropical wood-supply countries in reducing log exports and increasing the production of sawn lumber, rotary veneer and plywood. They also produce greater volumes of secondary wood products (FII 2004).

Central Africa

- Due to infrastructure constraints, lower population densities and, in some cases, political instability, large areas of the Central African forests have not yet been heavily exploited for wood. The seven countries of the Congo Basin cover about 500 million hectares, of which roughly 140 million hectares are forested. About 80% of this is considered suitable for wood production and about 50 million hectares are under some form of concession. The logging industry in the Congo Basin is organized around the two dominant species, okoumé in the south and sapele in the north, which act as the pillars of two groups of species that are differentiated both spatially and by their market niches (FII 2004).
- In 2002 Global Forest Watch reported that many rainforests in Central Africa remained in large tracts of low-access forest – defined as contiguous forest blocks, unbroken by public roads, of at least 1000 km^2. Over two-thirds (68%) of Central Africa's rainforest is in such tracts, constituting the world's second-largest

Table 2.1 Forest land area change, by sub-region

Region	Forest area (million ha)			Annual rate of change (%)	
	1990	2000	2005	1990–2000	2000–05
Eastern and Southern Africa	252.4	235.0	226.5	-1.7	-1.7
Northern Africa	146.1	136.0	131.0	-1.0	-1.0
Western and Central Africa	300.9	284.6	277.8	-1.6	-1.4
Total Africa	**699.4**	**655.6**	**635.4**	**-4.4**	**-4.0**
East Asia	208.2	225.7	244.9	1.8	3.8
South and Southeast Asia	323.2	297.4	283.1	-2.6	-2.9
Western and Central Asia	43.2	43.5	43.6	0.0	0.0
Total Asia	**574.5**	**566.6**	**571.6**	**-0.8**	**1.0**
Total Europe	**989.3**	**998.1**	**1001.4**	**0.9**	**0.7**
Caribbean	5.4	5.7	6.0	0.0	0.1
Central America	27.6	23.8	22.4	-0.4	-0.3
North America	677.8	678.0	677.5	0.0	-0.1
Total North and Central Asia	**710.8**	**707.5**	**705.8**	**-0.3**	**-0.3**
Total Oceania	**212.5**	**208.0**	**206.3**	**-0.4**	**-0.4**
Total South America	**890.8**	**852.8**	**831.5**	**-3.8**	**-4.3**
World	**4077.3**	**3988.6**	**3952.0**	**-8.9**	**-7.3**
Of which:	0.0	0.0	0.0	0.0	0.0
Mainly tropical	1760.4	1672.4	1627.1	-8.8	-9.0
Mainly temperate	2316.9	2316.2	2324.9	-0.1	1.7

Source: FAO (2006)

expanse of intact tropical rainforest after the Amazon. However, such forests are increasingly coming under development and new roads are providing access to previously remote regions. FAO (2009) predicted that improved accessibility would favor forest clearance for commercial and subsistence agriculture.

- FAO (2009) also expected progress in implementing sustainable forest management (SFM) to be slow in the region, primarily because of the generally unfavorable investment climate; severe institutional, financial and technical constraints hindering the ability of forestry administrations to manage logging concessions, which have often expanded so fast that governments cannot enforce rules and regulations and fully recover potential income; illegal activities and corruption; policies and institutional, technical and economic hurdles limiting wider adoption of community-based forest management; and a tendency to transfer only degraded forests to local communities, which lack the investment capacity to rehabilitate them.

Asia and the Pacific

- The area of natural forests managed for wood supply in the region has declined, partly because of the complexity and higher costs of natural forest management (FAO 2009). However, the forest situation varies very widely by country in the region. Some, such as Cambodia and Myanmar, still have extensive areas of undisturbed natural forest. Others, like Thailand and Bangladesh, are effectively logged out and have no commercially available areas of either undisturbed or semi-natural forest. Most other countries lie between these two extremes (FAO 1999).
- In general, institutional arrangements for forestry are weak throughout the region and unsustainable and often illegal logging is likely to continue, depressing the economic viability of SFM (FAO 2009).
- The region's two largest wood-producing countries, Indonesia and Malaysia, have both produced much more wood than the estimated long-term sustained yield in natural forests in recent years, partly because of the large quantity of wood derived from conversion forests (FII 2004).

- The levels of log harvest in Indonesia during the early years of the most recent decade may have been as high as 70 million m^3 per year. In 2006 Indonesia's Ministry of Forestry estimated the volume of illegal harvest to be 52 million m^3. The Government of Indonesia orchestrated a concerted campaign to eradicate this problem. One effect was a sharp decline in legally sanctioned harvests in Indonesia's natural tropical forests between 1999 and 2005, from more than 25 million m^3 per year to 5 million m^3 per year. In 2007 the Ministry of Forests projected that legally sanctioned volumes available from natural forests would rise from 5.8 million m^3 in 2007 to 15.1 million m^3 in 2017. While this would be a significant increase it would still be only a fraction of the levels prevailing in the 1990s (FII 2008).
- Supply from Malaysia's natural forests is currently 19–21 million m^3 per year; under the Ninth Malaysia Plan (2006–2010), log output was expected to be 19.6 million m^3 in 2010. According to the Malaysian Timber Council, log production from natural forests is expected to decline to around 14 million m^3 by 2020.
- In some countries, notably Thailand, Indonesia, India, the Philippines and Viet Nam, declining production in natural forests is being compensated by increased wood production in planted forests. Wood produced from these forests is generally much smaller and less durable than wood derived from natural forests.
- China has had a huge impact on log supply in Southeast Asia over the last decade: between 2003 and 2008 it imported 7.5–8 million m^3 of tropical hardwood logs per year. Recent modeling studies of China's future wood supply indicate that a massive supply–demand gap will open up over the next two decades in response to the declining availability of logs in Asia and huge growth in domestic consumption. The gap is expected to be particularly pronounced for decorative hardwoods from large-diameter logs (Northway and Bull 2007).

South and Central America

- In total, the Amazon rainforest covers 550 million hectares, around 60% of which is in Brazil. Over 80% of the original forest of the region remains intact. Large areas of the Amazon rainforest are reserved or are so remote that they are inaccessible for wood production. Annual deforestation rates in Brazil declined from 2.5 million hectares in 2004 to 1.2 million hectares in 2007. Brazil now has ambitious plans to reduce deforestation in the country by 70% against a 1996–2005 baseline through the creation of the Amazon Fund (FAO 2009).
- Nevertheless, FAO (2009) suggested that with the increasing global demand for food, fuel and fiber, forest-rich countries in South America that remain dependent on natural resources will continue to lose forests to large-scale industrial agriculture and cattle ranching as long as these remain competitive. New planted forests for industrial uses may partially offset the loss of natural forests in terms of wood production, but these are primarily being established outside the tropical zone, for example in Argentina, Uruguay, and southern Brazil.
- Natural forests remain an important source of wood in some countries. Natural production forests are largely managed through long-term private concessions of up to 200 000 hectares in Bolivia, Guyana and Suriname; medium-sized concessions in Guatemala, Peru and Venezuela; and small-scale concessions in Colombia, Ecuador, Honduras and Trinidad and Tobago. In Brazil, nearly all production has been in private forests, but new procedures are now opening up national forests in the Amazon for logging concessions with the intention of encouraging sustainable management (FAO 2009).
- The Brazilian government intends to allocate 50 million hectares of public lands under concession agreements by 2010, with the first agreements announced in early 2008. ITTO (2006a) estimated that the area of permanent forest estate on private lands in Brazil available for wood production was 43.9 million hectares, of which 21.9 million hectares of currently accessible forest could produce a sustainable yield of 15.2–21.9 million m^3 per year.
- Nevertheless, FAO (2009) identified significant constraints to sustainable forest management in the region as a whole. Selective logging is the primary focus of most concession management, with little attention being paid to post-harvest silviculture and unregulated harvesting leading

to degradation. Obstacles to sustainable natural forest management for wood production include the scarce adoption of reduced impact logging because of weak incentives; high costs and the absence of a price premium for certified wood, especially with the availability of low-priced illegally procured wood; ownership disputes from overlapping land tenure and illegitimate titles, which encourages illegal logging and land conversion, especially in the Amazon; diseconomies of scale for small community-managed concessions, especially those remote from markets; and the preponderance of the informal sector (especially illegal logging and wood-processing units). Such difficulties will discourage long-term private investments, and most logging will continue to be done by short-term investors.

- Against this background, accurate information on the level of commercial harvesting in the Brazilian Amazon has not been available. An ITTO Expert Mission Report to Brazil (ITTO 2002) noted that the Amazon region of Brazil produces about 60 million m^3 of roundwood per year. This contrasts with data from ITTO (2008a), which estimated average annual tropical hardwood log production levels between 2002 and 2007 of only around 25 million m^3, although the ITTO figures exclude tropical softwoods that may be included in the former. In practice it is extremely difficult to estimate the volume of wood derived from forest conversion in the Brazilian Amazon each year. The vast majority of wood (typically in excess of 90%) harvested in Brazil is consumed domestically.

Relative productivity and yield of tropical hardwood forests

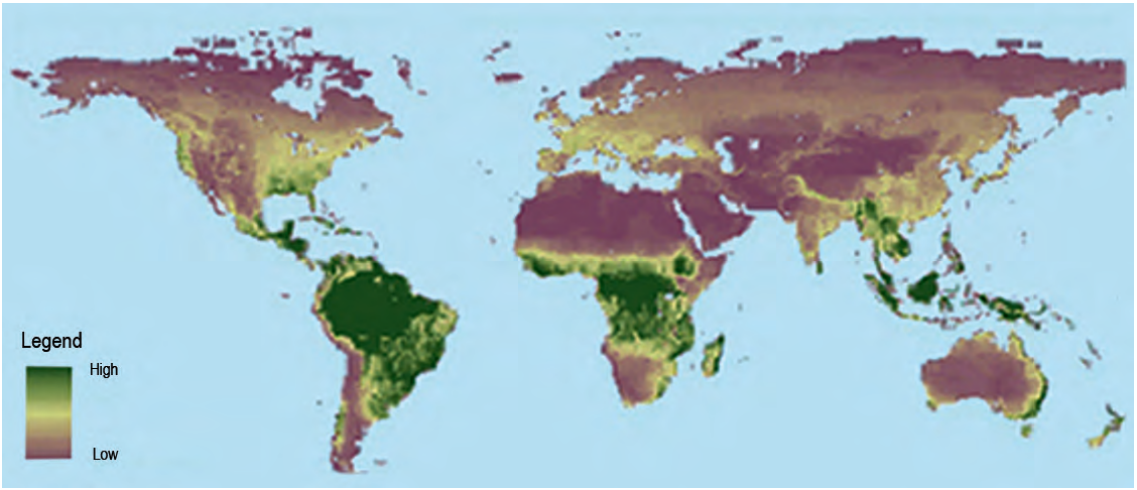
Advantages in the production of high-quality wood

Based on current global estimates of the spatial distribution of net primary productivity (Imhoff *et al.* 2004), tropical forests generally exhibit the highest productivity of all ecosystems (Figure 2.1).

Natural tropical forests have certain other natural advantages when it comes to the production of high-quality wood. Due to limited light below the forest canopy, tropical forest trees are adapted to maintaining branchless, straight and clear trunks that, for most merchantable species, are 30 meters or more in length and have diameters reaching 1.5 meters at breast height. The majority of trees have smooth, thin bark because there is no need for protection against water loss and freezing temperatures. This makes it difficult for epiphytes and plant parasites to fix themselves to trunks and, as a result, tropical hardwoods do not usually have natural defects – such as knots and rots – that can undermine quality and yield.

The wood of tropical hardwoods typically lacks growth rings due to continuous growth. For most of the dark-colored wood species there is usually a sharp color distinction between sapwood and heartwood, while there is usually no difference between the two in light-colored species. The diverse nature of tropical hardwoods is reflected in their differing physical hardnesses: some species (e.g. wawa) are extremely soft and fall within the lowest-density group of woods, some (e.g. sapele) are medium in density, and some (e.g. ekki) are

Figure 2.1 Spatial distribution of net primary productivity (grams of carbon)



Source: Adapted from Imhoff et al. 2004

among the densest or hardest of all woods. The high concentration of extractives in most tropical hardwoods imparts a broad range of attractive color variations, making many species amenable to high-value end uses.

Lower levels of productivity than temperate forests

Despite these natural advantages, tropical forests generally produce lower volumes of saleable wood compared to temperate forests. According to Vanclay (1996), natural forests in the humid tropics differ from temperate and plantation forests in several ways:

- There may be many tree species (often more than 100 in a single hectare and over 1000 in a region), many of which occur infrequently. Even common species may occur only once in a given hectare.
- There may be a large range of tree sizes and shapes. The size distribution often follows a 'reverse-J' or negative exponential distribution, with trees of every size but few large and many small trees. Trees may also be buttressed, fluted or otherwise 'deformed'.
- Tree ages may be unknown and indeterminate (growth rings, if present, may not be annual rings).
- Despite the luxuriant appearance of some rainforests, soils may be relatively infertile, with most of the nutrients present in the biomass rather than the mineral soil.

The annual wood yield of a tropical forest is generally very low. A 2002 survey of 31 logging concessions in the Congo Basin by the Center for International Forestry Research (CIFOR) for ITTO gave an average productivity of 6.1 m^3 per hectare. The value was highly variable, ranging from less than 0.1 m^3 per hectare to 13 m^3 per hectare. Gabon, which harvests only few species, particularly okoumé, showed a consistently higher productivity than other countries in the region. Productivity per hectare was lowest in the Central African Republic, which also harvests only a few species, particularly sapele (ITTO 2004a). Even these figures, however, are likely to over-estimate the long-term potential yield, given that over half of the concessions sampled lacked a management plan at the time of the survey. Moves to full management planning and eventual certification tend to be accompanied by a reduction in harvesting intensity. A large Ghanaian concession-holder working towards FSC certification interviewed for the current study said that average yields in a well-managed natural forest in Ghana were no more than 1.5 m^3 per hectare per year.

A study of sustainable wood yield in the Brazilian Amazon in the 1980s and 1990s (Silva *et al.* 1995) suggested similar low levels of productivity. It found that wood volume increased by approximately 4–6 m^3 per hectare per year, of which only 0.8 m^3 per hectare per year comprised commercially valuable species. The commercialization of new species would raise this yield to no more than 1.8 m^3 per hectare per year.

By comparison, a recent study of projected long-term yield in German forests, the majority of which are managed semi-natural forests, predicted the following average annual yields per hectare: 8 m^3 for spruce; 7.5 m^3 for beech; 5.75 m^3 for pine and larch; and 4.75 m^3 for oak. In many parts of the world, plantation yields are considerably higher (see below).

Gap between species availability and market demand

In addition to low overall yield, another challenge for the tropical hardwood industry is the gap which exists between the species that natural tropical forests are capable of producing in commercial volumes and market demand for particular wood types. In many tropical regions a handful of species are preferred in the market place and make up the bulk of production, while other species are under-used. In large parts of tropical Africa, for example, the prime species have largely been logged out, while natural regeneration mainly results in the growth of lesser-known species. Nevertheless, trade remains concentrated on a few prime species. In the Central African Republic, loggers harvest 15–18 timber species, but five species make up 90% of production. In northern Congo, 18–20 species are harvested, but five species account for nearly 80% of production. The market for Asian tropical wood is concentrated on dark red meranti/seraya/lauan, ramin and teak, although other species, including keruing, balau and merbau, have recently been traded in increasing volumes.

The declining quality of these primary species is now becoming increasingly evident in international trade. For example, during a conference convened by the International Wood Products Association

(IWPA) in 2008 , buyers formally complained to tropical producers about the waning quality of core veneers – for which the producers blamed poor-quality raw material from the forests – and threatened a possible shift to MDF.

Low financial yield

The relatively low yield of saleable wood in natural tropical forests is matched by low projections of financial yield from the sustainable management of tropical forests for wood production. For example, in a comprehensive review of literature on the direct financial returns to be derived from various forest-use regimes in the tropics, Pearce *et al.* (1999) showed that sustainable wood production is outperformed by many alternative land-uses including liquidation logging, conversion to intensive plantations, and, in some instances, cattle ranching. They concluded: "While sustainable systems appear capable of earning returns in excess of some 'modest' discount rate (5%, and in some cases 10%), they do not compete financially with other systems".[1]

Plantations

High yields mean that plantations make a disproportionately large contribution to global wood-fiber supply. For example, while plantations accounted for only about 5% of global forest cover in 2000 they provided an estimated 35% of global roundwood production (Hassan *et al.* 2005). Short rotations mean that economic returns can be achieved relatively quickly. This is particularly so in the tropics, where, for some eucalypt plantations, rotation lengths can be as short as seven years (Saville *et al.* 1997). High productivity and a relatively quick economic return suggest that plantation development has significant potential to offset the loss of wood supply from natural tropical forests. An analysis of current trends indicates, however, that this potential is not being realized and that tropical regions have fallen well behind other regions in the development of fast-growing plantations.

In most cases yields are significantly higher in plantations than they are in natural forests in both tropical and temperate regions. In the tropics, annual plantation wood increment is generally in the range 10–30 m³ per hectare per year, compared to 1–5 m³ per hectare per year in natural forests (Evans and Turnbull 2004). *Eucalyptus* is particularly high-yielding, capable of achieving increments of 45–100 m³ per hectare per year (Brown 1999). Fast-growing species in temperate regions commonly yield 20–30 m³ per hectare per year; with grand fir capable of a yield of 34 m^3 per hectare per year on some sites in Scotland (Aldhous and Low 1974) and radiata pine capable of growing at 40 m^3 per hectare per year in southern Australia (Everard and Fourt 1974). With further research, for example through genetic modification, these yields are likely to increase.

The wood supplied by plantations is not directly comparable to the wood supplied by natural forests. Fast growth generally implies significantly lower density and lower durability. The differences can be profound, even when dealing with the same species. For example, the properties of natural-forest teak are very different to the properties of plantation-grown teak, with the latter having a lower density, more sapwood and smaller dimensions. Compared to natural forests, plantations offer a more uniform wood quality, making them better-suited to the large-scale production of pulp, panels and other commodities but generally less appropriate for the supply of decorative products.

While plantations can offer high yields and there is significant potential for plantation expansion in some tropical regions, plantations are not necessarily the optimal forest management solution and may actually offer inferior commercial production potential compared to managed natural tropical forests. For example, a recent SWOT analysis of plantations in Ghana highlighted that, while performing well in drier savanna areas, plantations may perform poorly in the wet and moist evergreen zones due to difficult soils, the need for heavy weeding, and a very restricted base of suitable species (Hardcastle, P., personal communication, November 2009). Similarly, a study of silvicultural options for Cameroon's rainforest zone concluded that experience with systems involving complete site clearance followed by replanting has "not been very promising" (Hardcastle *et al.* 1998). This was due to a combination of factors relating to site

1 Pearce et al. also highlight the limitations of such economic analyses and suggest that "the prospect of sustainable forest management is low in the early stages of development, and increases as the values attached to the forest and its services rises over time. Extended to include carbon and biodiversity values, it is arguable that the potential for sustainable forestry is far greater, even in the early stages of development, than might be thought".

(e.g. lack of nutrients retained in tropical soils), pests (e.g. cleared sites were frequently invaded by the shrubby weed *Chromolaena odorata*, which depressed regeneration and increased vulnerability to fire), and management (e.g. a lack of planning and supervision often led to the application of inappropriate techniques). The study concluded that the optimal silvicultural regime in Cameroon's rainforest zone was "carefully managed polycyclic felling [of natural forest] with a long return cycle of perhaps 40 years".

Table 2.2 shows the current distribution of plantations around the world. Countries located fully in the temperate forest zone account for the largest share – 48.2 million hectares (43%) of the 109.6 million hectares of commercial plantations established worldwide. Countries located in 'mixed'

Table 2.2 Plantation area, by region and forest zone

Region	Forest zone	Plantation area			Of which productive (2005; '000 ha)	Rate of planting	
		1990	2000	2005		1990–2000	2000–05
		('000 ha)	('000 ha)	('000 ha)		('000 ha/yr)	('000 ha/yr)
Western and Central Africa	Tropical	1204	1660	2089	1975	46	86
	Temperate	1339	1473	1540	1540	13	13
	Tropical	1270	1304	1316	1250	3	2
Northern Africa	Arid/ mountain	8244	8248	8226	6033	0	-4
South and Southeast Asia	Arid/ mountain	283	348	371	361	7	5
	Mixed (India)	1954	2805	3226	1053	85	84
	Tropical	10 528	12 048	13 037	10 411	152	198
East Asia	Mixed (China)	18 466	23 924	31 369	28 530	546	1489
	Temperate	11 065	11 594	11 797	1476	53	41
Western and Central Asia	Arid/ mountain	4296	4946	5096	2591	65	30
Europe	Temperate	9877	11 227	10 679	9727	135	-110
Russia	Temperate	12 651	15 360	16 962	11 888	271	320
Caribbean	Tropical	393	393	449	279	0	11
Central America	Tropical	83	211	274	240	13	13
North America	Mixed (Mexico)	0	1058	1058	72	106	0
	Temperate	10 305	16 274	17 061	17 061	597	157
South America	Mixed (Brazil, Paraguay)	5093	5315	5427	5427	22	22
	Temperate	2711	4101	4656	4641	139	111
	Tropical	427	1159	1274	1258	73	23
Oceania	Tropical	163	236	247	235	7	2
	Mixed (Australia)	1023	1485	1766	1766	46	56
	Temperate	1261	1769	1852	1832	51	17
All regions	Tropical	14 068	17 011	18 686	15 648	294	335
	Temperate	49 209	61 798	64 547	48 165	1259	550
	Arid/ mountain	12 823	13 542	13 693	8985	72	30
	Mixed	26 536	34 587	42 846	36848	805	1652
	Total	**102 636**	**126 938**	**139 772**	**109 646**	**2430**	**2567**

Source: FAO (2006)

forest zones (i.e. that have areas of both tropical and temperate forest – Brazil, Mexico, Paraguay, China, India and Australia), account for a further 36.9 million hectares (33%). The vast majority of this plantation area is located outside the tropical forest zone, particularly in central and northern China and to a lesser extent in southern Brazil. Only 15.6 million hectares (14%) of the world's plantations are in countries fully located in the tropics, the vast majority of which is in Southeast Asia (mainly Indonesia, Thailand, Viet Nam and Malaysia).

Globally, new forest plantation areas were established at a rate of 2.6 million hectares per year between 2000 and 2005. The center of gravity in plantation establishment shifted during the course of the present decade. In the 1990s the majority of new plantations were established in temperate regions (notably in the United States, Russia and Chile), but since 2000 the vast majority of new plantations have been established in China. Tropical regions have also seen a slight increase in the rate of plantation establishment, with Viet Nam, Ghana, Côte d'Ivoire, Rwanda, Indonesia, Laos, Myanmar and Cuba all making gains. Compared to the massive expansion of China's plantation area, however, these have been modest.

Plantation establishment in China has been boosted by the National Fast Growing and High Yield Plantation Programme, which was initiated in 1998 as part of the National Natural Forest Protection Programme. In an effort to shift the country towards wood self-sufficiency, the Chinese government is investing US$8.7 billion to establish at least 13.33 million hectares of new plantations by 2015. The rate of plantation establishment has remained high in recent years. ITTO (2008b) reported the total plantation area in the country to be 53.25 million hectares, of which 12.5 million hectares were in the tropics. 35% of China's plantation area is managed for wood pulp, 43% for wood-based panels, 9% for large-diameter logs, 4% for bamboo and 2% for precious species.

Some tropical countries now have ambitious programs to expand their forest plantations. In Malaysia, for example, the government aims to increase tree plantation license areas by 375 000 hectares in Sabah, Sarawak, Johor, Terengganu and Pahang in five years and is offering full tax exemption for 15 years as an incentive to companies (Malaysian Timber Council 2005). In addition, the 2006 federal budget included US$59 million for a state enterprise to provide support for the establishment of tree plantations. The Sarawak state government has a target to establish around 1.4 million hectares of plantation production forest areas in the next 20 years. However, at present, private sector investment in forest plantations has yet to materialize on a significant scale (United States Department of Agriculture Foreign Agriculture Service 2006).

Worldwide, the leading plantation species are *Eucalyptus* spp. and *Pinus* spp. (Table 2.3). Together

Table 2.3 World forest plantations by species group

	Total area ('000 ha)	New plantation area ('000 ha/yr)	Plantation area by species group ('000 ha)							
			Acacia	Eucalyptus	Hevea	Tectona	Other broad-leaves	Pinus	Other conifers	Un-specified
Africa	8 036	194	345	1 799	573	207	902	1 648	578	1 985
Asia	115 847	3 500	7 964	10 994	9 058	5 409	31 556	15 532	19 968	15 365
Europe	32 015	5					15			32 000
North and Central America	17 533		234	198	52	76	383	15 440	88	1 297
South America	10 455		509	4 836	183	18	599	4 699	98	23
Australia/ Oceania	3 201	50	8	33	20	7	101	73	10	2 948
World total	**187 086**	**4 493**	**8 317**	**17 860**	**9 885**	**5 716**	**33 556**	**37 391**	**20 743**	**53 618**

Source: FAO (2001)

these two genera constitute about one-third of the world's plantation area. Eucalypt plantations are found on a large scale in Brazil, South Africa, China, India and Viet Nam. *Pinus* has been planted on a large scale in the United States, Chile, Australia, South Africa, Brazil and China. In the tropics the main species are rubberwood, acacia and teak (FAO 2001).

Sustainability and forest certification

ITTO's *Status of Tropical Forest Management 2005* (ITTO 2006a) estimated that the area of sustainably managed production forest in ITTO producer countries was 27 million hectares in 2005, which was about 7% of the total forest area reviewed at that time (Table 2.4). That report applied a comprehensive definition of SFM, and 7% represented a significant increase over the previous ITTO survey in 1988 (Poore *et al.* 1989). Nevertheless, the implication is that a significant proportion of tropical wood continues to derive from unsustainably harvested forests, reinforcing the conclusion that, overall, the volume of wood extracted from natural tropical forests will continue to fall in the future. It also implies continuing loss of market share in those market segments that demand reliable assurances of sustainability.

Since 2005 there has been progress in expanding management planning and certification in tropical countries. The area of FSC-certified forest in tropical Africa increased by 80% during 2008 and now stands at 5.6 million hectares. The area covered by management plans in the region is around 25 million hectares, 10 million hectares of which have been independently verified as in compliance. In April 2009, the Gabonese Forest Certification Scheme became the first African scheme to meet the requirements of the Programme for the Endorsement of Forest Certification (PEFC). Peninsular Malaysia has also taken decisive steps to implement certification. The Malaysian Timber Certification System (MTCS) was endorsed by PEFC in May 2009. The 4.8 million hectares of MTCS-certified forest includes the entire area of permanent production forest in Peninsular Malaysia. Progress to implement certification has been made in some tropical areas of South America. In Bolivia, for example, FSC certification currently extends to around 2.3 million hectares of the 7 million hectares of natural forests for which harvesting rights have been granted nationally.

Despite these pockets of progress, tropical forests continue to lag well behind temperate forests in certification (Figure 2.2). While more than 50% of Europe's forests and nearly 40% of North American forests are certified, only a tiny proportion of the forest estate in Latin America, Africa and Asia is certified. Over 97% of the world's production of FSC-certified or PEFC-certified industrial roundwood is estimated to derive from forests in North America and Europe.

The constraints to forest certification in the tropics are well documented. They include the extra costs involved, particularly those associated with the reduction in yield compared to conventional logging and, in the absence of state infrastructure, the costs of providing appropriate social services; the lack of consistent market signals and price premiums; the numerous opportunities to sell uncertified products, particularly in new and emerging markets; and shortages of skills and experience in responsible forest management.

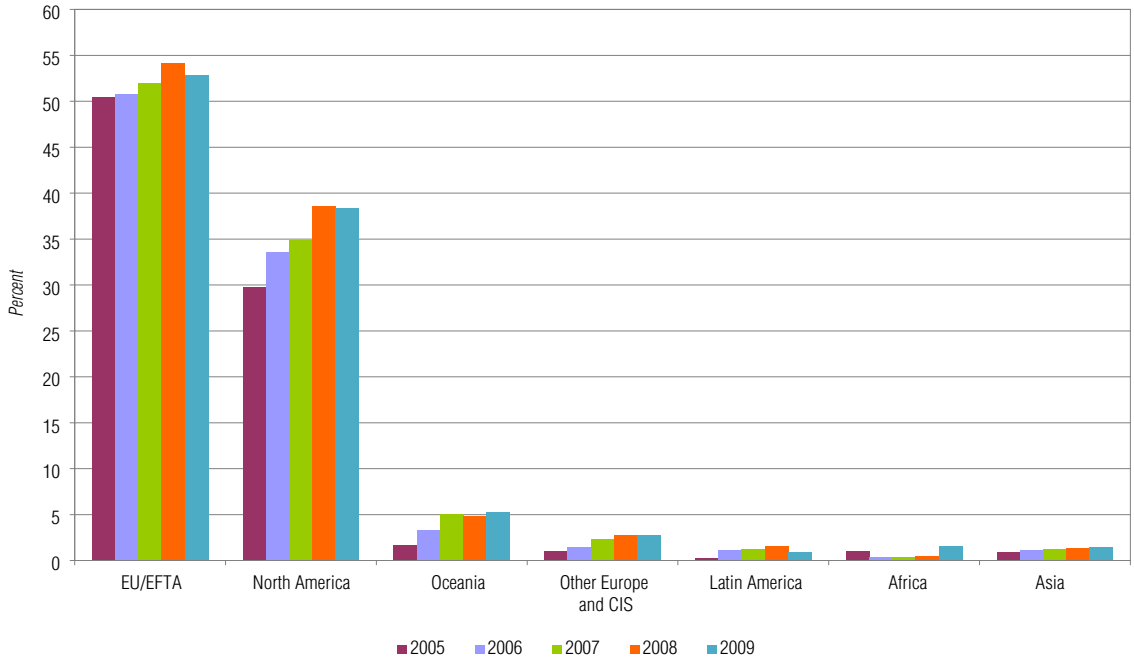
The certification of tropical plantations is also challenging. For example, plantation forests are likely to be ineligible for certification if logged-over forest was converted during their establishment.

Table 2.4 Summary of management status of tropical permanent forest estate established for production

	Natural				Planted		
million hectares	**Total area**	**With management plans**	**Certified**	**Sustainably managed**	**Total area**	**With management plans**	**Certified**
Africa	70.5	10	1.5	4.3	0.8	0.5	0
Asia and Pacific	97.4	55.1	4.9	14.4	38.4	11.5	0.2
Latin America and Caribbean	184.7	31.2	4.2	6.5	5.6	2.4	1.6
Total	**352.6**	**96.3**	**10.5**	**25.2**	**44.8**	**14.3**	**1.8**

Source: ITTO (2006a)

Figure 2.2 Certified forest as a percentage of total forest area, by region, 2005–09



Note: Proportion of forest area is calculated using FAO (2007) data, excluding the category 'other wooded land'. Eastern Europe includes only non-EU countries. Information valid as of May 2009.

Source: Compiled by the authors from individual certification systems, Forest Certification Watch, the Canadian Sustainable Forestry Certification Coalition and FAO (2006)

Under the rules of the FSC this can preclude from certification the area undergoing conversion, the plantation that follows, and any associated areas of natural forest that are covered by the same license or are licensed to the same company but are being managed sustainably (Knight and Sarshar 2007).

Certification challenges are not unique to the tropical forest sector; they are also a common feature of the temperate hardwood sector. Temperate hardwood resources in both Europe and North America are concentrated in the hands of non-industrial owners who are not in a position to benefit from economies of scale in forest certification and who are often insufficiently organized to exploit new systems of regional and group certification. In the United States it is estimated that no more than 100 000 (1%) of the 10 million forest land-owners are certified.[2] The majority of forest area certified in temperate regions comprises softwood rather than hardwood forests.

Tropical hardwood applications

The key characteristics of most hardwoods are their high density and aesthetic appeal relative to softwoods. Species with a high density have high strength properties and vice versa. Natural durability is a third characteristic of many tropical hardwoods that sets them apart from most softwoods and temperate hardwoods. To a significant extent, therefore, applications for individual tropical hardwood species are dependent on their combination of natural durability, high density and aesthetics. Tropical hardwoods may be very broadly divided into three groups based on this combination of factors (Table 2.5).

Due to the relative abundance of temperate and boreal wood species that are suitable for a host of structural and joinery applications and that have benefited from innovation to extend their range of applications, the use of tropical hardwoods has focused increasingly on either decorative or high-exposure applications (e.g. external joinery, boat-building and marine works).[3]

2 The PEFC-endorsed American Tree Farm System is the only system that has so far certified large numbers of small owners in the United States; it estimates that 90 000 forest owners are currently enrolled in the scheme.

3 More detailed discussion of specific tropical hardwood applications in different sectors is contained in Chapters 5–10.

Table 2.5 Summary of tropical hardwood applications

Use categories	Desirable wood properties	Main end uses	Examples of matching tropical species	Notes
Decorative woods	Appearance, consistent quality, dimensional stability, durability, good machining, staining and finishing properties, hardness (for the flooring industry)	Quality furniture and interior joinery	Teak, *Khaya* spp., *Dalbergia* spp., *Aningeria* spp., makore, sapele, bete, walnut, iroko, utile, okoumé, merbau, jatoba	This is the highest-value use category Solid wood is being increasingly replaced by MDF veneered panels There is competition from temperate hardwoods and non-wood surfaces The flooring sector requires wood combining decorative qualities with high density
High-to-very high-density woods	Appearance, strength, high natural durability, availability in large sizes	Principally in construction	Keruing, Greenheart, Ekki, Iroko	This use category constitutes a small share of total tropical timber use There is a more limited range of substitutes in this category The requirement for high-density woods is increasing in parts of the window sector
Low–to-medium-density utility woods	Appearance, clear grain, natural durability, good machining properties	External joinery, shop fitting, medium-priced furniture	*Shorea* spp, limba, niangon, rubberwood	This is the largest end-use category by volume and is prone to competition from substitute materials

Source: Updated from Cooper (1991)

Recent changes in the global share of wood markets

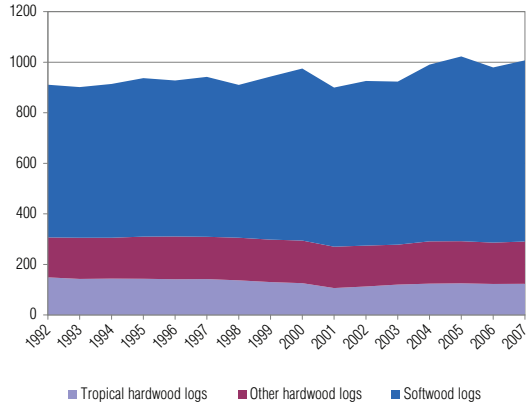
Share of global wood production

Figures 2.3 and 2.4 provide a broad overview of changes in the share of tropical wood in global wood production. According to FAOSTAT (2009), total global log production increased from around 0.9 billion m^3 in 1992 to just over 1 billion m^3 in 2007. The share of tropical hardwood logs in total global log supply fell from around 16% in 1992 to 12% in 2007. Tropical hardwood log production declined dramatically in the period 1992–2001 from around 148 million m^3 to 107 million m^3 but rebounded to around 125 million m^3 in 2005. Overall production has declined slightly since then.

Figure 2.5 indicates that the shape of the tropical hardwood log production curve is very heavily influenced by events in Malaysia and Indonesia, which, together with Brazil, account for the bulk of overall production. The curve is largely explicable with reference to the decline in demand that occurred in the wake of the 1998 Asian financial crisis, which led to a prolonged period of reduced production in Southeast Asia followed by a big increase in production during the middle years of the most recent decade as global demand, notably from China, surged. More recently, severe supply shortages have begun to be felt, only partly offset by a rise in production from plantations.

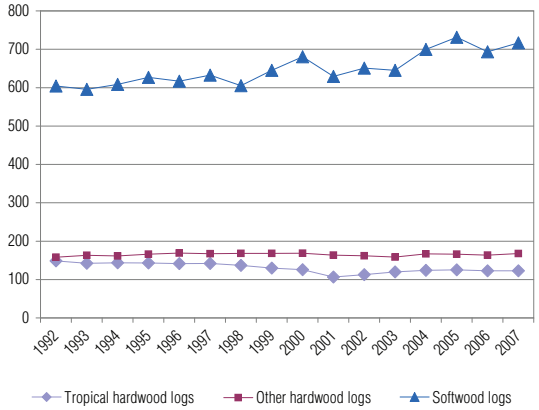
Meanwhile, the global production of temperate hardwood logs has been remarkably stable, fluctuating between 158 million and 168 million m^3 in the period 1992–2007. This picture of broad stability masks a shift in the geographic distribution of supply. Over the period there was a significant increase in hardwood log production in Russia and parts of Eastern Europe. Hardwood log production in the United States, which is by far the world's largest single producer, reached record levels at the end of the 1990s but then declined dramatically, before recovering slightly and stabilizing at around 60 million m^3 in 2007.

Figure 2.3 Total global production of sawlogs and veneer logs, 1992–2007 (million m³)



Source: FAOSTAT (2009)

Figure 2.4 Volume of sawlog and veneer log production, 1992–2007 (million m³)



Source: FAOSTAT (2009)

Although the United States hardwood resource is among the largest in the world, there are significant constraints to increased supply in the country, including declining domestic demand as the domestic furniture industry has largely relocated to China; a hugely fragmented ownership structure; rising stumpage rates, even during times of slow lumber demand because forest owners simply defer harvesting until the market shows more strength; increasing numbers of owners managing hardwood forests for non-wood objectives; a lack of credit for the hardwood industry; a lack of qualified harvesting personnel; and a general shift of skills away from the wood industry into other more lucrative and fashionable business sectors.

As these changes have been ongoing in the hardwood sector, a big increase in the level of global production of softwood logs occurred during the period 1998 to 2007, with volumes rising from 600 million m^3 to well over 700 million m^3. Again this increase was uneven. Declining production in the several industrialized countries, notably the United States and Japan, was more than offset by increases in production in the Russian Federation, Canada, Northern Europe, and China.

Between 1992 and 2007 the volume of sawn lumber produced annually in tropical countries declined from around 55 million m^3 to 40 million m^3. During the same period, plywood and veneer production in tropical countries remained broadly flat at around 16 million m^3 and 3 million m^3, respectively (Figure 2.6). In terms of their contribution to overall global production of these commodities, tropical countries have become relatively less significant. In 1992 they accounted for 45%, 32% and 13% of the world's production of veneer, plywood and sawnwood, respectively, but, by 2007, these percentages had fallen to 30%, 21% and 9%, respectively (Figure 2.7).

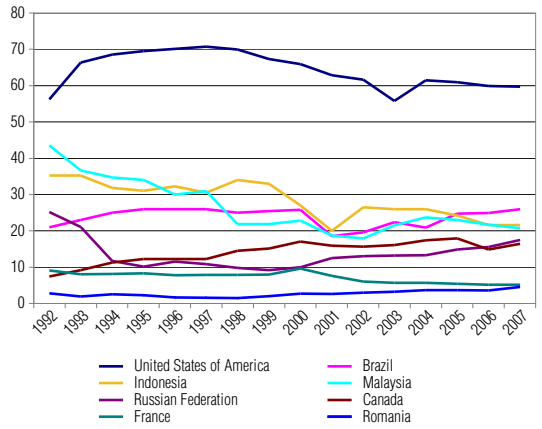
The big fall in the share of global plywood and veneer production in tropical countries was due largely to the rapid emergence of China as a large producer of those commodities. Between the early 1990s and 2007, China's share of global plywood production increased from 6% to 42%, while the country's share of global veneer production increased from 1% to 27%. This is despite a significant decrease in China's domestic sawlog and veneer log production, from a peak of 38 million m^3 in 1998 to 33 million in 2007. The log supply gap has been entirely plugged by rising levels of imports into China.

Share of global wood trade

The fact that China is so reliant on imported products, together with the comparatively small domestic markets in tropical countries, explains why tropical hardwoods continue to make up a large proportion of internationally traded primary wood products (Figure 2.8). Despite a fall in recent years, tropical hardwoods still contributed 38% of the total plywood volume exported by all ITTO members in 2008.[4] The share (by volume) of

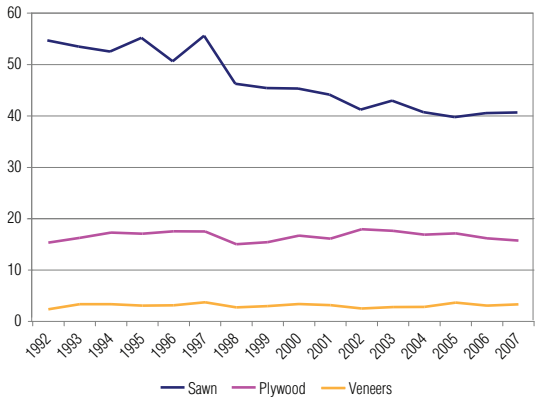
4 The ITTO membership includes the majority of the world's largest wood producers in both the tropics and the temperate zone, with the notable exception of Russia.

Figure 2.5 Volume of hardwood sawlog and veneer log production, by leading producer country (million m^3)



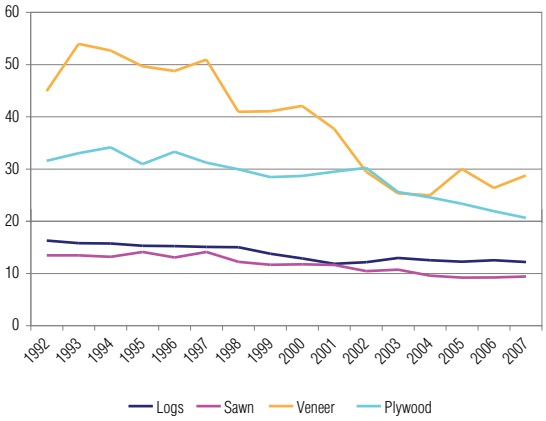
Source: FAOSTAT (2009)

Figure 2.6 Volume of hardwood sawnwood, plywood and veneer produced in tropical countries (million m^3)



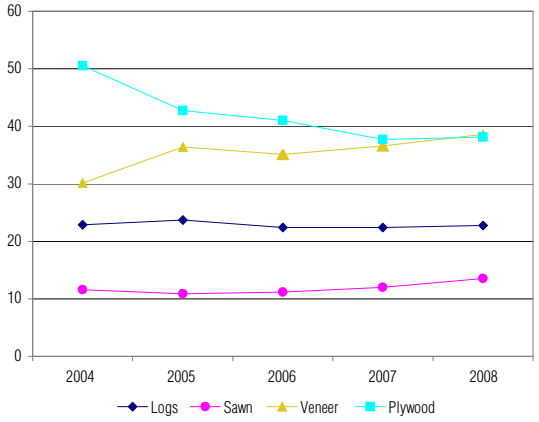
Source: FAOSTAT (2009)

Figure 2.7 % share of tropical countries in global production of hardwood logs, sawnwood, plywood and veneer (by volume)



Source: FAOSTAT (2009)

Figure 2.8 % share of tropical hardwood logs, sawnwood, veneer, and plywood in international trade (by volume)



Source: ITTO (2009a)

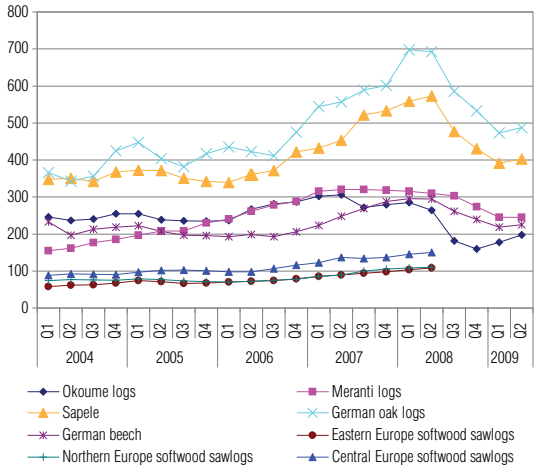
tropical hardwoods in international trade increased from 12% to 14% for sawnwood and 30% to 39% for veneer between 2004 and 2008. The share of tropical logs in international log trade remained stable during this period, at around 23%.

Overview of price trends for tropical wood and competing wood products

Since the price competitiveness of tropical hardwoods varies widely depending on the market sector, this issue is considered in more detail in the product-specific chapters of this report (Chapters 5–10). Here, a broad overview is provided of recent trends in tropical hardwood prices and comment is made on the price positioning of tropical hardwoods in relation to other wood products.

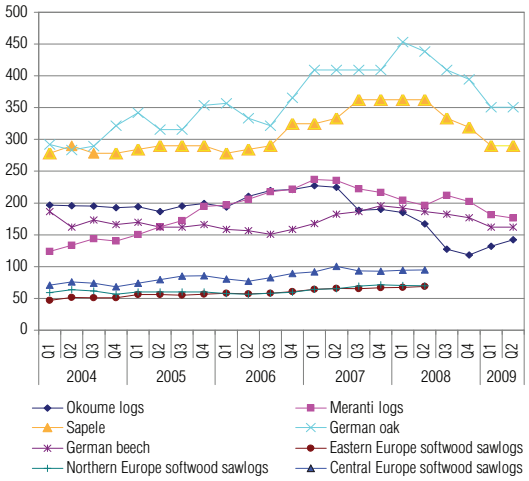
Figures 2.9 and 2.10 respectively track dollar and euro free-on-board (FOB) price trends for sawlogs of various Asian, African and European hardwood and softwood species. A price series for American hardwood logs could not be identified in the preparation of this report. Figure 2.11, however, shows the *Hardwood Review*'s index of prices for a basket of American hardwood kiln-dried sawn products important in export markets. Figure 2.12 shows recent price trends for a range of key

Figure 2.9 US-dollar FOB prices for a variety of sawlogs, 2004–09



Source: Compiled by the authors from a range of sources including UNECE (2009), World Bank database, ITTO Market Information Service

Figure 2.10 Euro FOB prices for a variety of sawlogs, 2004–09



Source: Compiled by the authors from a range of sources including UNECE (2009), World Bank database, ITTO Market Information Service

hardwood lumber products, both tropical and temperate, sold into the Italian market. Italy is one of Europe's largest hardwood consumers and is a good example of a relatively open market dependent on imported wood. A number of observations can be made:

- Prices for hardwood logs are significantly higher, in most cases several orders of magnitude higher, than softwood log prices. While this may be compensated in some cases by the higher yields that can be achieved from high-quality hardwood logs, it immediately suggests that hardwoods need generally to aim for higher-value niche markets. Seeking to compete in large-volume, low-value commodity markets where softwoods dominate is unlikely to be a sustainable long-term strategy.
- Log prices for most wood species generally rose between 2004 and 2008, coinciding with a period of increasing global demand. Although comprehensive 2008 price series data were not available, anecdotal reports indicate that both softwood and hardwood log prices suffered a major reversal, starting in mid 2008 onwards.
- While tropical hardwood logs are generally considered expensive by international standards, and this is often perceived as a source of competitive disadvantage, prices for temperate hardwood species may be just as high. German oak sustains higher prices than most other mainstream hardwood species, although even these fall short of the best Croatian oak log prices. The best sipo/utile logs are in a similar price bracket to oak, while sapele and iroko log prices are marginally lower. FOB prices for meranti and okoumé logs are in the same range as those for beech logs in Europe.
- Price stability is often perceived as an important competitive advantage because it greatly facilitates forward planning and reduces risk. In recent years, however, prices for hardwood logs – both tropical and temperate – have been very volatile. Prices for meranti, sapele and German oak logs rose quickly to the beginning of 2008 and then fell away quickly thereafter. This is generally, but not always, translated into volatile hardwood product prices. Prices in Italy have been very volatile for meranti laminates and American white oak, and moderately volatile for iroko. On the other hand, European oak prices have been more stable, sustaining a high level over a long period of time. In part this reflects local supply and the absence of exchange rate uncertainty. It may also reflect confidence in underlying market demand for a fashionable species.

Technical innovations with potential to affect competitiveness

Overview

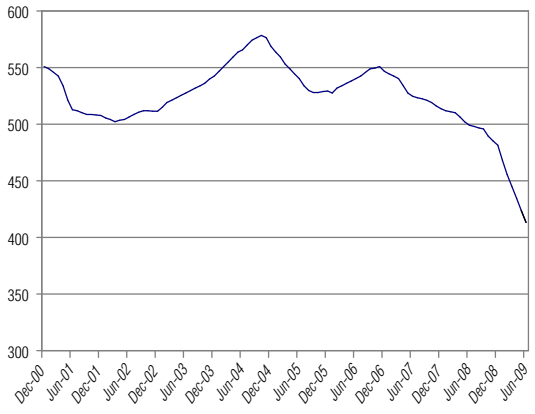
A review of science and technology in the forest sector highlighted several developments with potential to enhance the competitiveness of the tropical wood industry (FAO 2009). On the other hand it also demonstrates that tropical countries are likely to suffer from comparatively low levels of access to the scientific advances that are being made. Overall, this comparative lack of access to new knowledge and technology is likely to be an area of significant competitive disadvantage for the tropical hardwood industry compared with both alternative wood suppliers and non-wood suppliers.

FAO (2009) noted that "science and technology capacity differs significantly between developed and developing countries, mostly reflecting differing abilities to invest in education, training and infrastructure". Translating scientific knowledge into technologies and then applying them remain major challenges in developing countries, partly because the institutional arrangements are fragmented. This is becoming a more significant determinant of competitiveness given the increasing impact of new high-tech and capital-intensive forms of research such as biotechnology, nanotechnology and information and communication technologies.

While not explicit on this point, the FAO (2009) implied that ongoing institutional changes may have a detrimental affect on the access of tropical wood industries to new technology (Table 2.6): "historically, public-sector forestry agencies led the development of forest science and technology. Today, there are many more players; in general, the public sector's role has diminished and its capacities have declined sharply in many countries". The vast majority of new investment in demand-driven research to develop new processes and products that can be patented and which is aimed at raising product competitiveness is undertaken by large enterprises (FAO 2009). Meanwhile, with few exceptions, funding for public-sector forest-research institutions has been declining, with a concomitant reduction in human resources. These institutions also suffer from a fragmented research agenda and weak linkages between research areas.

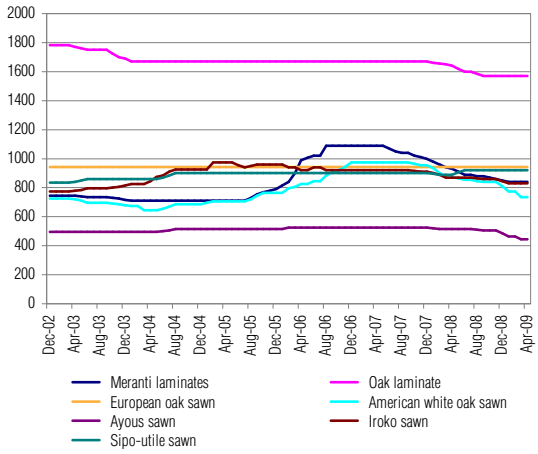
This shift in the balance of research funding and influence has serious negative implications for the tropical hardwood sector, which is highly fragmented, has few if any large companies operating at a global scale (see Chapter 4), and remains highly dependent on public-sector institutions for technical support and development.

Figure 2.11 American hardwood kiln-dried sawn lumber, FOB price index 2000–09 ($/m³)



Source: Hardwood Review (various issues December 2000 to July 2009)

Figure 2.12 Italian wholesale prices for a range of hardwood products, December 2002 to May 2009 (€/m³)



Source: Il Ligno (various issues, December 2002 to December 2008)

Table 2.6 Summary of forest institution research trends

Key players	Research focus	General trends
Public-sector forest research institutions	Basic and applied research in all aspects of forests and forestry A significant share of research is not demand-driven but provides the foundation for downstream applied and adaptive research	With few exceptions, declining because of reduced funding and concomitant reduction in human resources Fragmentation of research agenda and weak linkages between research areas
Universities	Mostly focused on the science of forestry and to a limited extent on applied research leading to technology development	Declining public-sector funding compelling shifts in favor of more applied and adaptive research in collaboration with industry
Industry	Demand-driven research primarily undertaken by large enterprises Focused on applied and adaptive research leading to the development of new processes and products that can be patented	Increased investments to raise competitiveness Collaborative arrangements with public institutions and universities, largely to benefit from capacity in basic research
International public-sector research institutions and networks	Global and regional issues and research networking (but very few in number)	Shift in focus from technical aspects of forestry to policy issues, with increasing emphasis on social and environmental dimensions
Independent think tanks and civil-society research institutions	Mostly policy issues, with particular emphasis on environmental and social issues Focused on supporting advocacy initiatives	Expanding influence, especially in policy processes at national and international levels
Manufacturers of equipment and machinery	Production of machinery and equipment that draws on many technologies for specific tasks	Intense competition and the constant need to upgrade machinery and add new features

Source: FAO (2009)

There has been a significant shift in the international forest research agenda away from the development of improved silvicultural systems and wood-product development for natural forests in favor of plantation forestry. According to FAO (2009), "with a shift to the sourcing of wood from planted forests and the exclusion of large tracts of natural forests from wood production, these low-intensity management systems have been abandoned in many countries. The development of technologies that made it possible to process wood irrespective of its natural qualities and size has also contributed to shifting attention away from these systems".

Improving tropical hardwood's competitive position

Forest management

While there has been an overall shift in the emphasis of applied silvicultural research designed specifically to increase wood productivity in natural tropical forest, there are several areas of ongoing research that could contribute to improved competitiveness in other ways, particularly by demonstrating sustainable forestry practices. However, it should also be noted that the implementation of much of this research remains challenging in developing countries and is also dependent on the objectives of the resource owners or concessionaires and their willingness and ability to comply with market and non-market signals. Specific areas of research include:

- The integration of environmental, social and economic objectives in line with sustainability principles: ITTO has been a leader in the tropics in the development of criteria and indicators for measuring progress towards SFM and in outlining the nature of the technology that needs to be adopted. Much research has focused on ecosystem structure and functioning, the spatial and temporal linkages among ecosystem components and processes, and their relation to the immediate and larger social and economic context.
- Research into reduced impact logging specifically in response to concerns about the long-term sustainability of wood production from natural forests: this involves measures to minimize damage to the remaining vegetation, enabling rapid recovery after logging.
- Technologies increasing the speed at which vast amounts of spatial and temporal data can be analyzed and synthesized: improvements in the

resolution of satellite imagery and the development of software to interpret are contributing to the real-time monitoring of deforestation, pests and diseases, fires and other potentially devastating events. GIS and global navigation satellite systems provide forest managers with increasingly precise information on the nature and condition of forest resources. This has particular potential to assist the process of legality verification and third-party certification.

- New techniques to identify the source of logs using tags, paints and chemical compounds that can be read by detection devices: new-generation radio-frequency identification tags and bar codes can easily track the movement of logs from forests to markets, helping to distinguish legally from illegally sourced wood (FAO 2009).

Matching technical properties to applications

A key part of recent tropical hardwood product development has been a focus on the various technical properties of different tropical wood types, information that may then be used to match a species to an application. This work has been given particular emphasis in the drive to increase the use of lesser-known species with the aim of taking the pressure off primary species or finding market outlets for such lesser-known species that happen to have been certified. The result has been the development of various databases and handbooks on tropical woods, such as the *Houtvademecum* ('The Wood Manual') in the Netherlands and the Building Research Establishment (BRE) *Handbook of Hardwoods* in the UK.

The work undertaken to date on the characteristics of tropical species has had limitations. For many tropical species the testing has often been based on a limited number of small sizes of mostly clear wood and has been insufficient to provide comprehensive information on the design properties of particular species (Wesselink and Ravenshorst 2008). The technical information available for the smaller number of temperate hardwoods and softwood species tends to be considerably more comprehensive. With respect to Malaysia, Ratnasingam and Tsai (2005) noted that "one of the largest constraints to maximizing the use of the wood resource is the lack of scientific and technical information pertaining to the use of wood in different applications. Although the basic properties of the common Malaysian timbers have long been established, information on its behavior in different applications remains sparse. As a result use of wood for high end applications, such as wooden structures in Malaysia is a long way from what has been achieved in Scandinavian countries … large-scale timber testing facilities are limited in the country."

There remains considerable scope for extending and improving the work on the properties of tropical species, particularly because designers are constantly searching for a 'new look' and there is an emerging trend in modern design of favoring natural products (see Chapter 4). This suggests continuing opportunities for adding value to tropical woods through marketing campaigns celebrating their huge diversity and promoting individual species rather than grouping them into grades (e.g. 'mixed redwoods').

At the same time, work celebrating the diversity and existing natural properties of tropical hardwoods should not distract from the emerging potential for altering the physical characteristics of timbers through new biotechnologies and nanotechnologies. These have the potential to alter the natural limitations of materials and to render them usable in applications for which they were previously unsuited. This area is still relatively undeveloped in the tropical hardwood sector.

Reactive rather than proactive research

Another issue is that much of the research work on the technical properties of tropical hardwoods is in response to new regulations or standards in an effort to avoid a loss of market share, rather than innovative work designed to extend share. A good example is research now being undertaken by Association Technique Internationale des Bois Tropicaux (ATIBT), Le Commerce du Bois, the Center for International Research into Agriculture and Development (CIRAD) and FCBA to develop a grading system for tropical wood earmarked for structural use. The aim is to simplify the process of conformance by tropical hardwoods with new mandatory Conformité Européene (CE) marking requirements for structural wood, originally due to be imposed in September 2008 but subsequently delayed until September 2009 to give suppliers more time to comply with the rules. At the end of the process suppliers should be able to grade any

type of tropical wood in line with the CE marking requirements using a set of dedicated correlation charts (ATIBT 2008).

While such work is clearly essential, the fact that it is only being undertaken at this late stage after all the major decisions regarding the CE marking process have already been made only serves to demonstrate the extent to which tropical hardwoods are at a competitive disadvantage relative to other products. As ATIBT pointed out, "Scandinavian industrialists have a huge advantage in that they use highly consistent raw materials and that their industrial processes are powered by the latest high-tech computer technology. This means that they will have no problem integrating the CE marking regulation, thus giving them a competitive edge in that they can start to offer contractors CE-marked wood immediately. By demanding CE marking, contractors are unintentionally penalizing those industrials not yet ready to introduce the system" (ATIBT 2008).

Examples of innovative work

Nevertheless, discussions with some of the larger companies marketing tropical hardwoods at various trade shows in 2009, together with a review of product literature, indicate that some innovative work is being carried out to develop new products. Much product development is associated with efforts to diversify the range of certified forest products, to enhance the performance of existing product lines such as decking, or to improve the quality or use of small-dimension lumber. For example:

- For several years, Malaysian and Indonesian manufacturers have exploited the advantages of finger-jointing and lamination technology to produce dimensionally stable and strong meranti window scantlings and rubberwood table tops and other furniture components from small-dimension timber. Due to the expense and knowledge required, this type of technology has been slow to permeate the garden-furniture sector. But the situation is beginning to change, with the first laminated garden-furniture lines appearing at trade shows in 2009 (UK Sales Director of Gloster Furniture, personal communication, May 2009).
- Limba (*Terminalia superba*, also known as afara or frake), from West Africa, is the only tropical hardwood species currently known to be marketed as a thermally treated product. In its natural state limba is a light-colored, medium-weight, very stable but only moderately durable wood (the sapwood is non-durable). In 2009, however, thermally-treated FSC-certified limba began to be marketed in Europe by the Dutch importer Reef Hout (and in the UK through the Ecochoice agency) under the Plato Wood brand. In offering the product Ecochoice aims to provide architects and contractors with a knot-free exotic wood with enhanced stability and durability acquired in a process that is free from chemicals. At present the product, which achieves durability class 1, is mainly being used for cladding, particularly in public-sector projects (Timber Trade Journal 2009).
- Plantation teak is generally characterized by a high sap content, which has limited its application in garden furniture. For many years, however, it has been the subject of thermal treatment trials in Thailand and Malaysia in an effort to improve durability. To date these experiments have been unsuccessful due to the difficulty of ensuring that the temperature is just right: too low and the teak will not alter, too high and the teak will scorch. There have also been problems associated with increased brittleness. Nevertheless the Thai Ministry of Forestry is funding further research. Meanwhile, Malaysian industry has transferred its attention to rubberwood, using thermal treatment in an effort to extend the species' range of applications (Deputy Director of Forestry and heads of departments at the Royal Forest Department, Bangkok, Thailand, personal communications, March 2009).
- Research work to develop new bio-composite materials from wood residues and other natural fibers has been under way in Malaysia for several years. In 2008 the Malaysian Ministry of Plantation Industries and Commodities and the Malaysian Timber Industry Board established the Fiber and Bio-Composite Development Center to assist industry to establish links and partnerships with research institutions and government agencies with the aim of accelerating the application of research findings into the commercial manufacture of bio-composite products (Asian Timber 2008).

- Malaysian manufacturers are already producing boards with cores comprising engineered wood manufactured from small-dimension wood and a 5-mm veneer facing in a range of species, both tropical and temperate. According to representatives of the manufacturers, although these products are no cheaper than solid meranti boards they are gaining market acceptance because of their greater stability and strong environmental credentials (DLH 2009).
- In the decking sector, a representative of a Malaysian tropical hardwood manufacturer interviewed at the Dubai Wood Show noted that the key to the company's continuing success in the sector was product diversification. Its strategy has been to keep a close eye on market trends and to continuously look for ways to access new niche sectors through product development. For example, one innovation has been the development of modular decking systems that can be easily clicked together.

Paint treatments have long been applied to temperate woods to enhance their outdoor use. Mounting teak supply problems, particularly of certified teak, is now encouraging greater experimentation with paint finishes on tropical plantation species. For example, in 2009 a leading Belgian garden-furniture manufacturer launched a new range of Indonesian acacia furniture protected with nine layers of paint (Tribu Furniture, personal communication, April 2009).

In addition to the above, the international veneer industry – which unlike other sections of the hardwood industry is dominated by larger firms – has been investing heavily in the development of reconstituted veneer products. This represents an attempt by wood-veneer manufacturers to combine the natural benefits of wood veneer with the variety and flexibility of laminates (Danzer representative, personal communication, 2009). Although the focus of these innovations is mainly to increase the range of applications for temperate hardwoods and plantation-grown species, at least one manufacturer is using a tropical species (ayous) as the base material for a new line of reconstituted veneer products (see Chapter 9).

The improving competitive position of alternative wood products

A major competitive threat for tropical hardwoods is ongoing efforts to modify the characteristics of temperate hardwoods and softwoods to improve their performance, sometimes with the specific intent of mimicking the aesthetics, durability and strength of tropical hardwoods. Examples of wood-modification processes and products are proliferating. Other competitive threats have emerged from the development of entirely new products comprised of small-diameter wood, woodchips and even sawdust. Many of these alternative products are sold with FSC or PEFC certification as standard to increase their marketability, particularly in the public sectors in Northwestern Europe and North America.

Engineered wood products

Engineered wood products (EWPs) are not new: the desire to improve the strength properties of wood by cutting, gluing, rearranging and bonding pieces together started with plywood in the 19th century. What is new is the rapid increase in the level of production, the geographic expansion of capacity from Europe and North America to Asia and South America, and the widening range of applications of these products. Most EWPs have been developed by firms in industrialized nations and are being used to enhance the value of softwood and low-grade hardwood products.

Key products are glulam (glue-laminated timber), laminated veneered lumber (LVL) and I-joists. Oriented strand board (OSB) is also often included under the general EWP heading and is also discussed briefly here. Applications of EWPs are diverse, but generally a large proportion is used for interior structural applications with much of the remainder used for interior joinery and furniture. Table 2.7 provides an overview of EWPs and their applications.

Key strengths of EWPs are that they are manufactured from small-dimension wood or sawdust; they may be extremely strong and offer great dimensional stability; and they can be supplied in a huge variety of sizes, including very large panels and long structural beams. Their manufacturers lay claim to strong environmental credentials based on their reliance on recycled and FSC-certified or PEFC-certified sustainable raw materials.

EWPs have certain disadvantages that limit their capacity to directly substitute for other wood products, particularly tropical hardwoods. They are

Table 2.7 Overview of EWPs

Product	Manufacturing process	Applications	Production capacity	Market trends
OSB and oriented strand lumber (OSL)	Manufactured from waterproof, heat-cured adhesives and rectangular-shaped wood strands arranged in cross-oriented layers. OSB is produced in big, continuous mats and OSL is produced in boards	OSB is used for interior structural applications and sheathing. In North America, Japan and Australia, nearly all OSB is used for building and construction. In Europe, it is also used for industrial applications. OSL is used for beams, headers, rim boards and structural framing lumber	Global OSB/OSL production was 26 million m3 in 2007 and is projected to hit 38 million m3 by 2012. OSB production is much higher than that of OSL. 85% of OSB/OSL capacity is in North America. Strong future growth is expected in China, Russia and South America	There was strong demand in North America and the EU until the end of 2007. OSB is now mainly replacing softwood plywood. OSL is intended to replace lumber. OSB prices are currently falling in the EU and North America in response to a collapse in residential construction. New products are being developed for high-exposure uses
I-joists	Consist of flanges made from solid wood, PSL or LVL and a web made from OSB, plywood or hardboard. The flanges and web are bonded together to form an 'I' cross-section shape	Structural framing in floors and roofs. Wall construction in place of solid timber studding	North America dominates, with production peaking at close to 400 million linear meters in 2004. North American production has declined since then to a predicted 100 million linear meters in 2009. Global production is forecast to increase by 53% in the period 2009–13	Heavy dependence on United States residential market led to an overall global consumption downturn of 32% between 2004 and 2008. New Zealand is also now engaged in supply to Australia, Oceania and East Asia
LVL	Manufactured by laminating together 3-mm-thick veneers to form panel boards from which structural sections of the desired dimensions are cut. May be cut using conventional woodworking tools	Mainly new home construction. In North America, 29% is used in I-beam flanges and 64% is used as heavy-duty beams and also as headers over windows and doors	Global LVL production is forecast to increase by 52% between 2009 and 2013. North America is the dominant supplier: it produced 2.1 million m^3 in 2006, but this declined to 0.9 million m^3 in 2008. New Zealand is also engaged in supply to Australia, Oceania and East Asia	There has been a major downturn in North American demand in recent years and signs of over-capacity. However, the market is expected to continue to expand in Europe and Russia. Japan is a major importer of LVL, but demand has been flat in recent years
Parallel strand lumber (PSL)	Comprises long thin strands of veneer laminated together to form structural members	Similar to LVL	PSL is manufactured primarily by one company in North America. Compared with other EWPs, production volumes relatively low	As for LVL.
Glulam	Short-dimension wood laminates glued together	No limits on section size, length or shape, so well-suited for use in large-scale structural systems. Commonly used as roof beams, portal frames, arches, floor beams and columns	Europe dominates, producing 3.9 million m^3 in 2007, up from 1.6 million m^3 in 2000. Production in Japan has been rising: it was 1.2 million m^3 in 2008. North American production declined from 0.75 million in 2006 to 0.43 million in 2008. Chinese capacity is growing: it was 0.55 million in 2007. Global production is forecast to increase by 25% between 2009 and 2013.	Global glulam consumption has remained strong over the medium term, rising 26% between 2004 and 2008

Source: Compiled by the authors from BIS Shrapnel (2009a, 2009b) and EUWID (2007a–k, 2008a–f)

generally less durable than tropical hardwoods and some EWPs readily absorb water unless treated with a sealant or paint. Some EWPs, such as OSB, have aesthetic, screwing and nailing properties that are inferior to plywood. They also tend to be heavier and their stiffness means they are less suitable for the creation of curved structures. EWPs generally require more primary energy for their manufacture than solid lumber, and the required adhesives may be toxic. A concern with some resins – such as urea-formaldehyde bonded products – is the release of formaldehyde in the finished product. Cutting and otherwise working with EWPs can expose workers to toxic constituents.

Traditional preservative treatments

Preservative treatment is an area that remains challenging for the temperate hardwood and softwood industry. It has become an emotive environmental subject because the best treatments, designed to kill insects and fungus, are also toxic to humans. The most effective preservative is still creosote, followed by copper chromium arsenic (CCA) and then copper chromium phosphate. Organic preservatives can leach out and thus have a poor external performance. In many industrialized markets creosote and CCA have been heavily legislated against limiting their use to specialist applications such as sleepers and bridge decks. In practice, low levels of demand have meant that, in many countries, these traditional forms of treatment are no longer financially viable. Some progress has been made with modern pressure/vacuum treatment processes, but even with these the chemical often only penetrates a few millimeters, which means that all cuts and holes have to be made good before treatment. These problems have stimulated a search for alternative treatments, notably heat treatment and acetylation (Freedman 2008).

Heat treatment

The Scandinavian companies Finnforest and Stora Enso are producing Thermowood, a heat-treated product made by steam-heating softwood to temperatures above 200°C, which drives out moisture and resin to enhance durability and stability. Plato Wood is an equivalent product produced in the Netherlands. Kebony is produced in Norway by a similar process, except that 'tropical-wood color' is added to the candidate softwood by impregnating it with furfuryl (a byproduct of sugar-making) before intense heating. These modified products are being marketed for decking, garden furniture and external cladding. The price of these products is relatively high. Kebony, for example, sells at between US$4000 and US$14 000 per m^3 depending on quality and is targeted specifically at the high-end teak market.

In June 2009 the German trade journal *EUWID* reported that European production capacity of thermally treated wood is now at least 160 000 m^3, with known capacity of 80 000 m^3 in Scandinavia, 40 000 m^3 in the German-speaking countries of Central Europe, 30 000 m^3 in the Netherlands, and 8000 m^3 in the Baltics. In 2009, reported projects in Germany and Finland will extend production by a further 20 000 m^3. These figures may not seem high, but they are significant when set against the 600 000 m^3 combined annual import volume of meranti and sapele, the two leading tropical joinery species in the European Union (EU).

Acetylation

Acetylation involves the use of naturally occurring acetic acid to alter the molecular structure of wood. The treated wood is more durable and stable and the treatment does not have a marked effect on visual appearance. Titan Wood's Accoya is probably the most well-known brand of this material and is being marketed for exterior joinery applications, particularly windows, doors, conservatories and cladding. Accoya claims a service life of 50 years and an initial maintenance-free period (i.e. no painting or other coatings required) of twelve years.

In a notable development from the perspective of tropical hardwood plywood, Titan Wood and Medite Europe Limited signed a joint development agreement in June 2009 to commercialize new MDF and OSB panels made from acetylized 'Tricoya' wood elements. The OSB is thus protected from wood rot, significantly improving durability and dimensional stability; the market development strategy for this acetylized OSB targets external applications currently occupied by tropical hardwood plywood in Europe.

Impregnation

Various impregnation processes have been developed in New Zealand, originally intended to improve the qualities of radiata pine. These have proved to be a profitable mechanism for producing highly durable and color-fast products, particularly for flooring, out of a low-density, fast-grown

material. Efforts are now being made to extend the new impregnation technologies to a wider range of woods and applications in other parts of the world. Fibre 7's Lignia brand uses a patented impregnation technology to infiltrate a colored formulation throughout the wood that is then locked in when kiln-dried. The result is a product with consistent weight and color throughout the board. The Indurite process adds density to wood by impregnation with a starch solution that is cross-linked by heat to solidify the material. Osmose is now developing the Indurite process in the UK and is also working with a potential marketing partner with the aim of launching a range of new products in the specification market. Their aim is to complement traditional hardwood flooring by offering a densified sustainable softwood option (Timber Trade Journal 2009). Testing of the Indurite process in the UK and New Zealand indicates that:

- It can significantly improve the performance of low-density radiata pine and other pine species as a flooring product. The improvement in hardness enhances the surface performance of the material, making it less prone to indentation and abrasion. The inclusion of a fixed color through the bulk of the wood ensures that, unlike surface treatments, it cannot be worn away with use.
- The improvements that result from increased density in such properties as strength, stiffness and hardness can make low-density woods suitable for a range of internal furniture and joinery applications. They also enhance machining characteristics, suggesting potential for use in applications such as turning blanks and therefore for direct competition with the highest-quality material for decorative stair parts or other high-value turned products.
- The dimensional movement of treated wood is lower than that of untreated wood, suggesting that treated wood would be suitable for applications such as windows and doors, where low dimensional movement in response to changing environmental conditions is required.
- The process increases the durability of treated wood so that it may be used for patio or garden furniture, directly replacing tropical hardwood (Holland 2005).

Surface technologies

The development of modern composite panels like MDF, high-density fiberboard, OSB and hardboard has gone hand-in-hand with the evolution of surfacing technology designed to enhance appearance and improve performance. Surfacing with real wood veneer is now just one of a wide range of approaches used to give composite panels the appearance of natural wood. Improvements in the dimensional accuracy and surface properties of composite panels have greatly enhanced the range of surfacing options. So too has the development of high-performance coatings (HPCs) that significantly improve durability, wear and mechanical properties.

The surfacing industry is now highly sophisticated5. Often a single furniture or joinery product will combine a range of surfacing technologies and materials, many of which are now offered in complementary and matching colors and designs. The choice of decorative surface depends on many factors, including the specific application, performance requirements, design objectives and cost. Costs vary widely but the cheapest are generally offered at a significantly lower price point than even the cheapest wood products. Production has expanded very rapidly in Europe, North America and East Asia.

Examples of the technologies available include:

- **High-pressure laminate:** One of the earliest but still widely used surfaces is high-pressure laminate (HPL), also known as plastic laminate. Made famous by the marketing efforts of the Formica Corporation in the 1950s and 1960s, HPL is typically constructed of several layers of kraft paper, a layer of décor paper with a solid color or printed design, topped with a protective wear layer that can also carry printed design accents. Lamination is carried out at very high pressures (normally 850–1450 psi) and temperatures that can exceed 270°F. Because HPL sheets are pressed individually, many different designs and colors can be offered in small quantities. Textured press plates may be used to mimic the feel of other materials, including wood. The final product is sturdy and wear-resistant and suitable for use in

5 For a comprehensive, user-friendly summary of surface technologies see the Composite Panel Association website at www.pbmdf.com. These issues are also dealt with in more detail in Chapter 9.

high-impact applications such as counters, desktops and laminate flooring; it is laminated over a variety of substrates but most usually particleboard.

- **Continuous pressure laminate:** Continuous pressure laminate (CPL) is similar to HPL but is produced in a feed-through process. CPL is generally a cheaper and thinner product with fewer design options; it is produced and sold mostly in Europe and Asia.
- **Thermally fused melamine:** Now one of the fastest-growing laminates, thermally fused melamine (TFM) uses a melamine-impregnated printed or solid-color décor sheet similar to that used in HPL, but instead of being laminated to layers of kraft paper it is pressed directly onto a substrate such as particleboard or MDF. Under heat and pressure the melamine resin from the décor layer flows into the substrate to create a bond, effectively creating a homogenous decorative panel without the use of an additional adhesive. These products may also carry the same type of wear layer as HPL and can be embossed to mimic woods and other materials. TFM panels are popular in cabinetry, laminate flooring, shelving, furniture and fixtures.
- **Decorative paper-based foils:** These are printed or solid-color papers saturated with a blend of resins, which can vary depending on the final application of the paper. Most papers may also receive a topcoat or a 'finish' coat for additional performance characteristics. Decorative foils are adhered to substrates such as particleboard or MDF. These products provide the manufacturer with the option of a wide variety of decorative designs and colors. The advancement of panel surface characteristics have helped advance the use and performance of this laminate type and, while typically laminated to flat panels, some products are being engineered to allow highly detailed profile wrapping. Decorative foils are widely used in cabinets, store fixtures, shelving, closet systems and home office furniture.
- **Decorative vinyls/3-D laminates:** The decorative vinyl category has seen significant innovation and growth in recent years. Some suppliers have taken to referring to it as '3-D laminate' because it can be pressed to panels with 3-D details machined into their faces, as well as to unconventionally shaped panels and panel edges. Vinyls are supplied either in solid colors or printed, and some suppliers offer special surface treatments for increased wear resistance. Use of these products has grown in recent years in line with a fashion for organic shapes in furniture (Surface and Panel Magazine 2009).
- **Direct printing:** A new development is to print images directly onto pre-coated wood panels. Modern 3-color printing machines are capable of printing a vast array of wood species, as well as custom designs and patterns. Direct printing is growing increasingly popular in the manufacture of furniture and board products because it eliminates the intermediary use of décor paper, thus streamlining production and reducing overall printing costs.

Wood–plastic composites

Wood–plastic composites (WPCs) take the concept of combining the properties of plastics and wood into a single product one step further. A major factor adding to the costs of using wood compared to other materials is that it cannot be extruded and moulded into components of specific sizes and shapes. Nor do composite wood panels offer the same level of durability as plastics or tropical hardwoods. WPCs are designed to overcome these problems, while at the same time improving the level of utilization of an even wider range of natural fibers, including residues from paper production and conversion. For this reason their development has been encouraged by large wood and paper corporations in North America and Europe.

WPCs are composed of wood from recovered sawdust (and other cellulose-based fiber fillers such as pulp fibers, peanut hulls, bamboo, straw, digestate, etc.) and a wide range of virgin or waste plastics. The powder or fiber is mixed to a dough-like consistency and then extruded or moulded to the desired shape. Additives might include colorants, coupling agents or reinforcing agents. The material is formed into both solid and hollow profiles or into injection-moulded parts and products (Wikipedia website 2009a).

While WPCs are extruded and moulded, with up to 70% cellulose content (although 50% is more common) they also behave like wood and can be

shaped using conventional woodworking tools. At the same time, they are resistant to moisture, rot, cracking and splitting. They can be moulded with simulated wood-grain details. Products tend to be marketed as an environmentally friendly alternative to tropical hardwoods, often backed by FSC certification.

WPCs are used most widely for decking, where they particularly target the tropical hardwood market, but may also be used for railings, cladding and siding, park benches, window and door frames and as landscape woods. Well-known trade names include Practiwood, NewTech, TimberTech, Trex, JER Envirotech, CorrectDeck, Artowood, Chylon, Ultradeck and Weatherbest.

Prices are highly variable depending on quality, product type and location. In the United States they have generally been 10–20% more expensive than pressure-treated softwoods but cheaper than ipe, the most popular tropical hardwood species for decking in the United States (Extruder Times 2008). Anecdotal reports from traders in Europe indicate that steep price rises and supply problems for key tropical decking species in 2007 and 2008, particularly selangan batu, have encouraged greater substitution by WPCs in the EU (Representative of Weltzholtz, personal communication, Maly 2009).

WPC materials also have their downside. WPC decking looks artificial, its colors are dull and uniform and, even with wood grain effect, it has only a passing resemblance to real wood. While highly resistant to rot, WPCs soak up water due to their mixing with organic wood fibers. Efforts to avoid this have involved loading up wood fibers with oils or other products that repel water, which adds to the cost and environmental load. The polymers and adhesives added to these products make WPCs relatively difficult to dispose of, although they can be recycled. The products are not as rigid as wood and may deform slightly in extremely hot weather. The material is also sensitive to staining from a variety of agents due to its porosity. The extra energy costs of production compared to wood raises questions about their real environmental credentials (Surface and Panel Magazine 2009).

WPCs made early progress in North America and production capacity is now expanding in Europe. Overall global capacity is estimated to be at least 1.12 million tons, including 900 000 tons in North America, 100 000 tons in Europe, 75 000 tons in China, and 50 000 tons in Japan (EUWID 2008a). WPC decking is believed to account for around 14% of the United States decking market, compared to around 80% for wood (Freedonia 2007). In Europe, WPC market share in the decking sector is estimated to be around 6%. Recent market reports indicate that the trend towards rising production capacity in Europe and China is expected to continue (Nova-Institute 2008).

Materials from other woody and short-rotation crops

In addition to modified wood products, a range of products are now being manufactured from other woody fibers and short-rotation crops which have the potential to act as substitutes for tropical hardwoods. These include:

- **Bamboo:** Bamboo is being used in an increasingly wide range of applications, including flooring, furniture, panels and veneers. With appropriate processing and treatment, bamboo can provide exotic visual impact together with high levels of strength, allowing use in heavy-duty applications such as high-traffic floors. This is nothing new to countries on the Pacific Rim, where bamboo has been widely used for decades. It is, however, a relatively new trend in Europe and North America. Some of the claims made for the product are far-reaching. For example, a German company Bamboo Concepts, which is marketing bamboo flooring in Europe, claims that the product is 27 % harder than oak; highly stable (having 50% less shrinkage and expansion than oak); machined to high tolerances to ensure a perfect fit; 'warmer' than wooden flooring; resistant to attack by mould and insects; and non allergic. As for hardwood products, adhesive-less 'floating floors' are becoming available in bamboo. It is presented as an environmentally friendly product, being derived from a short-rotation crop. On the downside, the range of colors is limited, although a wider range of stains and variety of grains is becoming available. It is sometimes carbonized to provide an amber color, although this reduces its hardness (Wikipedia website 2009b).

- **Rattan:** Rattan is the name applied to roughly 600 species of palms of the genus Calameae, a native of tropical regions in Africa, Asia and Australasia. Raw rattan is processed into several products for use in furniture making. Rattan species range in size from several millimeters to 5–7 cm in diameter. The skin is usually peeled off strands of rattan to be used as a weaving material. The remaining "core" of the rattan can be used for various purposes in furniture making. Rattan is lightweight, durable and reasonably flexible. Rattan is used extensively for making furniture and baskets. It accepts paints and stains like many other kinds of woody plants and is therefore available in many colors, and it can be worked into many styles (Wikipedia website 2009c). Indications at furniture trade shows in Europe and Southeast Asia during 2009 are that rattan is gaining in popularity in line with a general design trend towards natural materials and for lightweight furniture that can be used both indoors and outdoors.

- **Barkboard:** According to Global Industry Analysts (2008), the Canadian company CanFibre Group Ltd has developed a new building material called Barkboard manufactured from bark residues. The Canadian forest industry produces more than 12 million bone-dry tons of bark residues every year, posing problems of disposal. Strict regulations on land filling and the burning of the bark residues have forced producers to devise innovative uses for them. In developing Barkboard, CanFibre is building on its existing experience of manufacturing MDF from wood debris. Natural resins derived from the bark are used during manufacture, eliminating the need for chemical resins. The product is similar to but less expensive than OSB, and is targeted at markets for floor underlay, decking, roof shingles and core stock for doors.

3 OVERVIEW OF COMPETING NON-WOOD MATERIALS

Applications relevant to tropical woods

The competitive position of tropical hardwoods cannot be defined only in relation to other wood products. A host of non-wood materials are available to consumers, specifiers and designers, many of which may be directly substituted for wood products. Innovation in these alternative materials sectors implies that opportunities for the substitution of tropical woods are rising. Table 3.1 outlines the wide range of applications in which non-wood materials are in competition with tropical hardwoods.

Table 3.1 Comparison of applications of tropical hardwood and non-wood substitutes

Uses of tropical hardwood	**Non-wood competing materials**								
	Cement/ concrete	Plastic	Steel	Aluminium	Glass	Gypsum	Ceramic tiles	Stone	Composites
Construction use									
Building frames	x		x	x					
Partitions	x	x			x	x			x
Roof members			x	x					
Roof covers	x	x	x	x					x
Window frames		x	x	x					x
Door frames		x	x	x					x
Civil works	x		x	x				x	x
Interior use									
Quality furniture		x	x	x	x				x
Flooring	x	x					x	x	x
Skirting		x		x			x	x	x
Ceilings	x	x		x		x			x
Staircases	x		x	x				x	x
Handrails	x	x	x	x				x	x
Balusters	x	x	x	x	x			x	x
Doors		x	x	x	x				x
Windows		x		x	x				x
Quality joinery		x	x	x	x				x
Paneling		x			x	x			x
Architraves	x	x	x	x		x		x	x
Kitchen joinery		x	x	x					x
Kitchen worktops	x	x	x	x				x	x
Exterior use									
Garden furniture	x	x	x	x					x
Doors		x	x	x	x				x
Windows		x	x	x	x				x
Decking								x	x
Decking balusters	x	x	x	x	x				x
Cladding		x	x	x	x		x	x	x
Store-front frames		x	x	x					x
Staircases	x	x	x	x			x	x	x
Industrial use									
Flooring	x	x	x					x	x
Partitions	x	x	x	x					
Acoustic barriers	x	x	x						x
Sea defenses	x							x	x
Transport		x	x	x					x
Fencing	x	x	x	x					x
Tool handles		x	x	x					x

Consumption trends of competing non-wood materials

Figures 3.1 and 3.2 provide a broad overview of the value of global consumption of various building materials in the period 2002–08 and 2000–08, respectively. The value of all materials consumption rose strongly during this period, which, in many parts of the world, particularly China and the United States, was characterized by strong growth in construction activity. Overall, wood is estimated to have held a 12% share of the value of world building material consumption in 2008, a slight erosion of its 13% share in 2000 (Global Industry Analysts 2008).

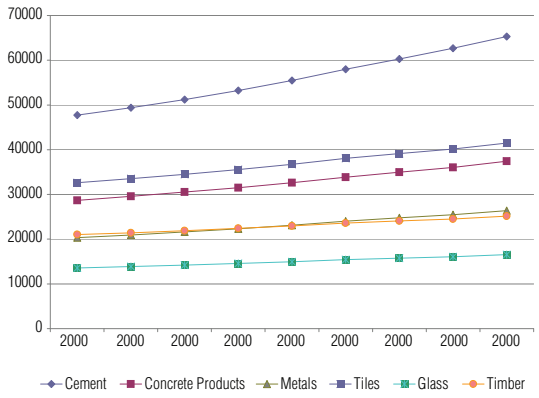
Cement is by far the most-consumed building material, accounting for around 31% of the value of building material consumption in 2008, up from 29% at the start of the decade. When combined with concrete products, this share rises to 49% of the total value of building material consumption, up from 46% in 2000 (Global Industry Analysts 2008). Cement is used both as a bonding agent for other materials (including stone, brick and tiles) and for the on-site production of concrete. Concrete is particularly valued for its durability, strength integrity, ease of use, and acoustic properties. Concrete's share of the building materials market has benefited in recent years from strong growth in multi-storied apartments relative to other residential types in global construction. Another key recent trend has been the development and marketing of 'sustainable' concrete, which uses byproducts such as ground granulated blast-furnace slag and fly ash as components. Both materials are available in large quantities as waste products of iron production and coal-fired energy generation, respectively.

Global Industry Analysts (2008) estimated that metals accounted for around 18% of the value of global materials consumption in 2008, a slight rise from 17% in 2000. While a range of metals are involved in building and construction, steel is dominant; aluminium is used in much lesser volumes and, globally, contributes only around 3–4% the volume of steel. While steel is used in large volumes in beams, reinforced concrete and other structural elements, aluminium's combination of high strength and light weight means it is used widely for off-site construction and prefabrication, for example in the manufacture of windows and doors. A general shift towards prefabrication in the global construction sector is tending to boost market prospects for aluminium. The metals industry is attempting to enhance market share and environmental image through increased recycling. Advanced coatings are also being developed that allow metal building system producers to offer long-term warranties.

The value of glass consumption is generally lower than that of other materials, although its use is increasing due to its emerging popularity in design and its perceived environmental benefits. Glass permits the use of natural light in buildings and therefore reduces energy consumption and subsequently carbon emissions (Global Industry Analysts 2008).

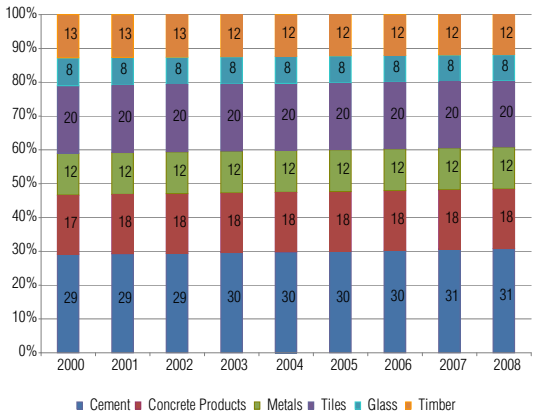
Global plastics production has grown strongly in recent years, rising from 50 million tons in 1976,

Figure 3.1 Global consumption by value (US$ million) of competing building materials, 2000–08



Source: Global Industry Analysts (2008)

Figure 3.2 % share of global consumption of competing building materials by value, 2000–08



Source: Global Industry Analysts (2008)

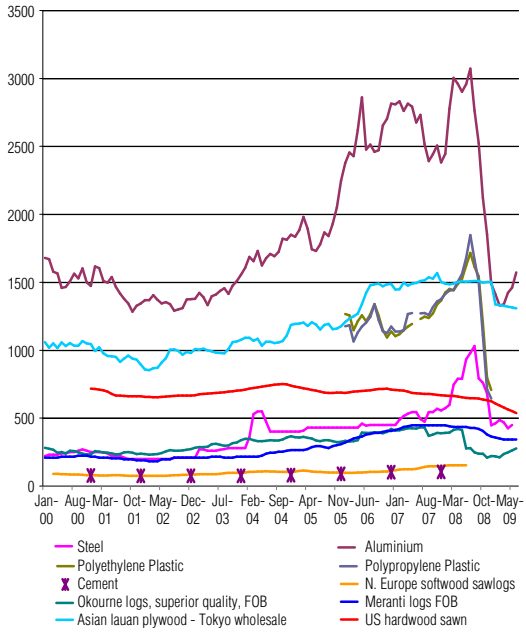
100 tons in 1989, 200 million tons in 2002, and more than 230 million tons in 2005. Global consumption of plastics stood at 260 million tons in 2007 (PlasticsEurope 2008). Around 22% of this volume was estimated to be destined for building products. Global consumption of plastics was £400 billion in 2007; it was expected to jump 25% by 2010 to £500 billion (PlasticsEurope 2008). Plastics are used in everything in construction from concrete foundations to the final coat of paint, including the more obvious applications such as cladding, flooring, pipework, cable sheathing and foam insulation. Plastics are valued as a cheaper and lighter alternative to metals and wood in construction and are also gaining market share through the development of more biodegradable and recyclable types designed to offset its negative landfill image.

Price trends of competing non-wood materials

Figure 3.3 shows price trends for commodities used in the manufacture of building products over the period January 2000 to May 2009. A number of issues arise:

- Most commodities experienced significant price increases between 2002 and mid 2007, when global construction was booming. The energy crisis in 2008 particularly exacerbated the rise in prices for products that consume large quantities of energy during the extraction process. Prices for aluminium, steel and plastics, which require the most energy, spiked in price in mid 2008, even after the first signs of a downturn in global construction became apparent.
- While price volatility is a problem for wood products, particularly tropical hardwoods, wood-product suppliers can take some comfort from the fact that volatility is at least as much a problem for most alternative products.
- Cement is an exception and seems to benefit from particularly stable pricing.
- Extremely low prices for cement, which doesn't require much additional working to convert into a usable product, explains the huge popularity of this product in the global construction market.
- The pricing of steel has also been extremely competitive, particularly given that prices are on a per-ton basis and steel has a high strength-to-weight ratio.
- Prices for aluminium seem high on a per-ton basis, but this is offset by aluminium's high strength-to-weight ratio.
- When factors such as strength-to-weight ratio, elongation fraction (see below), and the extra working required to turn wood into a usable product (since it can't be moulded or extruded), wood seems a relatively expensive commodity. This is particularly true for tropical hardwoods.
- Plastics prices reached very high levels in late 2007 and early 2008, comparable to those for tropical hardwood plywood. This is likely to have helped wood to gain market share in certain end-use sectors (e.g. the European window sector) at the expense of plastics during that period. If so, the big decline in commodity prices for plastics over the last twelve months may now spell trouble for wood.
- Prices for aluminium and steel have also fallen dramatically in the last twelve months, implying a renewed challenge to wood's overall position in the market.

Figure 3.3 Price trends for commodities used in construction and the manufacture of building products, January 2000 to May 2009



Source: Compiled by the authors from various sources including World Bank, Hardwood Review, various issues December 2000 to July 2009, ITTO, and UNECE/FAO Forest Products Market Review 2008/2009

Strengths and weaknesses of competing non-wood materials

Building and product design always has multiple objectives and constraints – light and stiff, strong and cheap, or tough and recyclable (or maybe all of these). The selection of materials in design is therefore a matter of assessing tradeoffs between several competing requirements. The choice of wood or its alternatives depends on which material achieves the most appropriate balance in accordance with the designer's objectives.

A useful insight into where the attributes of wood sit in relation to those of alternative materials can be derived from a project undertaken in 2002 by the Engineering Department of the University of Cambridge in collaboration with leading academics, funding bodies and industrial partners (University of Cambridge Department of Engineering website 2009). The key idea, derived from work by Professor Michael Ashby, is to plot data for pairs of material attributes which are commonly traded off against each other (Ashby 1999). Available examples of such charts cover a wide range of material properties critical to selection including technical (i.e. strength, density and maximum service temperature, etc.), economic (i.e. cost), and environmental (i.e. embodied energy and recycling, etc.). Figures 3.4 to 3.7 present data based on Ashby's work for various materials. Since only temperate species were tested, oak was selected as the material most comparable to tropical hardwood (having similar characteristics to most medium-density tropical hardwoods, with the exception of color).

Strength, density and elongation: Designers often have to find an appropriate balance between the properties of strength, density and elongation. Strength measures the resistance of a material to failure, density constitutes the mass per unit volume of a material, and elongation measures the ductility of a material. While strength is generally preferred in material selection, dense materials may not be desirable due to the extra weight. On the other hand, high density can be compensated by greater ductility, as it is with steel which, despite being dense, can be stretched very thin. As a result, steel tends to be preferred where long spans are required. Similarly, the high elongation fraction of polyvinyl chloride (PVC) allows the widespread use of plastics in window frames, despite this material's relatively high density and low strength compared to wood. Aluminium's performance on all three of factors is very strong, the material combining high strength and ductility with relatively low density. By contrast, concrete performs poorly because it lacks strength and ductility and is relatively heavy (hence it is often reinforced with steel).

Toughness: Toughness measures the energy required to crack a material. High toughness combined with high strength is desirable, hence the high use of composite materials regardless of their weight and elongation properties. In addition to high strength and elongation faction, metals also possess a high degree of toughness.

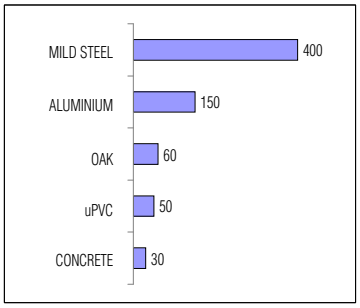
Production cost: Production cost is the total expenditure needed to make a product (Figure 3.8). High comparative cost, combined with only moderate or weak performance in strength, toughness and ductility, is clearly a key constraint to the use of hardwoods. Although it performs poorly on most measures of technical performance, concrete, on the other hand, scores highly when it comes to cost.

Maximum service temperature: Maximum service temperature indicates the maximum temperature at which a material can be used in engineering – above this its strength decreases rapidly. Among the materials under discussion, concrete is the material of choice when temperatures are likely to exceed 300°C. Unplasticized PVC (uPVC) performs particularly poorly in high temperatures (Figure 3.9).

Recycle fraction: The 'fraction recycled' is the potential fraction of a material that can be recycled cost-effectively (the qualifier 'potential' is important: the recycling fractions indicated in Figure 3.10 are not necessarily being achieved at present). The potential for recycling is clearly a considerable strength of the metals. Wood-panel composites, uPVC and concrete perform poorly relative to hardwoods on this criterion.

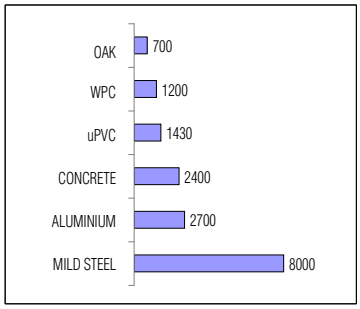
Energy content: Concerns about climate change and energy security have led to greater interest in the energy required to produce materials – their 'energy content' (Figure 3.11). With the exception of concrete, all materials perform poorly with respect to this criterion compared with wood, although increased recycling can greatly offset this problem (especially for metals). For materials that cannot be easily recycled, including composites and uPVC, this is a significant weakness compared with wood.

Figure 3.4 Strength (MPa)



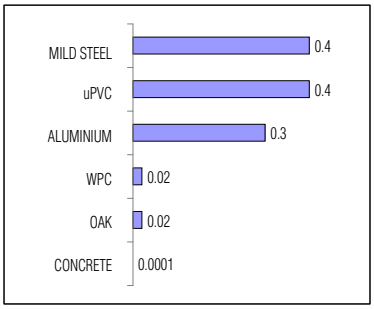
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.5 Density (kg/m^3)



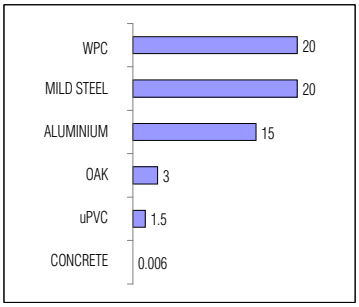
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.6 Elongation fraction



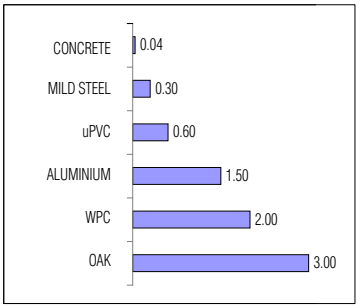
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.7: Toughness (kj/m^2)



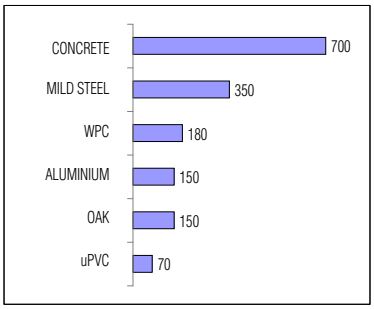
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.8: Production cost (£/kg)



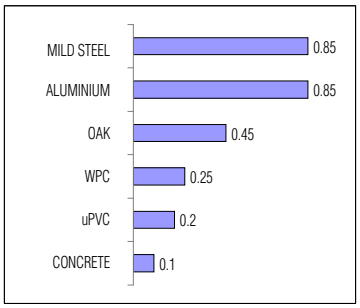
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.9: Maximum temperature (°C)



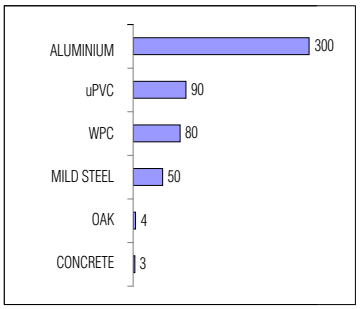
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.10: Recycle fraction



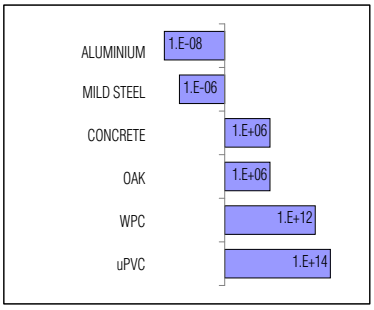
Source: University of Cambridge Department of Engineering website (2009)

Figure 3.11: Energy content (Mj/kg)



Source: University of Cambridge Department of Engineering website (2009)

Figure 3.12: Resistivity



Source: University of Cambridge Department of Engineering website (2009)

Resistivity: Resistivity is an indication of a material's ability to serve as an insulator of thermal energy (Figure 3.12). Aluminium and steel are generally poor in this regard. WPCs and uPVC, on the other hand, can offer superior insulation to wood.

In addition to the various values considered in the University of Cambridge study, other important qualitative factors influence material choice. The following are particularly relevant to tropical hardwoods:

- **Durability:** The concept of 'durability', as generally applied in the wood sector – i.e. the ability to withstand biodegradation – is much narrower than the concept applied by contemporary designers. For example, Natural Building Technologies, a supplier of 'sustainable building materials has noted that in addition to being physically robust, the durability of materials is dependent on their adaptability – so that they can cope with changes in lifestyle and fashion– and on their ability to maintain social integration and aesthetic values (Natural

Building Technologies website 2009). This broader concept of durability plays even more to the strengths of tropical hardwoods than does the narrower concept of durability for exterior use. For example, ipe has few competitors for decking and cladding because of its stability in use and ability to retain good color over long periods. Its natural, timeless appearance ensures it can cope with changing lifestyles and fashion.

- **Aesthetics:** This is one factor for which hardwoods have a significant competitive advantage over other materials – to the extent that other materials sectors, particularly plastics and composites, are investing heavily in efforts to mimic the look and feel of wood.
- **Environmental and health concerns:** These have been addressed above in relation to energy consumption and recyclability. There is, however, a host of other environmental and health issues that undermine the competitiveness of alternative materials relative to wood. For example:
  - Additives in concrete, including useful additives and unwanted additives, can cause health concerns. Radioactive materials, for example, have been added to concrete (Ademola and Oguneletu 2005). Moreover, radioactive substances can 'enter' concrete after formation as a result of nuclear leakage or detonation. Depending on what substances are in the concrete, dust from demolition rubble may cause serious health concerns.
  - Aluminium can cause severe ecological harm. It can accumulate in plants and cause health problems for animals that consume these plants. The uptake of aluminium by humans can take place through food, inhalation and skin contact. Significant concentrations of aluminium can lead to serious health effects, such as damage to the central nervous system, dementia, loss of memory, listlessness and severe trembling (Gitelman 1989).
  - The iron and steel industry is a major source of air pollution. Particulates are generated at virtually every stage, but most heavily by cokemaking and blast furnace operations (Environmental Roadmapping Initiative 2009).
  - The manufacture of plastics releases hazardous materials that affect the environment and the health of production workers. These include vinyl chloride monomer (in uPVC) and benzene (in polystyrene), which are known carcinogens, and styrene itself is a possible cause of cancer.[6]
  - The disposal of plastics has become a global dilemma. Very little is currently recycled, and its disposal introduces persistent organic pollutants (POPs) to the environment. This is particularly the case for plastics containing chlorine or bromine, which can become sources of POP dioxins when burnt (Tripoli and Deacon 2008). uPVC is of the greatest concern for dioxin generation, and should not be burnt under any circumstances.
  - The Healthy Building Network recommends that the use of WPCs should be limited due to concerns about the mixing of biological and synthetic materials, including limited end-of-life recyclability. It also suggests that products with multiple co-mingled recycled consumer plastics will have more contaminants and inconsistent properties (Platt *et al.* 2005).

6 See http://www.greenbuildingpress.co.uk/archive/plastics.php for a full discussion of the environmental impacts of plastics.

4 EXTERNAL FACTORS IMPACTING ON THE COMPETITIVENESS OF TROPICAL WOOD

Global demographic changes

Global demographic factors have significant potential to affect the relative competitiveness of tropical hardwoods and other materials. First, a very large absolute increase in the size of the global population is projected over the coming decades, from around 6.7 billion in 2008 to 9.4 billion in 2050. This implies significant underlying growth in global demand for all commodities, including wood of all types (World Population Bulletin 2008).

Second, population growth is unevenly distributed. During the 20th century, nearly 90% of population growth took place in less-developed countries (LDCs, as classified by the United Nations).7 This imbalance in population growth will intensify in coming years. While the combined population of the LDCs is projected to increase from 5.5 billion in 2008 to 8.1 billion in 2050, the more-developed countries (MDCs) are projected to grow from 1.2 billion to 1.3 billion. Particularly strong growth rates are projected for Africa, where population is expected to double in size between 2008 and 2050, and in India, which is widely expected to overtake China as the most populous nation in the world by around 2030, with a population in excess of 1.4 billion (India National Commission on Population Report 2009). The low levels of population growth projected for the MDCs will be largely accounted for by the United States and Canada, where growth will be boosted by immigration from LDCs. The population is forecast to decline significantly in several MDCs, including in Eastern and South Europe, Japan, Taiwan Province of China and South Korea (World Population Bulletin 2008).

The huge predicted population increase in LDCs implies growth in demand for commodities in those countries. On the downside, without successful moves to significantly increase the economic returns from tropical forests, growing populations in tropical LDCs also implies increasing pressure to convert those resources to other uses.

A third demographic factor is age-class structure, which differs radically between the LDCs and the MDCs. While the former are becoming increasingly characterized by large numbers of young people, exactly the opposite is true of the MDCs (World Population Bulletin 2008). Age-class structure has a very strong bearing on the types of products favored by the consuming public. For example, survey work in the Japanese construction sector has shown that the degree of openness to external trade and modern designs is closely correlated to age. Older people tend to prefer traditional Japanese post-and-beam building designs and the use of domestic materials. The fact that Japan has an ageing population goes some way to explaining the continuing dominance of traditional post-and-beam construction there and a particularly strong policy focus on substituting imported wood with domestic materials.

Another significant demographic factor is increasing urbanization. The world population is now evenly divided between urban and rural areas. By 2050, urban residents are likely to make up 70% of the world's population (World Population Bulletin 2008), suggesting an increase in demand for construction materials suitable for high-density living. Due to certain technical constraints on wood construction – for example, limits on the height of buildings that may be constructed with wood – the expansion of urban construction has, in the past, tended to favor non-wood materials such as concrete and steel. A major focus of technical development work in the wood sector has been to overcome these hurdles, for example through the development of EWPs and WPCs. At the same time, urbanization is contributing to the emergence of a trend in architectural and interior design to introduce wood materials in order to soften, 'humanize', and 'naturalize' harsh urban environments.

Rising demand in domestic and emerging markets

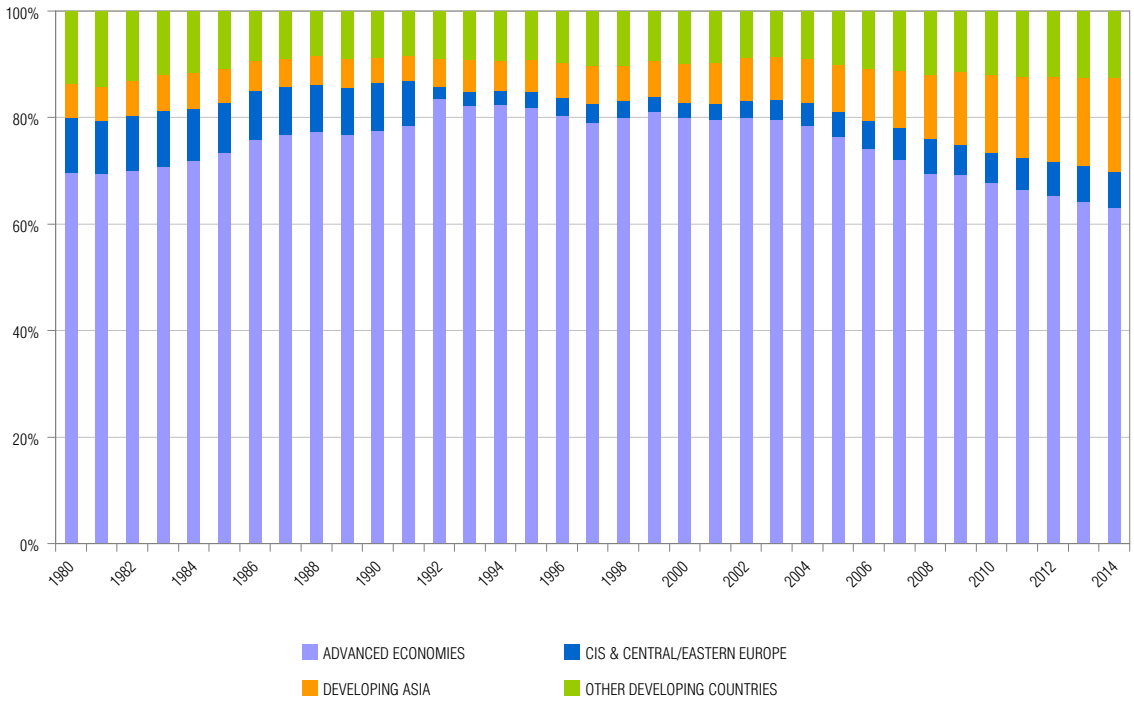
Taken as a whole, demographic factors imply that there are likely to be strong underlying opportunities to increase the volume of trade in tropical wood and that the best opportunities for

7 Includes all countries in Africa; Asia (except Japan); Latin America and the Caribbean; and Oceania (except Australia and New Zealand).

market growth may be in domestic and regional markets. This conclusion is reinforced by economic trends that indicate that a growing proportion of growth in gross domestic product (GDP) in recent years has been concentrated in tropical countries and other emerging markets (Figure 4.1) (World Bank 2009). At the beginning 1990s, the LDCs accounted for less than 20% of global GDP but on current trends this figure could reach 40% within the next decade. In terms of purchasing power parity, developing countries already account for around 50% of GDP. Much of this increase in GDP share can be attributed to rapid growth in 'developing Asia', the area encompassing China and India. While other developing countries may not have increased their share of global GDP their absolute level of GDP has grown significantly. For example, in the ten years preceding 2009, the GDP of sub-Saharan African countries increased from US$324 billion to US$870 billion, while the GDP of the Association of South East Asian Nations (ASEAN)-5 countries (Indonesia, Malaysia, Philippines, Singapore and Thailand) increased from US$462 billion to US$1195 billion.

Freedonia (2009) highlighted the importance of LDCs to future market demand in sectors particularly relevant to wood products. It forecast that the value of global demand for windows and doors, products that are significant outlets for tropical hardwoods, will grow by more than 4% per year to reach US$167 billion in 2013. This is only roughly one-half the pace achieved between 2003 and 2008, the slower rate due to a particularly weak outlook for building construction in the large West European market. Gains are forecast to be largely driven by demand in China, which is expected to account for over half of all expansion of the worldwide window and door market between 2008 and 2013. Although the rate of growth in window and door demand in China will also be slow compared to the 2003–08 period (when demand tripled), it is forecast to rise nearly 12% per year to US$40 billion by 2013, outpacing all other major national markets. China's expansion will be driven by the rapid growth of building construction in that country, especially in the non-residential market. By 2013 China is expected to surpass the United States as the largest market

Figure 4.1 % Share of world GDP by global region, 1980–2014 (current US dollar prices)



Source: World Bank (2009)

for windows and doors. Developing countries in Africa, the Middle East and Latin America are also expected to experience especially fast growth in 2008–13 as industrialization and rising incomes in many economies serve to boost demand (Freedonia 2009).

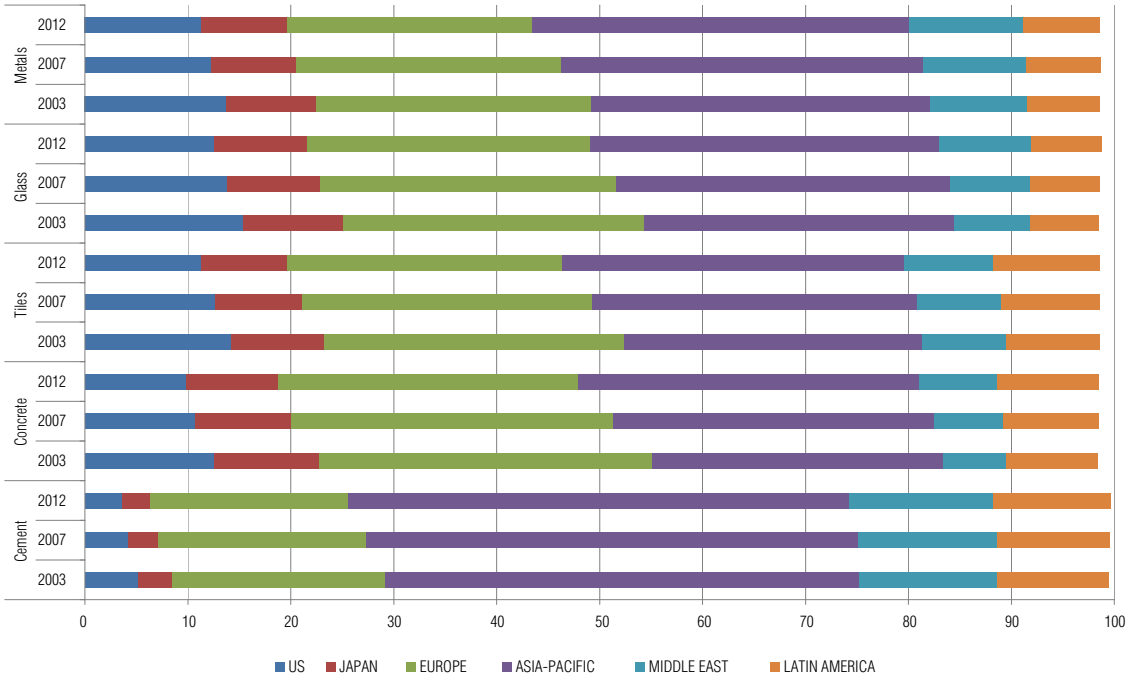
Global Industry Analysts (2008) also highlighted the growing importance of LDCs in global markets. Figure 4.2 shows market share (by value) for major non-wood materials used in construction in the main regional markets in 2003 and 2007 and the forecast share for 2012. For all products, the combined share of Asia and the Pacific, Latin America and the Middle East is already in excess of 50%; for cement the share is closer to 75%. The forecast suggests that this will rise significantly by 2012.

Market-access strategies for tropical wood in LDCs are likely to differ from those pursued in MDCs. In the MDCs, for example, the domestic availability of large quantities of temperate and boreal wood products tends to force tropical wood into relatively small niche markets that focus on either high-exposure external applications or high-value decorative internal applications. However, the combination of high humidity and pests such as termites mean that temperate species often do not perform nearly as well in the construction sectors of many LDCs as do domestic tropical species.

Moreover, just as temperate wood-product suppliers currently benefit from proximity to the consumer in Western markets, in the future some tropical suppliers will benefit from proximity to the consumer in their domestic markets. Local knowledge and presence is likely to be even more important in those markets, which tend to be chaotic and fragmented and where there is a very strong focus on price, a considerable premium is placed on rapid construction, there are lower levels of compliance to specific building standards, and the diffusion of innovative construction methods is a complex and difficult process.

In the longer term, a market-access strategy that relies on superior local knowledge of the low-value, high-volume construction sector in LDCs is unlikely to be sustainable. There are moves,

Figure 4.2 % market share (by value) of major non-wood materials used in construction in the main regional markets in 2003 and 2007, and forecasts for 2012



Source: Global Industry Analysts (2008)

however, to encourage the development of higher-quality and sustainable construction techniques specifically for LDCs, which could offer significant long-term opportunities for tropical hardwood producers both to add value to their products and to exploit the very low carbon footprint associated with the sourcing of wood products from sustainably managed local forests.[8]

Political and macroeconomic environment in tropical supply countries

The political and macroeconomic environments in the countries that supply materials are a major determinant in their competitiveness. Relative competitiveness is heavily influenced by a wide range of interconnected factors, such as the quality of infrastructure in supplier countries, the stability of institutions, business regulations, the availability of health and education services, labor and goods market efficiencies, financial market sophistication, technological readiness, the size of the domestic market, business sophistication, and innovation.

International competitiveness indices

The analysis of such factors has been simplified by the development by various international organizations of indices that rank countries on the basis of their relative competitiveness. Tables 4.1 and 4.2 show the rankings of key hardwood supplying and manufacturing countries against two indices. The World Bank's Doing Business in 2009 Index (DBI; Doing Business in 2009 website 2009) ranks countries on the basis of a quantitative analysis of factors that affect the ease of doing business (such as the number of days it takes to set up a business, the level of taxes and complexity of tax systems, and the costs and productivity of labor). The Global Competitiveness Index (GCI) of the World Economic Forum (WEF 2009) uses a wider range of more subjective measures, such as macroeconomic stability, health and education, labor market efficiency, and innovation.

Figure 4.3 shows how hourly wages vary across key hardwood producing and manufacturing countries. Consideration of this factor is important because in some parts of the wood-manufacturing sector, notably furniture, wages can form the single largest component of the cost of the finished product. Wage levels are also a useful indicator of where countries stand in terms of development status. High wages are closely associated with more advanced economic development.

These indices are designed to measure the relative competitiveness of nations rather than of a single product group like tropical wood. The indices do, however, provide valuable insights into how the geographic distribution of the tropical hardwood industries affects its overall competitiveness in relation to other wood and non-wood products and the appropriate strategies for enhancing competitiveness.

The most obvious observation arising from both the GCI and DBI is the low ranking of most tropical hardwood-supplying countries; some significant African hardwood-supplying countries in the Congo Basin are at the very bottom of the world rankings. While these countries are also characterized by extremely low wage rates, they lack other fundamental institutional and infrastructural requirements for the development of internationally competitive industries.

Competitiveness challenges in Africa

The challenge of encouraging investment in wood industries in tropical countries was explored in-depth at an ITTO-sponsored forum in 2006 on international tropical forest investment (ITTO 2006b). The forum highlighted that while foreign direct investment has grown at a rapid rate in recent few decades and now overshadows official development assistance, very little of this has been captured by tropical forest industries.

The forum particularly focused on the challenge facing investment in African ITTO producer countries. A wide range of factors that negatively affect the risk–return ratio of forest industries in the region was catalogued, including an unstable political situation; weak governance; the instability of fiscal policy and forest legislation; unfair competition from illegal operators; poor infrastructure; long distances to ports; environmental risks; poorly skilled labor; the

8 See http://www.gleearchitects.com/sustainablefaqtropic2.htm for a description of the types of measures being taken. One example is the US LEED program, which has developed a sustainable building model for tropical countries. This model, which was developed in Jamaica but has applicability for most tropical countries, calls for the use of lightweight building materials for construction as opposed to materials such as concrete and masonry that have a high thermal mass. The theory is that lightweight materials tend to cool down faster than heavy materials. See Shafii et al. (2006) for a review of the status of sustainable construction in Southeast Asia.

Table 4.1 GCI rankings, selected countries

	Overall ranking	Basic requirements	Efficiency enhancers	Innovation	Development stage
United States	1	22	1	1	3
Sweden	4	6	9	6	3
Singapore	5	3	2	11	3
Germany	7	7	11	4	3
Japan	9	26	12	3	3
Hong Kong, China	11	5	6	21	3
UK	12	24	4	17	3
France	16	13	16	14	3
Malaysia	21	25	24	23	2
Spain	29	27	25	29	3
China	30	42	40	32	1-2
Thailand	34	43	36	46	2
Portugal	43	37	34	43	3
Italy	49	58	42	31	3
India	50	80	33	27	1
Poland	53	70	41	61	2-3
Indonesia	55	76	49	45	1
Brazil	64	96	51	42	2
Romania	68	87	54	75	2
Viet Nam	70	79	73	71	1
Philippines	71	85	68	67	1
Peru	83	94	69	83	2
Ghana	102	106	95	107	1
Cote d'Ivoire	110	113	109	94	1
Cameroon	114	109	120	108	1
Guyana	115	115	112	111	1
Bolivia	118	108	128	134	1

Source: (WEF 2009)

complexity and heterogeneity of the forest structure; and pressure from campaigning non-governmental organizations (NGOs). It was also noted that only large companies operating in Africa have access to loan facilities and for large loans even they need international guarantees, which are hard to obtain. Added to these challenges is the fact that large timber companies operating in tropical Africa often have to shoulder the costs of social infrastructure (e.g. roads, water, housing, electricity, hospitals and schools) that in developed countries would be provided by the state.

Some tropical countries are internationally competitive

The GCI and DBI imply that macroeconomic conditions in most tropical wood-producing countries will be a constant drag on overall international competitiveness. They also show, however, that these conditions vary widely between tropical countries. For example, Malaysia and Thailand stand out for achieving relatively high global rankings across a wide range of competitiveness criteria. Both countries, which as well as being important suppliers of primary wood products have also become global players in the wood-furniture sector, fair well against major furniture-manufacturing countries, such as Italy and Poland, in the developed world.

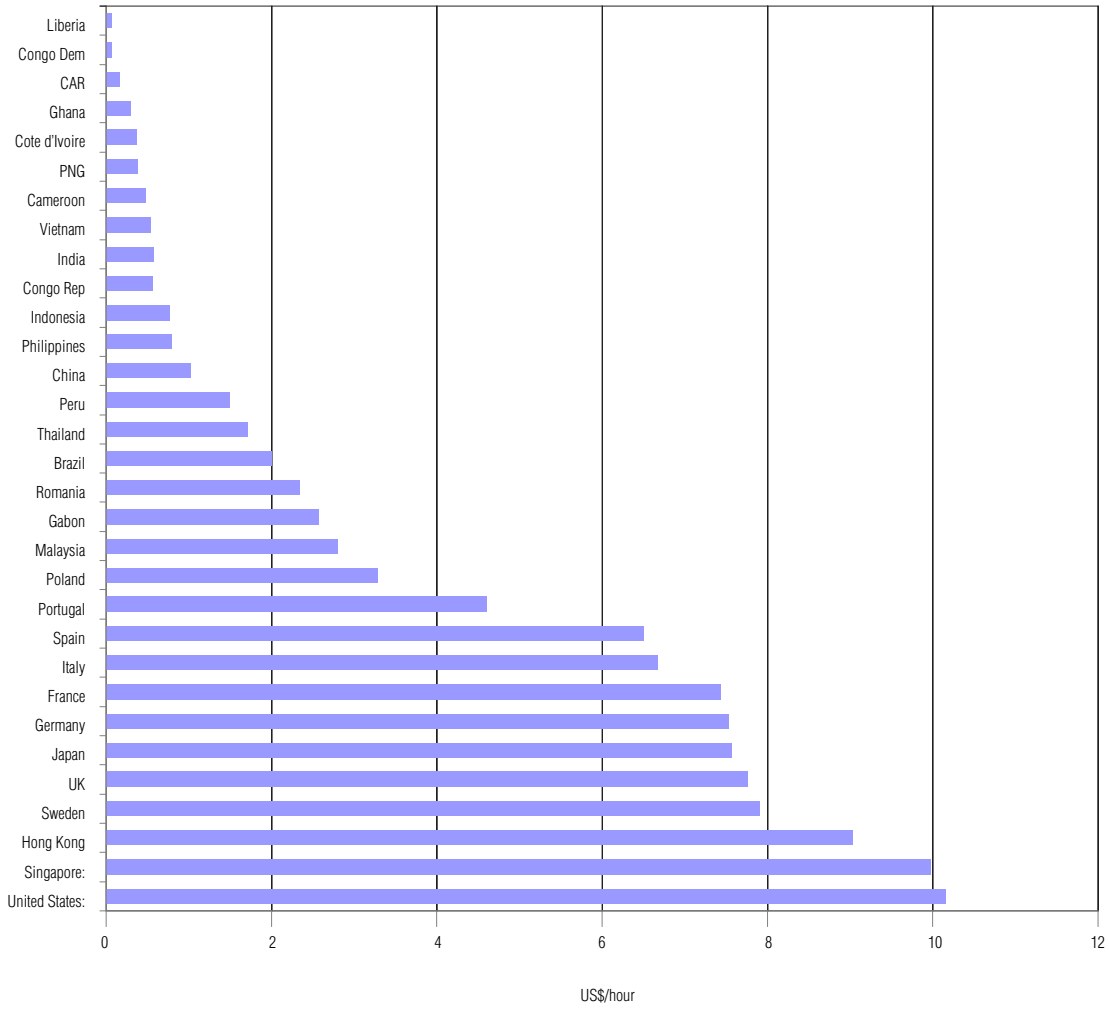
The position of Brazil in the global rankings is also interesting. Brazil ranks very low on the DBI, suggesting it is not an easy place to do business, but it has a middling rank in the GCI, which covers a wider range of criteria. WEF (2009) noted that while the country suffers from low (but improving) macroeconomic stability, government inefficiencies and poor educational standing, it also has "a remarkable degree of sophistication in the business sector". Factors contributing to this sophistication include the presence of a relatively large and efficient financial sector and a huge domestic market, which apart from providing a solid foundation for business development also provides a testing ground for new products. These factors have combined to contribute to relative dexterity

Table 4.2 DBI Index rankings, selected countries

	Ease of doing business rank	Starting a business	Dealing with construction permits	Employing workers	Registering property	Getting credit	Protecting investors	Paying taxes	Trading across borders	Enforcing contracts	Closing a business
Singapore	1	10	2	1	16	5	2	5	1	14	2
United States	3	6	26	1	12	5	5	46	15	6	15
Hong Kong	4	15	20	20	74	2	3	3	2	1	13
UK	6	8	61	28	22	2	9	16	28	24	9
Japan	12	64	39	17	51	12	15	112	17	21	1
Thailand	13	44	12	56	5	68	11	82	10	25	46
Sweden	17	30	17	114	10	68	53	42	6	55	18
Malaysia	20	75	104	48	81	1	4	21	29	59	54
Germany	25	102	15	142	52	12	88	80	11	9	33
France	31	14	18	148	166	43	70	66	22	10	40
Romania	47	26	88	143	114	12	38	146	40	31	85
Portugal	48	34	128	164	79	109	38	73	33	34	21
Spain	49	140	51	160	46	43	88	84	52	54	19
Peru	62	116	115	149	41	12	18	85	93	119	96
Italy	65	53	83	75	58	84	53	128	60	156	27
Poland	76	145	158	82	84	28	38	142	41	68	82
China	83	151	176	111	30	59	88	132	48	18	62
Ghana	87	137	142	145	31	109	38	65	76	50	104
Viet Nam	92	108	67	90	37	43	170	140	67	42	124
Papua New Guinea	95	92	124	31	73	131	38	87	89	162	102
Guyana	105	100	37	72	63	145	70	108	113	73	126
India	122	121	136	89	105	28	38	169	90	180	140
Brazil	125	127	108	121	111	84	70	145	92	100	127
Indonesia	129	171	80	157	107	109	53	116	37	140	139
Philippines	140	155	105	126	97	123	126	129	58	114	151
Bolivia	150	165	98	180	129	109	126	176	117	133	59
Gabon	151	148	60	154	158	131	150	101	128	147	134
Liberia	157	88	177	105	172	131	142	59	115	165	146
Cote d'Ivoire	161	167	160	112	139	145	150	148	155	124	68
Cameroon	164	171	154	124	138	131	113	171	137	172	95
Equatorial Guinea	167	174	87	178	69	131	142	161	133	69	181
Congo	178	157	68	170	171	131	150	179	176	155	117
Central African Republic	180	152	138	151	133	131	126	178	175	169	181
Democratic Republic of the Congo	181	154	141	175	152	163	150	153	160	173	150

Source: Doing Business in 2009 website (2009)

Figure 4.3 Hourly wage rates by country, 2006



Source: World Bank World Development Indicators database

in absorbing and adapting technology from abroad and leveraging information and communication technology.

Different competitiveness strategies for different tropical countries

The strategies required to enhance competitiveness of tropical wood industries will vary widely between tropical countries: the best strategy for enhancing the competitiveness of central African wood industries, for example, will be different to that needed in Malaysia, Thailand or Brazil.

The GCI is underpinned by twelve 'pillars of competitiveness'. WEF (2009) suggested that the significance of each pillar for competitiveness varies with a country's level of development:

- In the first stage of development, the economy is factor-driven and countries compete based on their factor endowments, primarily unskilled labor and natural resources. Companies compete on the basis of price and sell basic products or commodities, with their low productivity reflected in low wages. Maintaining competitiveness at this stage of development hinges primarily on well-functioning public and private institutions (pillar 1), well-developed infrastructure (pillar 2), a stable macroeconomic framework (pillar 3), and a healthy and literate workforce (pillar 4).
- As wages rise with advancing development, countries move into the efficiency-driven stage of development, where they begin to develop more efficient production processes and increase product quality. At this point, competitiveness is increasingly driven by higher education and training (pillar 5), efficient goods markets (pillar 6), well-functioning labor markets (pillar 7),

sophisticated financial markets (pillar 8), the ability to harness the benefits of existing technologies (pillar 9), and a large domestic or foreign market (pillar 10).

- Finally, as countries move into the innovation-driven stage they are able to sustain higher wages and the associated standard of living only if their businesses are able to compete with new and unique products. At this stage, companies must compete through by producing new and different goods using the most sophisticated production processes (pillar 11) and through innovation (pillar 12).

Based on this analysis, which builds on classic liberal economic theory, a conclusion that may be drawn is that the overall global competitiveness of the tropical hardwood industry, in terms of innovation, product quality and price, may be optimized in each supplying country by focusing on those areas where the country has a comparative advantage. Most tropical wood-producing countries are currently very low in the competitiveness rankings; in the short to medium term, therefore, their international competitiveness is likely to lie in the supply of unprocessed or only partly processed wood products. Maintaining or improving competitiveness in the supply of these products will depend on continued efforts to develop more robust institutions, improve infrastructure, promote a more stable macroeconomic framework, and improve the health and literacy of the workforce. On the other hand, countries higher up the ranking should focus on labor productivity, the quality of further processing, and innovation.

Value-added wood-processing industries and competitiveness

This analysis raises questions about the impact on the overall competitiveness of the tropical hardwood industry of policy measures implemented in both producer and consumer countries designed to protect domestic industries by encouraging greater local processing, for example export or import tariff-escalation policies. In interviews for this study, one leading Ghanaian shipper commented that Ghana's policy of preventing log exports undermined competitiveness because Ghana lacks the capacity and skills to maximize yield. Similarly an agent in the Netherlands suggested that Indonesia's policy of exporting only mouldings rather than rough-sawn wood had a negative impact on competitiveness. The mouldings were more expensive and, because they did not match the specifications of European buyers, had to be resawn in Europe, leading to additional cost and reduced yield.

In LDCs there may well be legitimate and pressing reasons to use policies such as tariff escalation to fast-track the development of value-added wood-processing industries, even in the absence of key preconditions for competitiveness, such as access to appropriately qualified staff, machinery and other infrastructure, and a lack of market knowledge. Such policy measures may be necessary to create local employment, generate trickle-down effects and enhance local appreciation of the forest's economic value. It may also be necessary to use policy interventions to encourage domestic value-adding and to develop the skills and other conditions necessary to improve long-term wealth and competitiveness. However, it also needs to be understood that the impact of such policy measures, at least in the short to medium term, may well be to undermine the competitiveness of tropical wood products in international trade.

The impact of China and Viet Nam on competitiveness

A related issue is the role played by emerging wood-processing hubs – particularly China and Viet Nam – in influencing the relative competitiveness of tropical hardwoods. Despite a lack of domestic wood resources, these countries have exploited other macroeconomic advantages – such as relatively low labor costs, their position in relation to global trade networks, and high levels of business acumen – to play an increasingly prominent position in the global wood trade. At one level the emergence of China and Viet Nam as major processing hubs may be seen as undermining the efforts of tropical wood-supplying countries to develop their own downstream-processing industries.

On the other hand, it may equally be argued that both countries have contributed to the increased competitiveness of tropical hardwood products. For example, the recent massive expansion of China's wood-flooring sector has made a wider range of wood-flooring products, including those based on tropical hardwoods, available to consumers in many areas of the world at highly competitive prices. This has been a significant factor helping to boost wood's overall market share in the global flooring market.

Viet Nam has played a similar role in the market for garden furniture.

Other market factors are now being introduced that appear to be undermining the ability of China and Viet Nam to compete in the manufacture and supply of tropical hardwood products – such as rising labor costs, declining regional tropical wood supply, and increasing demands for legality verification and environmental labeling. Nevertheless, developments in these countries' wood-processing industries are likely to remain a critical factor in the competitiveness of tropical wood products for the foreseeable future. A key strategic issue for tropical wood-supplying countries and industries will be how to most effectively align themselves in relation to these large wood-processing countries.

Freight

Three aspects of freight are important to the competitiveness of tropical hardwoods: price, reliability and shipping time. These are dependent on a host of factors including distance, the quality of transport infrastructure, position in relation to major ports and shipping routes, and the efficiency of ports (which, in turn, is determined by the quality of port management and equipment, labor relations and levels of congestion).

Price of freight

The price of sea freight has generally become a less important competitiveness factor over time. Sea freight rates have declined over time scales measured in decades. The Maritime Economics Freight Index (MEFI) fell from 883 in the immediate aftermath of World War II to just 140 in 1999 (at constant 2000 prices). This has been a major driver of globalization, enabling manufacturers located considerable distances from both raw materials and customers to exploit other comparative advantages, such as low labor costs or product innovation, to compete successfully with locally based manufacturers (Stopford 2009).

Nevertheless, changes in the last decade briefly raised the possibility that freight rates could become a more significant cost factor, even to the extent of partially eroding globalization. Between 1999 and 2007, the MEFI more than tripled from 140 to 477, driven by rising oil prices and the shortage of shipping created by strong global economic growth and the surge in demand for commodities in China (Stopford 2009). For the time being at least, the collapse in global trade in late 2008 seems to have reversed this trend. Freight rate rises in early 2008 were followed by a massive drop in the second half of the year. Forecasting future sea freight rates is fraught with difficulty, but the signs are that they will remain low in the short to medium term.[9]

While sea freight rates may have become a less important factor in the commodity trade overall, the combined cost of land and sea transport remains a major competitiveness factor for many tropical hardwood producers that are located in isolated areas at a considerable distance from ports, such as in the Congo Basin and the Amazon. It is also proportionally more significant when dealing with bulky and comparatively lower value primary commodities like logs and rough-sawn wood.

According to a study considering the impact of transport costs on trade in sub-Saharan Africa by the United States International Trade Commission, "the costs associated with movement to port in developing exporting countries are non-trivial. These costs have three dimensions: financial costs of land transport, opportunity costs of time in slow processes, and uncertainty associated with unpredictable arrival times and incomplete information" (Ferrantino and Christ 2009). For exports of logs and sawnwood from the Central African Republic, trucking prices from forest to port of export were estimated to account, on average, for 32–38% of the total CIF Europe price of the product (Ferrantino and Christ 2009). This was a significantly higher proportion of CIF costs than for any other of the commodities exported from sub-Saharan Africa analyzed.

Freight rate volatility

Short-term fluctuations in freight rates can be very disruptive to trade and there are reasons to believe that, due to its relative fragmentation (see Chapter 4), the wood industry is particularly susceptible to such disruption. For example, during the period of rising prices earlier this decade, the Federation

9 The shipping industry responded to rapid growth in demand in the years leading up to 2008 by ordering huge quantities of new tonnage. The world merchant fleet expanded by 7.2% during 2007 to 1.12 billion deadweight tons, and vessel orders were at their highest level ever in 2008. This has led to concerns, in the wake of the global downturn in the second half of 2008, that the shipping sector may be entering a period of over-capacity.

Table 4.3 LSCI for selected countries significantly engaged in the hardwood products industry

	2004		2008		% change, 2004–08
	LCSI	Rank	LCSI	Rank	
China	100	1	137.4	1	37.4
Hong Kong, China	94.4	2	108.8	2	15.2
Singapore	81.9	4	94.5	3	15.4
Germany	76.6	7	89.3	4	16.5
United States	83.3	3	82.5	6	-1
Malaysia	62.8	12	77.6	9	23.5
France	67.3	11	66.2	13	-1.6
India	34.1	21	42.2	20	23.5
Brazil	25.8	28	30.9	27	19.5
Romania	12	61	26.4	38	119.2
Indonesia	25.9	27	24.8	40	-4
Viet Nam	12.9	55	18.7	50	45.7
Ghana	12.5	58	18.1	53	45.3
Peru	14.8	47	17.4	57	17.5
Côte d'Ivoire	14.4	50	16.9	58	17.6
Congo	8.3	87	11.8	74	42.3
Cameroon	10.5	69	11	76	5.6
Gabon	8.8	81	8.9	87	1.8
Papua New Guinea	7	94	6.9	100	-0.6
Liberia	5.3	113	4.3	127	-19.6
Equatorial Guinea	4	127	3.9	134	-4.6
Myanmar	3.1	139	3.6	141	16.4
Democratic Republic of the Congo	3.1	142	3.4	145	10

Source: UNCTAD (2008)

of Malaysian Manufacturers reported that larger shippers of commodities who held long-term contracts with the shipping lines and who tended to monopolize space on the container ships were not feeling the full effects of the price rises. On the other hand, smaller shippers of lower-value commodities (timber exporters generally fall into this category) with insufficient volume to negotiate preferential rates were being asked to shoulder most of the burden of increased prices.

Reliability and speed of shipping

The absolute cost of freight is likely to be a significantly less important factor in relative competitiveness than the other two inter-related factors of reliability and shipping time. This is borne out in a study by Drewry (2007) which, using a modeling approach, found that supply-chain responsiveness and agility appear to play a more important role in outsourcing decisions than do transport costs. Short production cycles requiring rapid delivery times and 'agile' supply chains have become particularly relevant in the context of the furniture industry, which now places a significant premium on the ability to adjust rapidly to changing fashions. The credit crunch and onset of recession at the end of 2008 also increased the focus of construction materials suppliers on the maintenance of lower stocks and just-in-time delivery.

Liner Shipping Connectivity Index

A simple measure of the tropical hardwood sector's competitiveness with respect to reliability and delivery time is provided by UNCTAD's Liner Shipping Connectivity Index (LSCI). This index10 assesses the connectivity of 164 countries to international container routes by combining data on the numbers of container ships deployed, their total and per-capita carrying capacity, and the number of liner companies operating routes to each country.

Table 4.3 presents the results of the LSCI analysis for key countries engaged in the international hardwood trade. In terms of containerized shipping, China is now the world's most 'connected' country, a factor in its recent strong

10 The LSCI is generated by UNCTAD from data obtained through Containerisation International Online, which is at www.ci-online.co.uk.

growth as a wood-processing hub. Of the tropical hardwood suppliers, Malaysia's position as the world's ninth-most connected nation in 2008, up from 12th position only four years previously, is particularly notable from the perspective of international competitiveness. This accords with personal comments from traders that Malaysia's strong competitive position in the EU for plywood, sawnwood and wood furniture is bolstered by the perceived reliability of exporters and their ability to ship product from Port Klang into Rotterdam in less than three weeks. Brazil also performs reasonably well on this measure of connectivity, although any advantage this may convey is undermined by the length of transport routes within Brazil. Most other tropical hardwood suppliers perform relatively poorly on this measure, falling well behind suppliers of alternative temperate hardwoods, such as the United States, Germany and France and also behind those countries that are now emerging as key wood-processing hubs, dominated by China.

Link between connectivity and degree of wood processing

One, perhaps obvious, observation is that there tends to be a close link in the wood sector between high levels of connectivity and the degree of wood-processing. Countries that are poorly connected to international trade routes have tended to focus on exports of primary wood products due to a lack of access to Western consumers, the high costs of importing essential raw materials for value-added manufacturing, and the unwillingness of highly skilled staff to locate in isolated areas. This general observation holds true for temperate wood products (a large proportion of New Zealand's wood exports comprise logs) as well as tropical hardwoods. The link is even evident on a regional basis. In Africa, the most connected countries – Ghana and Côte d'Ivoire – evolved value-added industries much more extensively and rapidly than the less-connected countries of Central Africa. In Asia the obvious example is Papua New Guinea, which is still very unconnected and is still largely dependent on log exports. This analysis suggests that moves to increase the competitiveness of tropical countries in value-added wood-processing industries cannot be viewed in isolation from broader measures to improve transport infrastructure.

Industry consolidation and the changing nature of supply chains

Size matters in any industry. Consolidation can provide critical competitive advantages, such as increased efficiency; asset, product, or geographic diversification; and lower capital costs. Diversification can reduce cash-flow volatility and improve market access, and larger firms are better able to attract capital for innovative investments. Larger companies tend to be better placed to dictate terms to their suppliers and to influence the purchasing practices of their customers. Smaller numbers of large companies also tend to be better placed than large networks of small companies to coordinate financing for research and development, marketing and political lobbying. The process of certifying against technical and environmental standards also tends to be simpler and less costly for larger companies.

Given that the international wood industry is dependent on a widely distributed resource covering over 30% of the world's land area and that barriers to entry into the sector are low compared to more capital-intensive sectors such as plastics, steel and aluminium, industry fragmentation is likely to be a source of competitive disadvantage compared to many non-wood products.

Higher degree of consolidation in sectors supplying competing materials

There has been considerable consolidation in non-wood materials in recent years through mergers, asset swaps, joint ventures and acquisitions as companies have sought to expand their geographic presence and gain access to new product markets. By 2004, the top ten iron-ore producers accounted for around 70% of world output, while the top ten steel producers accounted for around 26% of world output. In the steel industry, one company alone – Arcelor Mittal – boasts an annual crude steel production of 116 million tons, representing around 10% of world steel output and revenues of US$105.2 billion (World Steel Association 2009). The 25 member companies of International Aluminium Institute are collectively responsible for up to 80% of global primary aluminium production and around 20% of recycled metal production (International Aluminium Institute website 2009).

A similar process of consolidation has been under way in the international forest products sector, although this has impacted much more heavily on the large softwood, composite-panel and paper-producing sectors than on the hardwood sector. White *et al.* (2006) estimated that the top 100 forest products companies may process as much as 50% of total industrial roundwood supply, while the top ten companies may account for 20% of total industrial roundwood supply. However, the 2009 list of the world's top forest, paper and packaging industry companies – compiled by PricewaterhouseCoopers (2009) based on annual turnover – contains only 19 companies located in countries with emerging economies, and all of these, with only one exception (in Thailand), are outside the tropical forest zone (mainly in China, Brazil, Chile and South Africa).[11]

Industry data from several tropical countries also indicate high levels of fragmentation. For example, according to the Malaysian Timber Industry Board, 80% and 90% of companies operating in Malaysia's wood industry and furniture sector, respectively, are small and medium-sized enterprises (SMEs). Malaysia has an estimated 1100 sawmills, 352 mouldings mills, 170 plywood mills and 2400 furniture firms. According to data compiled by Forest Trends, over 98% of enterprises in Brazil engaged in wood-harvesting, wood-processing and furniture-manufacturing are classified as SMEs, which together account for around 75% of total wood industry production value. According to Mayers and Macqueen (2007), 93% of forestry enterprises and 50% of revenues in Guyana derive from small forestry enterprises. In India the equivalent figures are 87–98% and 82%.

Fragmentation is equally a feature of temperate hardwood-producing regions. For example, in the United States the hardwood lumber industry has consolidated to some extent in the last decade, but there are still an estimated 2300 sawmills (down from more than 4000). Around 50% of these mills produce less than 5000 m^3 per year, and the largest single mill (Anderson-Tully) produces only about 212 000 m^3 annually, equivalent to a medium-sized softwood lumber mill (Leonard Guss Associates 2004).

Extent of consolidation in end-use sectors

The marketplace for wood products and its competitors also remains relatively fragmented. For example, according to Eurostat data there were 149 000 furniture manufacturers in the EU in 2006, each employing an average of only nine employees. There were also about 100 000 furniture retail outlets employing around 600 000 people. The EU's construction sector comprised 2.8 million enterprises, 93% of which are micro-enterprises with fewer than ten employees (FII 2009).

Nevertheless, consolidation has been significant within some distribution channels and end-use sectors, notably the do-it-yourself (DIY) and builders' merchants sectors. For example, the European Confederation of Woodworking Industries (CEI-Bois) reported that, in 2002, the market shares of the top ten companies in the DIY and builders' merchants sectors was 58% and 67% (respectively) in the UK; 65% and 74% in France; and 32% and 22% in the United States (CEI Bois 2004). It is likely that these percentages have risen considerably more recently because the trend of consolidation intensified in most countries in the last decade. For example, it is estimated that in the UK only five companies now control over 80% of the builders merchants' market (Buildingtalk 2007). The recession in the construction sector that began in 2008 in many Western countries is expected to intensify consolidation trends further as struggling companies are bought up by the more resilient, usually larger, companies at rock-bottom prices.

While the process of consolidation in the furniture and joinery manufacturing sectors has been slower, there have been significant developments in some areas. For example, the emergence of IKEA has had a very significant impact on the furniture sector in many parts of the world. Companies like Jeld-Wen and Vicaima have been expanding market share in the windows and doors sectors throughout Europe and North America.

Consolidation and brand protection

Consolidation within major retailing and manufacturing sectors has tended to go

11 The failure of tropical timber companies to make it on to this list is only partly due to its focus on the paper industry. No list of the world's largest tropical timber companies has been compiled, but such a list would likely include Rimbunan Hijau, DLH, Samling, Danzer and Rougier. While all these companies are considered very large in the context of the tropical hardwood industry, only two – Rimbunan Hijau and DLH – would make it onto the PricewaterhouseCoopers top 100 list. Both would sit in around 80th position, each with an annual turnover of about US$1 billion. All the other 'giants' of the industry have turnovers well below the US$654 million of PricewaterhouseCoopers' 100th-listed company. The largest 'forest, paper and packaging company' identified by PricewaterhouseCoopers is International Paper, which in 2008 had a turnover of nearly US$25 billion.

hand-in-hand with the development of high-volume branded products backed by long-term guarantees and other services. Larger consolidated buying companies have also been concerned to protect their brands and reduce reputational risk and have been better placed to exert influence on suppliers. Increasingly these companies have seen their role as gate-keepers, taking responsibility for complicated material sourcing issues on behalf of their customers. This in turn has driven a process of the restructuring of overall procurement practices, often in favor of a limited number of key suppliers who are able to reliably and regularly supply larger volumes and who adhere to specific quality, environmental and social standards. This process has often involved the complete substitution of one raw material for another. In the European DIY, builders' merchants and joinery sectors, for example, this process has helped to drive the replacement of tropical sawnwood by engineered wood in window frames, teak by eucalypt in the garden-furniture sector, and tropical hardwood plywood by combi plywood or OSB (FII 2009). Materials sectors with significant fragmentation will be at a significant competitive disadvantage as this process runs its course.

Lack of consolidation a more pressing problem in the downturn

There are indications that the problems of fragmentation may intensify during the current recessionary period as low consumption, limited cash flow and a lack of credit have placed a huge premium on the ability to supply products on a just-in-time basis. Manufacturers are under pressure to switch to materials that can be more easily supplied little-and-often and more easily adapted at short notice to changing consumption patterns. Thus, Italian kitchen furniture manufacturers, for example, are being encouraged to switch away from solid hardwood surfaces in favor of laminates.

Potential measures to mitigate problems of fragmentation

Measures can be taken by wood suppliers to mitigate the problems caused by fragmentation. Mayers and Macqueen (2007) suggested that the development of effective alliances, confederations, cooperatives and associations provide part of the solution. Many such organizations have emerged in the tropical hardwood sector; most tropical wood-producing countries, for example, have wood-exporting associations of variable effectiveness. The role of these organizations is likely to increase in the future and there is a very strong case for ensuring that they are provided with adequate support.

Measures can also be taken by players within the hardwood distribution chain to overcome problems of fragmentation at the level of the forest owner or primary processing mill. Over the last decade, for example, some of the larger European importers have established huge concentration yards close to the main ports, notably in Belgium, the Netherlands, Luxembourg, northern France and Germany. These now act as key links in the supply chain between hardwood shippers on the one hand and European merchants, retailers and smaller distributors on the other. Such concentration yards iron out the problems of inconsistent supply and provide a wide range of other services to allow for regular supply of products accurately against specification and on a just-in-time basis. They have established direct contact with mills in major supply countries, built large warehouses, established hi-tech stock control and customer management systems, developed large-scale processing capacity to supply kiln-dried, cut-to-size timber. One large Belgium-based importing and distributing company interviewed by the Timber Trade Journal in mid 2008 noted that they could supply any location in Europe within 48 hours. These companies have been so successful that many expanded warehousing and their supply and customer base during 2008.

Some benefits of small-scale operation

While fragmentation of the means of production can be a source of competitive disadvantage, it is not necessarily a bad thing. Mayers and Macqueen (2007) catalogued numerous benefits of small forestry enterprises, including the following: wealth accrues locally; conflicts due to external resource appropriation are reduced since decisions are made close to home; 'cultural' products can be developed for niche markets; local environmental accountability is strengthened; and the spread of entrepreneurship is encouraged.

Under certain circumstances, advantages may also flow from the distribution of manufacturing functions amongst a wide range of smaller specialist firms. Ratnasingham (2006a) suggested, for example, that significant advantages to be gained in the high-value-added furniture sector from the

increased outsourcing of components, noting that the reluctance of many players in the Southeast Asian woodworking industry "to move their manufacturing operations outside their roof" may be a source of competitive disadvantage. After all, the huge success of the Italian furniture industry has been built on large concentrations of SMEs, each specializing in the production of particular components. This industry structure has helped foster flexibility and innovation in production and design. As Ratnasingham (2006a) commented: "furniture factories that are small and specialized in one single operation have a better chance of keeping the investment costs low, hence reducing the total overhead cost".

Under certain circumstances, therefore, fragmentation can be a source of strength. The key is to ensure that the activities of the various players are organized and coordinated effectively.

Climate change

Energy efficiency in the construction sector

Mounting concerns about energy security, global warming and the risk of catastrophic climate change combined with national commitments to targets under the Kyoto Protocol has led to numerous policy initiatives to improve energy efficiency in wood-consuming countries. The built environment, which is globally responsible for 30–40% of energy use and CO_2 emissions (United Nations Environment Programme 2009), has been a key focus of many of these initiatives.[12] Compared with many other industry sectors, opportunities to reduce energy consumption and emissions in the construction sector tend to be regarded as easier to achieve and more substantial.

For tropical hardwoods, these various measures have particular implications for the supply of materials to window and door manufacturers. Substantial quantities of heat can be lost through windows and external doors, exceeded only by the potential loss through the roof; building regulations, therefore, tend to focus heavily on the U-values (i.e. the overall heat transfer coefficient) of these components. Manufacturers are increasingly looking to improve energy performance without a loss of price competitiveness.

This focus on energy efficiency has tended to improve wood's overall competitiveness against non-wood products in the door and window sectors. Wood is a good natural insulator. Unlike metals it does not suffer from thermal bridging and, if the correct species is used, it is sufficiently strong to be combined with triple glazing without modification. As a result, wood windows – including tropical hardwood windows – are capable of achieving relatively high U-values without adding significant cost.

Nevertheless, other materials sectors have made significant progress through innovation in the development of new techniques and products. In the UK, for example, uPVC external doors with a U-value of 1.8 w/m^2 Kelvin were being offered in mid 2009 at prices comparable to equivalent tropical hardwood external doors with a U-value of 1.905 w/m^2 Kelvin. Similarly, data compiled by the

12 For example, the EU has been promoting energy-efficient buildings through the Energy Performance of Buildings Directive (EPBD), which came into force in January 2003 and which covers all new buildings and the renovation of large existing buildings. The Directive requires member states to set standards and to establish mechanisms for implementation. Member states have responded with the introduction of energy-efficiency requirements in building regulations. The toughest standards have been imposed in the Nordic countries as well as Germany, Austria, the UK and Ireland. In the United States, energy-efficiency requirements for buildings are being introduced through various initiatives at state and federal levels. Since January 2007, for example, energy-efficiency performance standards have been imposed on commercial and multi-family high-rise buildings built by, or for the use of, any federal agency. Many individual states now have tough legal requirements for the energy efficiency of buildings. California introduced energy-efficiency standards as long ago as 1978. Most recently, President Obama's 2009 stimulus bill enables homeowners to claim a tax credit of up to US$1500 for upgrading their primary residence with energy-efficient building components, such as exterior windows, doors and skylights. In Japan, the Act Concerning the Rational Use of Energy requires those engaged in the construction of large buildings to report on energy-saving methods. The law was amended in March 2008, with effect from April 2009, to strengthen energy-conservation measures in both the commercial and household sectors. In a move that is particularly significant from the perspective of the potential volume of construction in the future, the Chinese government introduced a far-reaching energy efficiency law on 1 October 2007 which established unified technical codes for building energy efficiency covering the preparation of energy-efficient designs, the testing of energy-efficient construction projects, and energy-efficient construction quality assurance.

United States Efficient Windows Collaborative[13] suggest that the best triple-glazed argon wood windows can achieve a U-value of 1.7 w/m^2 Kelvin. While this is greatly superior to the best aluminium windows (2.7 w/m^2 Kelvin), it is equivalent to the performance of the best uPVC windows and falls short of the best fiberglass windows (which achieve U-values of around 1.0 w/m^2 Kelvin).

Green building initiatives and life cycle assessment

Energy-efficiency standards in construction are often linked to green building initiatives (GBIs), which attempt to provide a broad measure of the environmental performance of whole buildings. GBIs include Leadership in Environmental Design (LEED) and Green Globes in North America, BREEAM in the UK, CASBEE in Japan, HQE in France, and DGNB in Germany. The available data suggest that GBIs are beginning to make very significant headway in the United States and the UK, with most other markets still some way behind.

In the United States, McGraw-Hill Construction (2008) suggested that the value of green building construction starts was up five-fold in 2008 (to US$36–49 billion) compared with 2005 (US$10 billion) and that the 2008 value could triple (to US$96–140 billion) by 2013. On these data, green construction starts in the United States during 2008 accounted for around 7.3% of total construction starts and will grow to over 20% in the next four years. A major driver is expected to be President Obama's 2009 federal stimulus bill, which states that a percentage of recovery funds must be used for work performed in accordance with green building standards.

In the UK there are already around 100 000 BREEAM-certified projects (Joyce 2008). The number of housing units certified annually under BREEAM increased from 15 000 in 2004 to 35 000 in 2007. Meanwhile, the number of developments registered annually with the BREEAM office scheme increased from negligible levels in 2003 to 800 in 2007. There are now plans to use building regulations to phase in green building requirements that draw heavily on the BREEAM standard so that they eventually become standard practice in the UK construction sector.

Data on the uptake of GBIs in other countries tends to be less impressive. The HQE system, for example, has certified only 190 buildings, with a further 450 in the pipeline, while the DGNB system only operated on a pilot basis in 2008 (Joyce 2008). Nevertheless, anecdotal reports suggest that interest in GBIs is now rising strongly in many markets, particularly boosted by emerging concern for climate change.[14] There is also evidence to suggest that GBIs are making progress in some regions not previously regarded as particularly 'green'. For example, the UAE capital Abu Dhabi has set its sights on enacting the world's toughest green building standards. In pursuit this aim, Abu Dhabi has launched the Estidama Program (Arabic for 'sustainability') which will eventually become mandatory for all new buildings in Abu Dhabi and is also being promoted for adoption throughout the UAE and wider Middle East region (UNECE 2009).

GBIs have significant potential to improve the overall competitiveness of wood products. Independent life cycle assessments regularly score wood more highly than alternative building materials on a wide range of environmental criteria. For example, an ITTO review of LCAs undertaken on tropical wood products in August 2004 concluded that "In general terms, LCAs show timber-based products to have favorable environmental profiles in comparison with alternative materials" (Murphy 2004).

However, a considerable amount of work is still required to ensure that standards give appropriate credit to the environmental attributes of wood products, particularly tropical products. GBIs are often as much political as technical processes. Materials' supplying sectors have become heavily engaged in efforts to lobby the governing bodies of GBIs in an effort to ensure that standards play to their materials' strengths. So far the wood industry has not proved particularly adept at lobbying and GBIs have been a mixed blessing for wood products. Discrimination against wood can actually be built into GBI standards since wood is often the only material required to demonstrate

13 A United States coalition of window, door, skylight and component manufacturers, research organizations, federal, state and local government agencies, and others interested in expanding the market for high-efficiency fenestration products.

14 This conclusion is suggested, for example, by the range of presentations at the UNECE Timber Committee Workshop on Green Building convened in October 2008.

responsible sourcing. At present the LEED standard only credits FSC-certified wood helping drive demand for the FSC brand at the expense of wider appreciation of the environmental merits of wood. Similarly, the Japanese CASBEE system provides credits for the use of wood from sustainably managed forests, but the current guidance includes a basic presumption against the use of any tropical hardwood which are considered unsustainable and a presumption in favor of softwoods which are considered sustainable. Locally produced softwoods are seen as particularly benign.

Nor are GBIs necessarily built on a comprehensive life cycle assessment approach. The Architects' Council of Europe has noted that GBIs may reward building planners for taking a few environmentally progressive steps, some of which may not be particularly relevant, while ignoring deeper problems. As a result it is quite possible to manipulate credit systems to design a building that achieves a high rating which is nevertheless not very environmentally sound (Joyce 2008).

Successful engagement in GBI processes is heavily dependent on ensuring that the industry fully understands and has access to reliable objective research on life-cycle environmental impacts. Currently, however, this is an area in which the tropical industry is losing competitiveness. Murphy (2004) identified only one comparative LCA involving tropical hardwoods conducted in full accordance with the International Organization for Standardization (ISO) 14040 series of standards. That study compared the use of acetylated EU pine timber for sheet piling in an urban waterway in the Netherlands with the naturally durable timbers azobe (a hardwood from West Africa) and larch (a softwood from Siberia), finding that the overall environmental profile of azobe compared very favorably with that of larch for that particular use. Murphy 2004) recommended that the tropical hardwood industry undertake further work on LCA to avoid losing the initiative to temperate species and non-wood products. There is little evidence of effective follow-up, however, either to promote the results of the LCA or to carry out further LCAs on a wider range of tropical wood products.

There is also now a growing need to engage in ongoing efforts to improve the application and conformity of GBIs. At the international level, for example, the ISO is considering GBIs under Technical Committee 59 on sustainability in building construction. In the EU, CEN Technical Committee 350 is working on the sustainability of construction works. The EU-funded LENsE [European Methodology Development towards a Label for Environmental Social and Economic Buildings] project is also engaged in an effort to develop a relatively simple and user-friendly approach to GBIs. At the level of an individual system, LEED is currently engaged in what it calls an 'LCA-into-LEED' process that includes an initiative to award LEED points for the selection of products or assemblies highly ranked on a full LCA basis from a pre-rated list.

REDD initiatives and carbon markets

Forests are now at the very heart of international efforts to counter the threat of climate change. In 2009 there was a strong political focus on hammering out the foundations of a possible future international framework for 'reduced emissions from deforestation and forest degradation' (REDD) in the run-up to the 15th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in December 2009. Policymakers are also keeping a close eye on the progress of the Obama Administration's cap-and-trade bill, which could alter attitudes towards the inclusion of forestry offsets in international carbon-trading mechanisms. At the same time, United Nations agencies are deeply engaged in efforts to develop an international architecture for REDD, notably through the World Bank's Forest Carbon Partnership Facility and the United Nations Programme on Reduced Emissions from Deforestation and Forest Degradation. At present much of the work is focused on the preparation of 'readiness plans' for REDD in tropical countries and pilot projects to demonstrate the potential of the concept.

By placing a value on a key environmental attribute of standing forests, REDD initiatives have significant potential to alter the economics of tropical land management. Numerous studies have shown that, on a purely financial basis, liquidation logging (with or without subsequent conversion to agriculture) is often many times more profitable than sustainable forestry (e.g. Rice *et al.* 1997, Pearce *et al.* 2002): the difference in profitability has been documented to be as high

as eight-fold (Howard *et al.* 1996). Inevitably, this has been a major driver of deforestation in tropical regions, which are typically characterized by rapid population growth, short time horizons, and associated high discount rates.

Maximizing payments from environmental services

It is questionable, however, whether the international community will come up with sufficient resources to finance REDD initiatives to the extent necessary to discourage forest conversion. The UK-commissioned Eliasch Review (Eliasch 2008) suggested that close to US$30 billion per year would be required to halve the rate of forest loss and its associated impacts on climate change, an amount far beyond the level of financing produced by the international community to date. At a project level, Butler *et al.* (2009) showed that even if REDD credits were priced at the level of carbon credits traded in compliance markets, the profits to be derived from forest protection for carbon sequestration would fall short of the profits that may be derived from the conversion of natural forests to oil-palm agriculture in Southeast Asia.

This analysis highlights the importance of maximizing payments for a wide range of environmental services beyond carbon, including forest-derived goods and services that benefit local and regional economies. Such payments could boost the value of standing forests and complement returns from REDD and, in so doing, make the preservation of forests economically competitive with agriculture and other competing land uses.

A good example of how this can work is provided by Precious Woods, an FSC-certified company operating in the Amazon (Salvesen 2006). In 2005–06 it introduced a product diversification strategy with the aim of supplementing income from wood with revenues from carbon credits (by switching to biofuels and avoiding methane), essential oils (a high-margin business with local employment opportunities and high profitability), the sustainable harvesting of orchids, and the sale of renewable energy from its biofuel investments. Overall, Precious Woods revenues increased by 50% in 2006 and profits tripled. Profits prior to the diversification strategy were around US$1 million but increased to around US$3 million after the change. Profits from wood products declined by around 25%, to US$0.75, after diversification but this loss was offset by profits of US$2.25 million derived from carbon credits, biofuels and botanicals. Precious Woods is also now benefiting from reduced reliance on cyclical wood markets and seasonal fluctuations, while carbon contracts bring in foreign currency. The reduction of waste wood has reduced fire risk and local communities are satisfied with the job opportunities provided.

The need to integrate, in a consistent and systematic manner, all (carbon and non-carbon) environmental services within a comprehensive SFM framework for tropical forests is recognized by ITTO in its Thematic Programme on Reducing Deforestation and Forest Degradation and Enhancing Environmental Services in Tropical Forests (ITTO 2009a). This covers all the main environmental services of tropical forests, including climate-change mitigation and adaptation; the maintenance and enhancement of biodiversity; the improvement of soil and water conservation; disaster prevention and flood control through improved resilience; ecotourism, amenity and recreation values; and sustainable forest production. The main instrument of implementation is the provision of coordinated support for projects and activities proposed by stakeholders in ITTO member countries.

Risk of over-emphasis of carbon at the expense of broader sustainability objectives

Despite ITTO's initiative, there remains significant risk that REDD initiatives will focus attention on the carbon-sequestration role of tropical forests at the expense of their broader role in the delivery of social, environmental and economic services. This is evident at a number of levels. At its 8th session the United Nations Forum on Forests failed to reach agreement on the financing of commitments made under the international non-legally binding forest instrument. According to one analysis, forest financing could, as a result, be skewed towards the UNFCCC, despite the widely held view in the forest community that this carries the risks of ignoring the role that SFM can play in both adaptation and mitigation and of marginalizing the many other values delivered by forests (Earth Negotiations Bulletin 2009). Meanwhile, at the level of national policies, REDD is encouraging the development of national forestry programs in accordance with narrowly focused procedures for the measurement, assessment, reporting and verification of emissions from deforestation (ITTO 2009a).

Some environmental groups are also now vigorously arguing that REDD initiatives should reward only forest preservation and that any form of wood extraction, including reduced impact logging, is incompatible with the goal of climate mitigation. This argument is based on claims that preserved old growth forests are not carbon-neutral but continuously build up carbon stocks; that even reduced impact logging results in significant collateral damage to forest stands, leading to increased carbon emissions compared to a strategy of total preservation; and that the amount of carbon actually stored in tropical wood products is small compared with emissions during production (Global Witness 2009).

These arguments can be challenged on a number of grounds. They fail to acknowledge the role of tropical wood industries in creating rural employment and providing social services. No account is taken of the intense population pressure in many tropical countries, which could make the opportunity costs of total preservation extremely high. Nor is there consideration of the potential for the imposition of stringent restrictions on forest use in certain areas to significantly increase the potential for deforestation leakage into surrounding areas. There are contrasting scientific views on the long-term potential of old-growth forests to absorb CO_2. And, while the carbon contained in tropical wood may be relatively small, the increased use of tropical woods may well offer much more significant carbon-mitigation benefits through substitution of other, much more energy-intensive, products in construction and the manufacture of furniture.

Bolstering the case for harvested wood products in the international climate-change policy regime

Research is already bolstering the case for the recognition, in carbon-trading schemes, of harvested temperate wood products as carbon stores and of sustainable wood production in temperate regions. For example, drawing on data relating to softwoods in the eastern United States, Perez-Garcia *et al.* (2005) showed that a strategy of forest preservation would be superior to one of sustainable wood production if only the carbon stored in forests is considered. If, however, the additional carbon stored in wood following harvest and the benefits of substituting wood for more energy-intensive products are included, the carbon-storage benefits of regular wood-harvesting outweigh the forest-preservation strategy. Studies in Switzerland (GEO Partners 2008) and Sweden (Otersund University 2008) have drawn similar conclusions.

Overall, the science suggests it would be wrong to assume that either preservation or sustainable wood production is always the best strategy for long-term carbon storage. The optimum solution will vary from place to place depending on such factors as forest type and local demand for forest products and other forest services. It is likely that, in many tropical regions, a strong case can be made that the management of natural forests for wood production is a better carbon-sequestration strategy than forest protection and preservation. Sustainable tropical wood production combines low-impact selective harvesting with the supply of a durable product that can directly substitute for highly energy-intensive products such as steel and aluminium.

Nevertheless, there is an urgent need for comprehensive and region-specific research to assess the impact of different management strategies on carbon storage in both forests and forest products, including the substitution effects of tropical wood use in construction and manufacturing.

FLEG initiatives

Numerous policy measures are now being implemented with the aim of improving forest law enforcement and governance (FLEG) and countering the trade in illegally harvested wood. These measures are being promoted and coordinated through various intergovernmental processes, such as the World Bank-led regional FLEG processes, the EU's Forest Law Enforcement, Governance, and Trade (FLEGT) Action Plan, the ITTO/FAO regional workshop process on forest law compliance and governance, and other regional efforts such as those of the Central African Forestry Commission (COMIFAC), the Congo Basin Forest Partnership, the Asian Forest Partnership, ASEAN, and the Amazon Cooperation Treaty Organization.

The programme document for the ITTO Thematic Programme on Forest Law Enforcement, Governance and Trade noted that "there is a common perception that illegal operations are widespread in the tropical-wood sector which taints its image in major import markets" (ITTO 2009b). Various modeling studies (admittedly drawing on highly speculative estimates of the level of illegal logging) have indicated that the

presence of significant volumes of illegal wood on international markets, mainly from tropical sources, significantly depresses prices for products derived from legitimate sources.

At a very basic level, therefore, the emergence of a concerted international response to the problem of illegal logging has significant potential to increase the competitiveness of legally sourced tropical wood by removing cheaper illegal products from the market and by tackling a major factor that undermines their reputation and acts as a constant drag on marketing.

Certain policy measures have clear potential to boost the competitiveness of tropical woods in very direct ways. For example, many bilateral development programs contribute resources to developing countries to assist them to strengthen forest governance. Through the FLEGT voluntary partnership agreement (VPA) process, the EU provides support to developing countries for assessing and improving legality assurance systems, policy analysis and communication activities.[15] Support for measures to improve forest governance is also provided through two EU FLEGT programs covering Asia and the Africa–Caribbean–Pacific group of countries.

On the other hand, as highlighted by ITTO (2009b), inappropriate and poorly conceived policy measures could have a detrimental effect on the international competitiveness of tropical woods. The governments of both producer and consumer countries need to ensure that measures imposed to prevent illegal logging and the trade in illegally harvested products are proportionate to the scale of the problem and do not unnecessarily add costs to legitimate wood supply chains. This is a difficult balancing act, particularly in a market where end-users may be reluctant to pay higher prices for legally verified wood products. Those facing higher costs associated with efforts to meet and demonstrate legality could be put at a competitive disadvantage.

Balancing enforcement with the need to avoid additional costs on legitimate operators

It is still unclear just how successful policymakers have been in achieving an appropriate balance between improving enforcement and avoiding the imposition of extra costs on legitimate operators. In producer countries there has been criticism of the increase in command-and-control measures that have arisen in response to the perceived threat of illegal logging. The Para State Timber Exporters Association (AIMEX) noted, for example, that Brazilian-government measures to crack down on illegal logging has imposed heavy regulations on the bigger companies engaged in the export trade while numerous small companies remain unregulated and dependent on illegally felled wood (Netto 2008). Other observers have argued, to the contrary, that forestry laws tend to favor dominant interests such as large industry and political elites and that enforcement processes unevenly target small-scale users and fail to adequately take account of the need to ensure continued access to wood supply by rural communities (Colchester *et al.* 2006).

Both arguments highlight the importance of ensuring that FLEG measures are integrated with a process of law reform in producer countries, which, in some cases, might actually involve deregulation and efforts to simplify forest legislation combined with a more structured approach to enforcement, the clearer definition of rights and responsibilities, and the strengthening of social contracts.

In consumer countries the available evidence suggests that some policy measures may be leaning too much towards demanding extra controls without adequate consideration of the need to avoid additional costs on legitimate operators. ITTO (2009b) noted, for example, that "[major import] markets have responded by introducing requirements for legality and sustainability to provide assurance for buyers and consumers of the acceptability of using tropical timber and timber products… the hurried imposition of various market requirements poses difficulties of market access to many tropical timber suppliers who may be ill equipped to meet these requirements, particularly community and other small and medium-scale forest-based enterprises". Similarly, CIFOR noted that: "trade-based approaches designed to encourage law enforcement and discourage timber imports from illegal operations may ignore national realities and pay little attention to the social implications of enforcement" (CIFOR 2006).

15 Ghana and the Republic of the Congo both signed FLEGT VPAs with the EU in July 2009, and formal negotiations on similar agreements are under way in Cameroon, Malaysia and Indonesia. VPA-licensed timber is not expected on the European market until at least the second half of 2010.

Public-sector procurement policies

These problems are apparent in the efforts of government authorities at national and local levels to introduce policies for public-sector wood procurement. About ten national governments worldwide have introduced some form of procurement policy for wood: Brazil, Japan, Mexico, New Zealand, Norway and several EU member states. Procurement policies and guidelines are also being developed and implemented in several other countries with the potential to affect the demand for wood products, including Australia, the United States and China.

Rather than merely seeking to avoid wood from illegal sources, several government authorities have moved rapidly to require that wood must be certified as sustainable. The Belgian and German governments have set a minimum requirement for wood to be sustainable and effectively recognize only FSC or PEFC certification as appropriate evidence. The UK and Netherlands governments adopted a more phased approach, accepting both legally verified and certified sustainable wood for a period of time[16] before moving to a policy of requiring only sustainable or FLEGT VPA-licensed wood when available. The Norwegian government has simply banned the use of all tropical wood in public-sector contracts, arguing that no certification system can credibly certify sustainability in the tropics.

Not all government procurement policies are so restrictive. For example, the French and Japanese policies draw no distinction between legally verified and certified sustainable wood products and accept a wide range of approaches to demonstrate compliance. Such evidence includes, in France, various legal documents such as forest management plans and, in Japan, conformance with industry codes of conduct.

Nevertheless, a common failing of all wood-procurement policies is that they are rarely matched by the imposition of equivalent controls on the legality and sustainability of alternative materials. As the requirements for wood may be complicated and convoluted they have the potential to act as a strong incentive to avoid wood and to use other materials instead.

16 Certified sustainable or FLEGT VPA-licensed timber was introduced as the minimum requirement for public-sector contracts on 1 April 2009 in the UK and will be introduced at the beginning of 2010 in the Netherlands.

Questions also need to be raised with respect to the processes used by consumer-country governments to develop procurement policies. Stakeholder consultations surrounding public-sector wood-procurement criteria are inevitably driven by domestic interests. Concern for accommodating the views of domestic stakeholders often appears to override the real needs of sustainable forestry in supplier countries. Generally, national timber-importers associations are expected to represent and articulate the interests of suppliers and forest managers in all supplier countries. Where overseas interests are directly engaged it is often assumed that they are 'represented' by certification systems. This inevitably reinforces a particular concept of 'sustainability' based on compliance with specific certification standards.

The jury is also still out on the extent to which Europe's FLEGT VPA licensing process will affect the relative competitiveness of tropical hardwoods in the European market. An impact assessment commissioned by the Dutch government on a potential EU–Malaysia VPA concluded that, without additional efforts to ensure that no significant extra costs or bureaucratic delays are imposed on licensed wood and that wood from potentially illegal sources in non-VPA countries is reliably removed from European supply chains, the competitiveness of FLEGT-licensed wood could be undermined in the EU.

Consumer-country legislation designed to remove illegal wood from trade

Frustration at the limitations of public-procurement policies and private initiatives to guarantee the removal of illegal wood from supply chains has encouraged a regulatory approach in the United States and the EU. On 22 May 2008 the Lacey Act (United States) was amended with the intent of extending its application to include illegally harvested wood. The amendment makes it illegal to import, export, transport, sell, receive, acquire, or purchase in interstate or foreign commerce any plants or products made from plants – with limited exceptions – that were harvested or taken in violation of a domestic or foreign law. The Act gives the government the power to fine and jail individuals and companies that import wood products harvested, transported or sold in violation of the laws of the country in which the wood was originally harvested.

An important principle of the Lacey Act is that the burden of proof is on the United States government to demonstrate that the violators knew or should have known of the underlying violation. The amended Act includes new import-declaration requirements for information on the tree species used in imported wood products and the name of the country in which the wood was harvested. It does not, however, require the importer to have all of the information necessary to be certain of the legal origin of the wood. Instead, the importer must collect information that, depending on what it suggests about the origin of the wood, should prompt further inquiry by the importer to assure its legality.

In October 2008 the European Commission proposed similar legislation that would oblige European operators who place wood and wood products for the first time on the European Community market to apply a 'due-diligence system' designed to reduce the risk of illegal wood entering European supply chains. The expectation is that a law along these lines will be introduced sometime in 2010, with detailed requirements for due-diligence systems to be phased in over a period of years.

Trade impact of consumer-country legality legislation: opportunities and threats

The impact of both pieces of legislation is still uncertain. Given the challenges of establishing a reliable chain of evidence it is not yet clear how successful the United States authorities will be in bringing successful prosecutions under the Lacey Act. The impact of the European law is likely to be heavily dependent on the specific requirements of due-diligence systems and the sanctions to be imposed, details that have yet to be worked out.

In broad terms however, the Lacy Act amendment in the United States and the proposed due-diligence legislation in the EU is expected to encourage importers to seek further assurances – typically backed by independent third parties – that, in areas or regions where the risk of illegal logging is judged to be high, wood has been obtained from legal sources, while imposing few extra demands on wood suppliers in regions where the risk of illegal logging is judged to be low. Since illegal logging is widely perceived to be a more serious issue in tropical countries, the new requirements are likely to fall most heavily on suppliers of tropical wood products. Neither piece of legislation spells out clearly what is actually required of wood suppliers in 'high-risk' countries, which could be a potential source of confusion. As with other demands for technical and environmental standards, compliance is likely to be particularly challenging for more fragmented industry sectors. From this narrow perspective, the legislation may be detrimental to the competitiveness of tropical hardwoods, particularly those derived from small enterprises and community forests.

On the other hand, new opportunities for tropical hardwood suppliers may also flow from the new regulatory framework. An underlying principle of both pieces of legislation is that they apply equally to all wood products –tropical, temperate, domestic or imported. This should encourage increased scrutiny of the legality of non-tropical as well as tropical suppliers, helping to level the playing field. The focus of both the Lacey Act and the European Commission's proposed legislation is very specifically on legality rather than sustainability. There are signs that this is already increasing appreciation of the value of phased approaches to certification in tropical countries. The legislation should benefit the increasing number of tropical suppliers that have already made substantial investments to develop and implement legality verification and certification systems or that are actively engaged in the EU's FLEGT VPA process and can be expected to actively encourage a more widespread uptake of such measures by a wider range of suppliers.

While a potential source of confusion in the early stages, the fact that there is currently neither piece of legislation contains detailed guidance on the types of assurances necessary to avoid prosecution may be beneficial in the longer term. There is a window of opportunity now for tropical countries to help shape the discussion on the most appropriate forms of evidence to show that wood is low-risk with respect to illegal logging. This may be more desirable than foisting detailed and potentially inappropriate systems of legality verification and risk assessment on suppliers.

Against this background, the recommendations made in ITTO (2009b) seem appropriate: that "close cooperation between producer and consumer countries is required in order to avoid possible adverse impacts of unilaterally imposed market requirements", and that "common approaches or

standards [for legality assurance] at international level would facilitate implementation but flexibility is needed to adapt them to local conditions in tropical timber producing countries which vary extensively in terms of the legal framework and institutional set-up".

Corporate social responsibility

Corporate social responsibility (CSR) is an increasingly important component of global business strategies. Definitions vary but generally include references to voluntary actions by corporations – over and above compliance with legal requirements – to address the interests of wider society.[17] The key implication of the trend towards CSR is that it considerably broadens the range of issues traditionally regarded as falling within the remit of corporate action. The United Nations Global Compact, which is used as the basis of the CSR policies of many of the world's largest companies, encompasses principles on human rights, labor standards, the environment and anti-corruption.[18]

CSR therefore implies something more than the knee-jerk reactions to single-issue campaigns designed to protect image and brand that have typified most corporate action in the past. It suggests forward planning, a proactive approach to identifying potential problems before they arise, the development and communication of coherent strategies, and the implementation of management systems to ensure their implementation.

KPMG survey highlights expanding CSR practice

The growing importance attached to CSR by big business is clearly demonstrated by KPMG's three-yearly International Survey of Corporate Responsibility Reporting, conducted most recently in 2008 when it encompassed 2200 companies including the Global Fortune 250 Group of Companies and the 100 largest companies by revenue in 22 countries (KPMG 2008). The study concluded that "there has been an important shift … with CSR reporting becoming the norm instead of the exception within the world's largest companies. Three years ago only 50% of companies surveyed included CSR in their reporting, in this survey the figure jumped to 80%".

KPMG also asked whether these reports passed the 'greenwash' test and concluded that: "for the first time in the 15 years we have been doing this survey, we think they just might. Nearly all of the Global 250 companies that report also publish a corporate responsibility strategy with defined objectives. Our findings show that management systems are maturing and that reporting is likely the result of a systematic approach to corporate responsibility that includes a strategy, management system, stakeholder engagement, reporting, and assurance".

The survey results suggest that, to a large extent, growing interest in CSR is internally driven by factors such as ethical concerns, employee motivation and innovation and learning. However, other external factors, such as the risk of negative publicity for brands, are also frequently cited as important drivers. In some countries, notably in Europe, there are also signs of moves to the mandatory reporting of non-financial issues in company accounts, which might become a more significant factor in the future.

The KPMG survey highlights significant variations in the extent of CSR commitments in various countries. The UK and Japan have long been leaders in the process, but KPMG concluded that "in the next several years we could expect reporting by companies in the United States, Spain, the Netherlands, Italy, Canada, Sweden, and Brazil to track against the same trend line witnessed in Japan and the UK – toward the 100 percent mark". KPMG suggested that Brazil is likely to be a leader among LDCs: "Brazilian companies will have an impact on their Latin American peers and competitors so we expect the practice to take hold in this region".

Implications of CSR for tropical hardwood's international competitiveness

At one level, the rapid emergence of CSR activities, which is particularly prominent among larger companies in the developed world, may be seen as detrimental to the international competitiveness of the tropical hardwood industry. Requirements for higher labor and environmental standards and moves to avoid areas perceived to suffer from high levels of corruption may simply lead to further discrimination in favor of products from developed countries at the expense of developing countries. There is potential for CSR activities to be hijacked by protectionist interests in developed countries

17 For example, see the discussion of CSR definitions at http://www.mallenbaker.net/csr/definition.php.
18 See http://www.unglobalcompact.org.

to deny developing countries their comparative advantage in low labor costs. Empirical studies have certainly indicated that higher labor standards can undermine the comparative advantages of developing countries (Busse 2002).

On the other hand, CSR policies, if practiced well, have the potential to improve the competitiveness of tropical hardwoods. Good CSR implies the adoption of a comprehensive life-cycle philosophy recognizing that efforts to improve conditions in one area might be detrimental in another and requiring that tradeoffs are made. It implies that companies will spend the time to improve their knowledge of the underlying issues and to develop realistic programs of action. Tropical hardwoods have suffered considerably more than most other commodity sectors from simplistic single-issue campaigns. Therefore, any move to a more rational and informed approach that balances the impacts of different materials and takes account of broader issues such as rural development should be beneficial. For example, interviews with large retailers and builders' merchants in the UK, which have been leaders in the CSR process, suggest that these companies are now well-informed about tropical forestry issues and understand the challenges of meeting tough certification standards. As a result they have avoided the introduction of unrealistic targets for tropical suppliers and have been ready to work with them through step-wise systems of legality verification and forest certification (FII 2009).

An implication of the rise of CSR is that it heightens the importance of engagement by all materials-supplying sectors in initiatives now under way to guide and harmonize CSR procedures and standards. Particularly significant is the Global Reporting Initiative, which, in the KPMG survey, was used by 77% of companies. Another key initiative likely to have an impact in the future is the development of the ISO 26000 Guidance Standard on Social Responsibility.

Recycling and waste reduction

In some markets the ability of products to be disposed of or reused at the end of their life cycle is becoming an increasingly important competitiveness issue. It is particularly critical when considering the overall competitive position of wood in relation to non-wood products. The proportion of materials manufactured from finite resources such as aluminium, steel and plastics that are derived from post-consumer waste streams is critical to claims about the sustainability of these alternative materials. For example, the World Steel Association claims that 25–30% of all steel manufactured today is derived from recycled sources, with the remainder extracted from iron ore. According to the International Aluminium Institute, the equivalent estimate for the aluminium industry is 33%.

Although complex plastics products do not lend themselves so readily to recycling, there are clear indications that the plastics industry is waking up to the importance of demonstrating waste-minimization strategies. For example, drawing on LCA methodology the UK's BRE recently awarded an A rating to uPVC windows in its Green Guide. This guide forms a component of the BREEAM environmental rating system for buildings and of the UK government's Code for Sustainable Homes. According to BRE, a significant reason for this upgrading of uPVC window environmental performance is the development of new recycling procedures in the UK plastics industry (BRE 2009). One specialist company – Dekura – now recycles over 50% of available uPVC waste in the UK (Dekura website 2009).

At the same time, governments in many countries are developing strategies to minimize the level of waste going to landfill from the construction industry. This reflects the huge volume of waste generated in the construction sector (in the UK, for example, the tonnage of construction-sector waste is estimated to be three times that of domestic waste); the growing costs associated with landfill in increasingly crowded urban areas; and the impact of waste streams in the calculations of the overall embodied energy of a building. There are increasing regulations about waste disposal from construction, and many products – even common products like gypsum, plasterboard, and mineral wool insulation – are now labeled as hazardous and require special disposal.

The focus on waste disposal and recycling has the potential to be a significant competitive advantage for tropical hardwood products which, unlike many other materials, tend not to require the application of chemicals and other treatments to enhance performance. Generally the less

processed a material is, and the less hazardous, the easier will be its re-use, recycling and healthy disposal. Exploiting this opportunity, however, requires systems and procedures to be in place in wood-consuming regions to facilitate recycling. Where such procedures do not arise spontaneously, the wood industry may need to take the initiative to encourage their development. In the UK, for example, wood-industry associations are cooperating in the creation of regional clusters, bringing together wood processors, manufacturers, merchants and other organizations that generate waste wood and linking them with wood recyclers.

Architectural and designer perceptions and trends

Current perceptions

Several surveys of architectural and other designer perceptions of wood have been undertaken, providing insights into the competitiveness of wood products relative to non-wood alternatives (see Annex 3). These studies suggest that, in certain sectors of the architecture and design community, preconceptions about wood's behavior in fire and its durability and strength, together with its image as an old-fashioned material, are significantly undermining wood's competitive position relative to other materials. Moreover, even where the design community appreciates the aesthetic qualities of wood there is a risk that their views will be overruled by other actors (such as building contractors and clients) in the specification process who may be more risk-averse with respect to technical characteristics.

Robichaud (2008) surveyed North American architects engaged in non-residential construction, finding that wood products were perceived to perform less well than steel and concrete in their contribution to high building value, durability, fire resistance and structural performance. Only on one issue – that of environmental friendliness – did wood products outperform these key non-wood competitors. An assessment of the 'brand personality' of wood among surveyed architects suggested that it was generally perceived to be down-to-earth, outdoorsy, honest, charming and wholesome, but was not widely seen as intelligent, upper-class, tough, up-to-date or daring.

Robichaud (2008) concluded that existing wood-industry communication campaigns targeting architects, which tend to focus heavily on green issues, are performing a useful role in reinforcing the perceived positive attributes of the material. On the other hand, the study suggested that communication campaigns should be broadened to address architects' negative perceptions with respect to fire resistance, durability, structural performance and value. It also concluded that architects' information needs with respect to wood were related to, in order of priority, design possibilities; regulations and standards; sustainable design; project costing; and environmental footprint.

It would be wrong to read too much into this and the other surveys referenced in Annex 3. Most are limited in scope and do not capture the huge scale and diversity of the design community. There is a lack of existing studies dealing specifically with designer attitudes to tropical hardwoods, which in itself is a source of competitive disadvantage as it implies a shortage of hard information about underlying market needs.

Most studies to date have focused heavily on structural uses of wood in Western markets, which are much less relevant to many types of tropical hardwood than the finishing and furniture sectors. The structural sector is renowned for being relatively risk-averse and conservative compared with the finishing sectors, where there is more room for experimentation and a greater focus on aesthetics, versatility, ease of use, and naturalness (Gaston *et al.* 2001, Rametsteiner *et al.* 2007).

Interviews with interior and furniture designers undertaken during 2009 for the current study suggest that, compared with softwoods, which were the main focus of past surveys, tropical hardwoods tend to be viewed more positively on some issues (e.g. natural technical performance and aesthetic qualities) and worse on others (notably environmental attributes).

Emerging design trends

Another key feature of design trends is that they are highly fluid and dynamic, particularly in the furniture and finishing sectors. Drawing on impressions gained from products and interviews at major furniture and construction shows in 2009 combined with a review of recent design literature (e.g. David Report 2007, 2008), it is possible to provide a flavor of some key themes in design that are likely to impact on the future consumption of various materials:

- **Responsible and sustainable:** 'Sustainability' is the buzz word everywhere. Among architects, sustainability covers a host of issues. In furniture design the term is frequently linked to efforts to increase the durability of products, reduce waste and enhance recycling rather than to the origin of the raw materials.
- **Delight and aesthetics:** Designers today tend to feel an obligation to incorporate 'delight' and aesthetics into their designs. Moreover, they recognize that aesthetics is not just about visual appeal. Sound, touch and even smell are increasingly seen as important in the creation of 'delightful' architecture and products. According to the David Report (2008), "while design is partly about bringing function into our everyday life, it's also about creating desire. Good design can make savvy customers pay a premium for an artifact or ingredient".
- **Natural:** There is and increasing view that design should be humane and should connect people. This view, linked to demand for products that seduce by appealing to all the senses, has encouraged borrowing from nature and led to more interest in low-tech and globally understandable design. The recession has played a part in deepening this trend, as people increasingly seek to 'escape' from their economic woes through recourse to nature. In the furniture sector, designers are interpreting this theme in a huge variety of ways, such as through the widespread use of natural fibers and reclaimed materials and non-geometric 'rough', 'ethnic' and 'rural' designs.
- **Narrative:** Designers are increasingly interested in the 'narrative' behind particular materials – for example, what is its historical context and what cultural, social and moral messages does it send?
- **Health:** There is emerging concern for how products and buildings affect physical and psychological well-being. These trends are both influenced by and feed wider public concerns about personal health (Rice *et al.* 2006).
- **Mixed materials:** The huge range of materials now available and a more eclectic approach to design – mixing Eastern and Western or old and new, the use of traditional shapes in modern materials, and combining unique pieces with mass-produced items – is encouraging a much greater mixing of materials.
- **Authentic and individual:** Parts of the design community are reacting against anonymous globalization (e.g. look-a-like airports, shops and hotels). This reflects a perception that consumers no longer want simply to buy they want to experience the 'real deal' and are looking for regional or local individuality and the knowledge of who has made a certain product. This suggests that rather than shipping generic products around the globe, companies can benefit from creating a unique profile and a unique assortment on each continent or in each country. Folklore and artisan production may see a boost.
- **Pragmatic, durable and timeless:** According to the organizers of the 2009 Milan Salone del Mobile show, a major impact of the recession is that "some designers and firms have striven for greater pragmatism, a more balanced relationship between object and cost and a greater focus on consumer demand". This has led, in turn, to an "unexpected return to minimal, scaling down the decorative explosion of the last few years". Greater emphasis is being placed on timeless objects that are built to last rather than paying lip-service to passing fashions.

All these trends have significant implications for the future competitiveness of tropical hardwoods and the direction of marketing strategies. For example, the move to mix materials has tended to undermine the competitiveness of tropical hardwoods in sectors where it has been dominant in the past. Furniture shows in 2009 clearly showed that, in the outdoor sector, teak has increasingly had to give way to rattan, wicker, plastic, aluminium and fabric.

On the other hand, the move towards 'natural', 'timeless', 'authentic' and 'minimalist' products in the interiors sector should, with appropriate marketing, benefit suppliers of a traditional material like wood. Research has provided some evidence that the use of wood products in indoor settings had a positive impact on people's emotional states and psychological health (e.g. Rice *et al.* 2006, Tsunetsugu *et al.* 2007). The narrative surrounding tropical hardwoods can be very enticing if presented in the right way, given the material's exoticism and diversity and the role it can play in the development

of poor rural communities. Tropical countries may also be able to improve their competitiveness by creating furniture products that incorporate elements of their cultural identity and contribute to a feeling of 'authenticity' and 'individuality'.

Influencing the specification process

This analysis is a limited snapshot of current trends in a highly fluid and dynamic field. Ultimately the competitive performance of different materials will be dependent on their ability to influence the specification process. The first step is to understand this process. A lack of understanding has been identified as a common factor amongst many materials suppliers and manufacturers (Emmitt *et al.* 2008). Some limited research has been undertaken into this issue on behalf of the wood sector. For example, studies by Kozak and Cohen (1999) and Gaston *et al.* (2001) in the North American market for structural woods have indicated that architects and structural engineers have the most influence, with architects ranking first by a slim margin. Similarly interviews for the current study with furniture companies at 2009 trade shows indicated that professional designers had considerable influence over the choice of materials used, although the situation is likely to vary widely by country and sector. Moreover, while architects and designers have traditionally been the major specifiers, the introduction of new methods of procurement and the growth of other specialists, specification processes now often involve a wider variety of professionals (Bysheim and Nyrud 2008).

It is also important to understand how best to deliver information that is effective in driving specifiers to work with alternative materials. Surveys of North American architects (Kozak and Cohen 1997, Gaston *et al.* 2001, Robichaud *et al.* 2009) indicate that the most effective sources of information are physical examples in the form of case studies backed by technical manuals and data files, and word-of-mouth. Generic promotional literature issued by associations, sales calls and visits, and other proactive industry marketing campaigns are likely to be less successful. This is consistent with the literature supporting a preference on the part of users to be in control of the communication channel (Krishnamurthy 2001).

Robichaud *et al.* (2009) found that North American architects preferred the following information sources, in order of priority: design, regulation and fire manuals; physical examples; company-specific or product-specific internet resources; and company-specific products, manuals and brochures. They also noted that as the economy becomes increasingly knowledge-based, the use of wood not only requires 'knowledgeable users' but also 'knowledge-based products'. The wood products themselves need increasingly to become bundled with product information in the form of third-party labels and other forms of declaration, for example with respect to technical performance, the legality and sustainability of sources, corporate responsibility practices, contributions to the carbon balance, LCA, and energy consumption.

Another key issue is the interaction between designers and consumers. Variations in demand for tropical wood products are often presented as simply a result of changes in fashion – for example as consumer preferences move from light to dark shades or from clear-grained to heavily textured woods. The implication is that 'fashion' is an external force over which supplying sectors have little or no influence. The reality is that fashion is neither determined by consumers alone nor by supposedly powerful retailers and their trend consultants. The two march together as consumers ask for variation over time and as retailers and producers aim to create new trends and fashions to maintain or increase sales (Rametsteiner *et al.* 2007). In theory, supplying industries have the potential to influence both sides of the equation – through publicity campaigns to alter consumer attitudes and through more targeted campaigns to engage with professional designers. In practice, resource constraints usually dictate a focus on the latter approach.

An important aspect of competitiveness, therefore, is the extent and effectiveness of the direct engagement of the various materials-supplying sectors with the best architects and designers. This is necessary not only to inform designers of the technical characteristics of their materials but also to excite them with respect to the aesthetics and wider cultural narrative of the material.

It is this recognition that lies behind the increasing focus in the most pro-active wood-marketing campaigns on the design profession. A few strong, design-led marketing campaigns are already under way in the wood sector. An example from the hardwood sector is that of the American Hardwood

Export Council (AHEC), which focuses very heavily on communicating with architects and other designers, for example through regular seminars, the sponsorship of individual designers, and design competitions in leading markets. The output of these projects is publicized widely in design media in an effort to influence future design trends. Design-led marketing campaigns are becoming more visible in the tropical wood sector, too – the IWPA's *International Wood* magazine being a notable example – but they need to be considerably strengthened and broadened if they are to have a lasting impact on competitiveness.

Public perceptions

Numerous consumer surveys of attitudes to forests and forest products have been undertaken in Europe and North America over the last two decades. The attitudes of European consumers are particularly well understood, the wide range of surveys being the subject of a meta-study published by the Ministerial Conference for the Protection of Forests in Europe in 2007 (Rametsteiner *et al.* 2007). This study came to the following general conclusions:

- Consumers across Europe often have very clear opinions on wood products and these are generally consistent across the continent. [19]
- However, these clear opinions are formed largely on the basis of limited knowledge. There is little awareness or understanding among European consumers of the forest industry and its importance.
- Consumers prefer wood in furniture and interior applications where the wood can be seen and its most highly regarded characteristics may be fully appreciated. These characteristics are wood's status as a natural material and its aesthetic design properties.
- Consumers are significantly less confident about the virtues of wood as a construction material, being skeptical of technical features such as strength, durability and fire resistance.
- The link between wood and forests as a potent symbol of nature is a major strength of wood as a material – perhaps even its greatest strength.
- Wood is generally ranked ahead of other materials in terms of environmental friendliness. European consumers rank materials in the following order based on environment friendliness: wood (best); paper; glass; steel; aluminium; concrete; and plastics (worst).
- The high ranking for wood applies only if tropical wood is specifically excluded. In many European countries, consumers consider the use of tropical wood to be harmful for the environment.
- There is a marked difference in the perceived environmental friendliness of domestic wood (high) compared with tropical wood (low). This difference in attitude is considerably less pronounced in countries with high shares of imports and/or a high share of forests that are considered to be monocultural plantation forests (e.g. the UK, Ireland and the Netherlands).
- While tropical wood scores badly it seems to have a more positive environmental image than plastics. A consistent finding among all studies is that plastics are the most environmentally harmful material.
- Consumers do not regard certified wood products as significantly better or more environmentally friendly than wood products without a label. This finding differs, however, for tropical wood, for which labels have a more positive influence.
- There is generally little or no consumer willingness to pay for certified softwood commodities, but there is more willingness to pay premiums for high-quality and specialist assortments, particularly tropical wood.
- Consumers consistently state, however, that environmental attributes are less important than other attributes such as quality, price and design when it comes to purchasing products.
- Promotion of the use of wood on the basis of arguments regarding its renewability is generally in line with the views of, and accepted by, consumers. However, many consumers are still unsure whether the cutting of more forests and trees to substitute for other materials is the right thing to do.
- There is a low level of awareness and knowledge among consumers of what SFM means and a

19 Given fairly wide cultural variety across Europe, such consistency implies that the results are likely to be repeated in many wood markets outside Europe.

general assumption that using more wood inevitably means more destruction of forests.

- The industry is not perceived by consumers as being innovative or attractive to work in.

No such comprehensive analysis of consumer surveys in other parts of the world has been undertaken. However, a brief review suggests that many of the broad conclusions drawn in relation to European consumers are likely to be repeated elsewhere. For example, in June 2007 the United Nations Economic Commission for Europe (UNECE) Timber Committee noted that "the public perception is that the more paper or wood products are consumed, the more deforestation is going to take place" (UNECE 2007).

Marketing campaigns

The number of wood-industry organizations now engaged in promotion is impressive. Preliminary work to develop a database of wood-industry marketing campaigns undertaken for the UNECE Timber Committee in 2004 identified over 150 trade associations engaged in one way or another in promoting wood products. Some effective wood industry campaigns are now in operation, the largest of which are led by North American and European forest-sector interests.

Since 2001 the North American Wood Promotion Network, a coalition of more than 330 wood-sector organizations with an annual budget in excess of US$10 million, has been promoting the generic attributes of wood to North American builders and consumers in many different ways, including television and print advertising, trade shows, special events and targeted media outreach. Since 1989, AHEC has coordinated the overseas market-development activities of the American hardwood industry. These activities are led and guided by the private sector and funded jointly by exporting companies, US trade organizations and the federal government. The annual budget is in excess of US$6 million.

In Europe, numerous wood-promotion campaigns are in operation at a national level, such as 'wood for good' in the UK, the Charta für Holz ('Charter for Wood') in Germany, Centrum-Hout (the Wood Center) in the Netherlands, the Swedish Wood Programme, and Wood Focus Finland. CEI-Bois has facilitated greater coordination between these marketing initiatives through its Roadmap 2010 exercise, which involved background studies into market perceptions and the development of a promotional action program for the European woodworking industries.

Most of these initiatives aim to improve the market position of wood from northern temperate forests relative to non-wood competitors and do not engage in efforts to improve understanding of tropical-forest issues. Only a few organizations are now engaged in that task. The Malaysian Timber Council is raising the profile of tropical hardwood issues in the markets in which it operates (it has offices in London, Dubai and Shanghai). The IWPA is engaged in design-led marketing and political lobbying activities focused on tropical wood use in the United States. The Inter-African Forest Industry Association is becoming more vocal in support of the African hardwood industry in the European market and is a regular presence at international meetings, particularly highlighting efforts to expand forest management planning and forest certification in Central Africa. The Ghanaian Timber Industry Development Division has an office in London and a small marketing budget.

One notable development in recent times has been the increasing engagement of the Worldwide Fund for Nature in public discourse on the need to generate an income from the sustainable management of tropical forests for a wide range of values, both wood and non-wood, in order to discourage conversion to other land-uses (Verweij *et al.* 2009). This discourse, which is closely tied to a call for FSC certification, is a clear indication that, under certain conditions, some environmental groups are willing to publicly endorse the continued use of tropical hardwoods. This is a significant move away from the NGO calls for blanket bans on tropical hardwoods that 15 years ago characterized the debate in industrialized countries.

Another initiative worth noting is the EU's Timber Trade Action Plan, which is funded by the European Commission to facilitate private-sector action under its FLEGT VPA Action Plan. As part of this initiative, The Forest Trust[20] is playing a creative role in bringing wood-trade associations together at annual International Timber Trade Federation meetings with the underlying aim of discussing how best to respond to emerging

20 Formerly the Tropical Forest Trust.

requirements for legality verification in Europe, North America and Japan. Although currently aimed more at industry technical and policy responses, it could in time develop into a forum to improve the coordination of communication activities.

Despite these efforts it is hard to escape the conclusion that promotional efforts to promote wood generically against other materials remain very fragmented and lacking in coordination. In 2007 the UNECE Timber Committee noted that: "The forest products industry has not been very successful in communicating with the public about their efforts to conserve forest resources and use them sustainably, not only conserving existing resources, but also rehabilitating degraded lands and converting them into planted forests … The industry urgently needs to gain the public's trust. The major environmental activist organizations are focusing on forests, biodiversity and climate change. They work to make people feel guilty about using wood. Meanwhile, the substitute product industries (metals, plastics and cement) are capitalizing on these negative perceptions to gain market share. These twin threats to the forest products industry work in concert. The forest products industry has long been plagued by negative public perceptions" (UNECE 2007).

These weaknesses are particularly apparent in the tropical hardwood sector, which lacks a single, coordinated generic promotional campaign. As a result, any positive messages arising from efforts to improve tropical forestry practices, the contribution of tropical wood industries to rural development, or the potential LCA benefits of using tropical wood tend to be swamped by single-issue environmentalist campaigns focused on high levels of illegal logging or continuing deforestation.

Meanwhile, large marketing networks for competing materials have been established that seek to expropriate the strong environmental and other advantages of wood through supposed product improvements, impressive exhibitions, advertising, and modern methods of viral marketing. For example:

- In an effort to improve the public's perceptions of its products, the plastics industry launched a US$10 million social-media blitz aimed at millennials (i.e. people born between the late 1980s and the early 1990s). Created by the Apco Worldwide agency for SPI, the industry trade group in the United States, the four-year effort is designed to spark viral conversations among millennials about the many benefits of plastics (AdAge 2009).
- The European plastics industry launched its 'design innovation in plastics' competition in 1985 and it has been held annually ever since. The first international plastics design competition, sponsored by SPI, was held in June 2009 (Institute of Materials, Minerals and Mining website 2009).
- Living Steel, a worldwide collaborative program designed to stimulate innovative and responsible housing design and construction, was launched in February 2005. Funded by contributions from the world's leading steel manufacturers, Living Steel is a five-year program managed by the World Steel Association, an industry representative body that has committed more than €14.25 million to support the global search for more efficient and effective housing solutions (Living Steel website 2009).
- The American Institute of Steel Construction, Inc. freely distributes (in the United States) a glossy monthly magazine *Modern Steel Construction* designed "to bring its readership in-depth information on the newest and most advanced uses of structural steel in buildings and bridges".[21]
- The 'aluminium in renovation award 2009' involves 14 European countries, a series of national competitions and a European final and is designed to reward the most sustainable and original uses of aluminium in building renovation. The national competitions are sponsored by the Aluminium for Future Generations program, in cooperation with those national aluminium trade associations that are members of the European Aluminium Association (EAA) or the Federation of European Window and Curtain Wall Manufacturers' Associations (European Aluminium Association website 2009).

21 Available at http://www.modernsteel.com.

5 TROPICAL HARDWOOD PLYWOOD FOR THE EUROPEAN AND UNITED STATES MARKETS[22]

Background

Tropical hardwood plywood has long been a key export product of Indonesia, East Malaysia, Brazil and Gabon. Europe has traditionally been a major market for tropical hardwood plywood and the UK is the largest plywood importer in the EU by a significant margin. Meranti plywood has been a standard product for the UK building trade for decades. More recently the UK has been strongly influenced by green issues and the green procurement policies of UK plywood importers and builder's merchants are likely to provide insights into longer-term green procurement trends. France plays a particularly important role in the market for tropical hardwood plywood manufactured from African species, notably okoumé. Okoumé plywood – both imported from Gabon and manufactured in France from imported logs – has been a standard reference product on the French market for the past 15 years. Prior to the credit crunch the United States was a significant growth market for imported hardwood plywood, particularly since demand from Japan, formerly the largest global market for this commodity, began to wane.

Supply

Producer countries

Table 5.1 provides an overview of recent trends in hardwood plywood production in the major supply regions and exports to the EU and the United States. The overall picture in Southeast Asia is one of decreasing long-term supply of tropical hardwood plywood as the availability of large-diameter logs suitable for plywood manufacture declines. This problem has been offset in Malaysia by a reduction in the volume of log exports and by the development of combi-plywood lines that combine a softwood core with a tropical hardwood face (see Chapter 2).

China has seen massive growth in hardwood-faced plywood production in recent years, the vast majority comprising combi-plywood with a poplar or eucalypt core. Although only around 20% of China's hardwood plywood production is exported, the volume sold internationally increased dramatically between 2002 and 2006. The majority of these exports went to the United States and European countries, particularly the UK and the Netherlands. Exports began to decline in 2007 and suffered a significant fall in 2008 (Table 5.2). Prospects for China to supply growing volumes of tropical-hardwood-faced plywood to the international market in the future seem limited. China's supply–demand gap has already been noted in Chapter 2. Market reports also suggest that significant structural changes are under way in China's plywood sector, putting further obstacles in the way of continuing increases in plywood exports (ITTO 2008c, EUWID 2007e, 2007i). The Chinese government has progressively reduced the export credits available to plywood manufacturers, removing one significant source of competitive advantage. At the same time, labor, energy and raw-material costs rose strongly in China prior to the 2008 global recession, a trend that is expected to resume in the medium term in response to rising domestic consumption. There are signs that the Chinese plywood-exporting sector is beginning to consolidate around a few larger companies that are better informed of market requirements and are able to provide a higher-quality service.

Brazilian exports of hardwood plywood have generally declined in recent years for various reasons including the increasing regulation of wood extraction in the Amazon in response to concerns about illegal logging; a greater focus on domestic markets; and a shift by Brazilian manufacturers to develop more downstream products such as engineered wood flooring and cabinetry. As a result, Brazil is now a relatively minor player in the international hardwood plywood sector.

22 This case study uses information from interviews with trade associations and leading plywood distributors in Europe (notably the UK, France and Germany) combined with data from various published sources (including ITTO's Market Information Service, FAOSTAT, the UNECE Timber Committee, the International Trade Centre, the Global Trade Atlas, Eurostat, EUWID, and the Timber Trade Journal).

Table 5.1: Estimated production and exports of hardwood plywood in key supply areas ('000 m^3)

Country		2002	2003	2004	2005	2006	2007
China	Production	5077	9523	9900	8469	11 526	11 526
	Exports	941	1042	1819	2218	2701	2160
Indonesia	Production	6550	6111	4514	3820	3012	2900
	Exports	5250	4500	4000	3000	2000	1800
Malaysia	Production	4341	4771	4734	5006	5072	5190
	Exports	3614	3875	4,349	4537	4,800	4372
Brazil	Production	1100	1220	1380	1305	1,387	1,250
	Exports	747	825	1003	731	454	419
Gabon	Production	98	101	103	146	142	150
	Exports	25	26	23	23	35	45
United States	Production	1855	1855	1855	1844	1786	1800
EU-27	Production	1611	1580	1689	1677	1712	1800
	of which tropical	206	177	152	128	116	123

Source: Compiled by the authors from a variety of sources, notably ITTO and FAOSTAT

Table 5.2 China exports of hardwood plywood, 2003–08 (m^3)

Year	2003	2004	2005	2006	2007	2008
World	1 042 566	1 818 816	2 217 959	2 700 723	2 160 018	1 685 709
United States	221 564	603 218	790 662	908 092	488 926	355 579
Canada	11 301	38 939	46 883	50 012	40 540	38 207
UK	17 104	59 578	77 092	74 211	125 850	81 572
Netherlands	15 530	18 645	31 487	51 366	62 362	65 940
Spain	3797	26 873	42 918	46 590	67 447	43 373
Belgium	20 081	20 117	62 835	48 319	37 943	48 188
Irish Republic	140	19 246	51 988	75 274	24 239	17 719
Italy	9843	14 802	27 475	32 975	54 296	69 458
Denmark	1217	11 721	21 009	23 348	20 604	22 955
Germany	773	14 140	12 404	16 688	17 962	19 074
France	5084	2602	4565	12 906	14 447	14 591

Source: Global Trade Atlas

EU domestic supply

Europe is host to around 70 plywood manufacturers, which together produce around 3.6 million m^3 of plywood per year. About 50% of this volume comprises hardwood plywood. EU hardwood plywood production is dominated by birch plywood, of which Finland is the main supplier. Smaller volumes of beech and poplar plywood are produced in parts of central and southern Europe. EU domestic hardwood plywood production increased from around 1.6 million m^3 in 2002 to 1.8 million m^3 in 2007 (FII 2009), while softwood and hardwood plywood production combined decreased by 7.2% in Europe in 2008 (UNECE 2009).

A small volume of okoumé plywood is also produced in Europe. Judging from the volume of okoumé log imports and assuming a 60% conversion efficiency, this volume declined from around 275 000 m^3 in 1999 to only 95 000 m^3 in 2008. Of the latter, around 85 000 m^3 was produced in France, while smaller volumes were manufactured in Spain and Greece. France still hosts around five major okoumé plywood manufacturers, most of which also have production plants in Gabon. The vast majority of the okoumé plywood manufactured in France is consumed in either France or the Netherlands.

In addition to plywood, EU production of composite panels including MDF and OSB has risen dramatically in the last decade. Between 1996 and 2006, EU-27 production of MDF increased from 6.3 million m^3 to 16.5 million m^3. European OSB production increased from 2.8 million m^3 in 2004 to 4 million m^3 in 2008. A recent report forecasts that OSB production will grow at an annual rate of 10% between 2008

and 2012 to reach 5.8 million m^3 (BIS Shrapnel 2009b). Despite increasing European production of panel products there are indications that the competitiveness of domestic manufacturers is coming under pressure. The UNECE Timber Committee noted, for example, that there were significant hikes in European production costs for composite panels through the period 2002–07 (UNECE 2008). Even during 2008, when global consumption and trade turned downward, wood-raw-material prices remained high in the EU. Lower production activity in 2008 generally caused forest owners in the EU to defer harvesting.

There is also mounting pressure to divert more small-dimension industrial roundwood to energy production. European costs for energy and resin rose sharply throughout 2008, by 30% and 20%, respectively, although they had stabilized by the end of the year (UNECE 2009).

United States domestic supply

The United States has a huge domestic hardwood industry. Overall hardwood log production was about 61 million m^3 per year in the period 2002–07 (except in 2003 when wet weather hampered logging), making the country the world's leading hardwood producer. The ready availability of a large domestic hardwood resource and a large wood-manufacturing sector means that imports are limited to specific niche markets (International Trade Commission 2008).

The United States has around 24 hardwood plywood manufacturers, with the five largest accounting for over three-quarters of US production by quantity. Annual production in 2002–07 remained stable at 1.8 million m^3. United States hardwood plywood manufacturers rely almost exclusively on North American sources for their wood raw material. Plywood manufactured in the eastern United States typically comprises a decorative American hardwood face with a tulipwood core. West Coast firms typically use softwood veneer for cores. Small volumes of tropical wood are occasionally imported in veneer wood for conversion into plywood in the United States (International Trade Commission 2008).

An International Trade Commission enquiry published in 2008 that concluded that United States hardwood producers had suffered a significant loss of market share to imports in recent years. It noted that "higher input costs in the United States between 2002 and 2007, mainly for raw material and labor, put upward pressure on US product prices at the same time that lower input costs, mainly for labor, in competitor supplier countries (other than Canada) put downward pressure on finished product prices and contributed to the rise in the import share of the US market". Chinese plywood manufacturers were by far the largest beneficiary (International Trade Commission 2008).

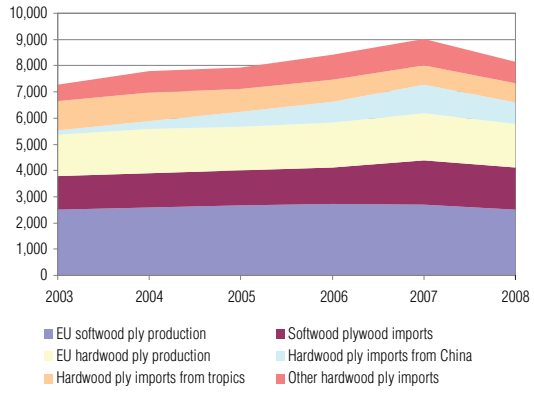
Share of trade

Europe

An analysis of EU plywood supply from 2003 to 2008 reveals the following key trends (Figures 5.1–5.4):

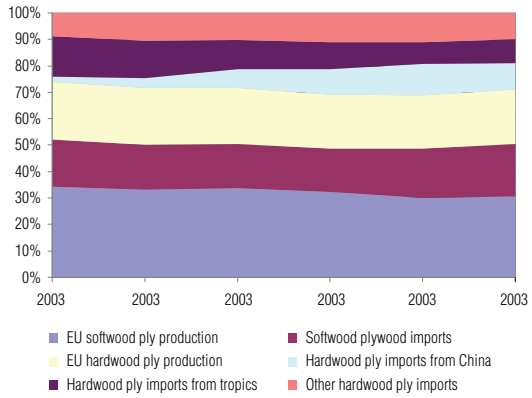
- The overall supply of plywood products to the EU market increased from around 7 million m^3 in 2003 to 9 million m^3 in 2007and then declined to around 8 million m^3 in 2008.
- The market is split roughly 50:50 between softwood-faced and hardwood-faced plywood. This split in market share remained constant between 2003 and 2008.
- In the hardwood sector, imported plywood took market share from domestic plywood in the period 2003–07.
- Among international hardwood-faced plywood suppliers, China and, to a lesser extent, Russia gained significant market share between 2002 and 2007 at the expense of tropical hardwood suppliers. During this period, tropical hardwood plywood's share of all hardwood plywood imports fell from over 50% to less than 20%.
- Of tropical hardwood plywood suppliers, Indonesia and Brazil lost market share during the period 2002–2007, while Malaysia maintained its market share.
- In 2008, EU imports of hardwood plywood from China and Russia suffered a reversal, while imports from tropical countries remained more stable. As a result, tropical countries, particularly Malaysia, made up some of the ground lost to China in terms of market share in the previous four years.

Figure 5.1 EU plywood supply, 2003–08 ('000 m^3)



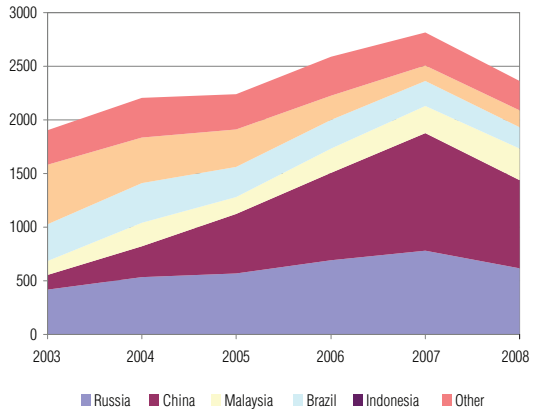
Source: Authors' analysis of Eurostat

Figure 5.2 % share (by volume) of EU plywood supply, 2003–08



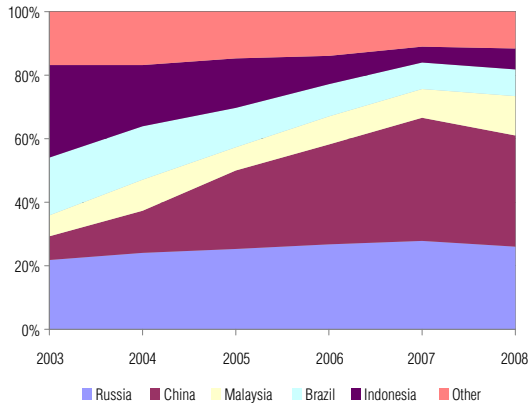
Source: Authors' analysis of Eurostat

Figure 5.3 EU hardawood plywood imports by supplier country, 2003–08 ('000 m^3)



Source: Authors' analysis of Eurostat

Figure 5.4 % share (by volume) of EU hardwood plywood imports by supplier country, 2003–08



Source: Authors' analysis of Eurostat

United States

Figures 5.5 and 5.6 show trends in United States imports of hardwood plywood and flooring[23] in the period 2003–08. The key trends were as follows:

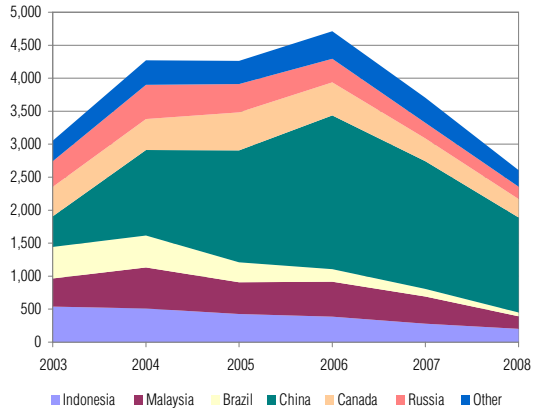
- US imports of hardwood plywood and flooring rose dramatically between 2003 and 2006, from 3 million m^3 to 4.7 million m^3, but then declined sharply in 2008, to 2.5 million m^3.
- China was responsible for all the increase in United States imports of hardwood plywood and flooring in the period 2003–06.
- All the leading tropical hardwood plywood producers lost market share in the period 2003–08. Brazil suffered the greatest loss of market share, followed by Indonesia. Malaysia's share remained more stable.

23 Unlike the EU, the United States trade data include flooring products in the plywood category.

Applications and competing materials

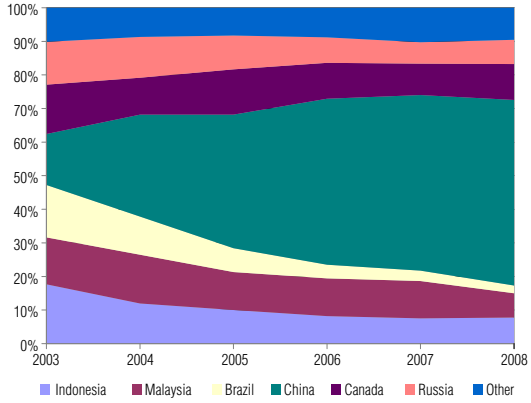
Table 5.3 presents an overview of the current position of tropical hardwood plywood in the market in relation to the wide range of alternative wood products now available in the EU and United States markets. Over the long-term and in certain sectors, tropical hardwood plywood has lost significant market share. Fifteen years ago in Europe, for example, tropical hardwood plywood was widely used for interior doors and cabinets, a niche now dominated by veneered MDF. A large part of the loss of market share is due to price – tropical hardwood plywood is significantly more

Figure 5.5 United States hardwood plywood and flooring imports by supply country, 2003–08 (m^3)



Source: Authors' analysis of Global Trade Atlas

Figure 5.6 % share (by volume) of United States hardwood plywood and flooring imports by supply country, 2003–08



Source: Authors' analysis of Global Trade Atlas

expensive than most other materials. Nevertheless, tropical hardwood plywood continues to offer technical advantages over its competitors and there are certain niches – for example heavy-duty exterior construction, marine applications, and interior fitting for mobile homes and yachts – where it is more difficult to substitute.

In addition to wood products, a range of non-wood products are now competing with tropical hardwood plywood. The plastics and wood composites industries have particularly set their sights on the tropical hardwood plywood sector, developing look-alike products for exterior applications. Examples of competing products include the following:

- Trespa is a composite material combining a wood fiber base and melamine resins – used both for internal and external applications
- Rockpanel is manufactured from mineral wool fibers compressed under high pressure. This external cladding product can be worked and applied like wood, does not need pre-drilling, breathes, is lightweight and maintenance-friendly and needs no edge finishing.
- Fermacell is a board material combining gypsum and recycled paper for interior applications (e.g. dry partition walls and dry flooring solutions).
- Plascore combines engineered honeycomb and foam cores with a wide variety of facing materials. These lightweight panels have gradually replaced okoumé plywood in the marine and transport industries (e.g. aerospace and high-speed trains) because they are lighter and much more fire-resistant.
- Ecogenic is a product manufactured entirely from recycled plastics that can replace tropical hardwood plywood in non-structural exterior applications (notably hoardings). Two plants, each capable of churning out 400 000 panels of this new product per year, were being set up in the UK in 2009.

Competitiveness factors

Price

Raw-material and capital costs make up a significant proportion of final costs in the panel-products sector. For example, logs account for around 50% of production costs in Sabah and Sarawak and up to 60% in Peninsular Malaysia for plywood and sawnwood producers (International Trade Commission 2008). This means that factors that give tropical countries a price advantage in sectors such as furniture manufacturing – notably low labor rates – are less significant in this sector.

Figures 5.7 and 5.8 show price trends for tropical hardwood plywood and various competing panel products in the EU market (in US dollars and euros, respectively). The following observations can be made:

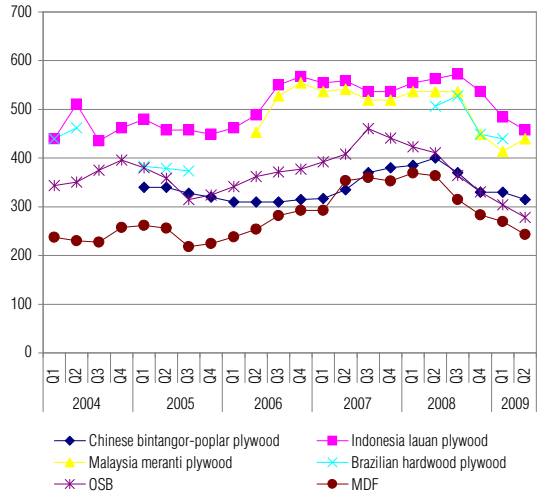
- Prices for tropical hardwood plywood are significantly higher than for alternative panels. Indonesian prices tend to be slightly higher than Malaysian and Brazilian prices. This largely explains recent losses in market share.

Table 5.3 Tropical hardwood plywood and other competing wood panels

Material	Origin	Applications	Strengths	Weaknesses	Market trends
Tropical hardwood plywood	Malaysia Indonesia Brazil Gabon France	External joinery (e.g. soffits and cladding) Decorative panels (thin plywood) Vehicle construction Freight containers Factory-built homes Packaging (3-ply) Marine/boat-building Hoardings	Natural durability Lightweight Strong Stable Clean aspect Few defects Attractive edge Easy to work Takes stain and paint MTCS-certified (in Malaysia)	Relative price: e.g. Malaysian raw BB/CC plywood starts at US$440/$m^3$ CIF UK. Okoumé plywood prices in France start at € 700–900/m^3 Volatile pricing Long lead times Poor green image Limited certified supply	Relatively high prices leading to loss of share, particularly to combi-product from China and Malaysia. Being squeezed out on environmental issues
Bintangor/ poplar combi plywood	China	Decorative panels Packaging Concrete formwork Hoarding	Cheap: EU prices for raw BB/CC grade start at US$320/$m^3$ CIF	Lower durability than tropical throughout Persistent quality issues Limited certified supply	Won market share where high-quality aspect is not essential. Quality issues and rising costs have weakened competitiveness. Prices (in US$ terms) are falling in the downturn
Birch plywood	Scandinavia Russia	All indoor applications and some exterior when filmed (e.g. concrete formwork) Freight containers (with wire mesh to add strength)	Clean aspect Few defects Mid range prices: Russian circa US$400–500/$m^3$ CIF UK Wide range of specs Strong Melaminated paper finish easy to paint FSC-certified	Lower durability Heavier: 30–40% higher density compared to okoumé	Birch plywood prices from Russian and Baltic States is currently falling. Russian filmed birch plywood is now substituting for Chinese filmed plywood
Poplar plywood	France Italy Spain	All indoor applications Industrial plant flooring	Light Stable Easy to work Cheap PEFC-certified	Low durability Lacks strength Some knots	Being favored in public tenders in France due to PEFC certification
Softwood plywoods	Spruce pine France Scandinavia North America	Mostly indoor applications: ceilings, structural panels, wind bracing Concrete formwork (film-faced) Packaging	Cheap: EU prices start at € 200/m^3 Light Stable Strong PEFC-certified	Less durable More knots Aspect not so clean	Winning market share where high quality aspect is not essential
OSB	Europe	Internal structural panels/sheathing Concrete formwork	Cheap: EU prices start at € 200/m^3 'New generation' OSB with improved performance Predictable Strong V. large panels FS-certified	Heavier than plywood Aesthetics Greater sag or creep than plywood Doesn't hold screws as well as tropical plywood Some risk of delamination Swells when wet	Supply rising rapidly. Prices fallen 50% between 2007 and 2009. Winning share in sheathing sector. Suppliers pushing FSC certification hard.
MDF	Europe	Veneered panels Furniture Interior panels	Cheap: EU prices start at € 75/m^3 No knots Easy to glue and paint Easy to machine FSC-certified	Heavier than plywood Lacks strength Might split Aesthetics Formaldehyde risk Swells when wet	Supply rising rapidly. Prices fallen 30% between 2007 and 2009. Winning share in interior panels sector

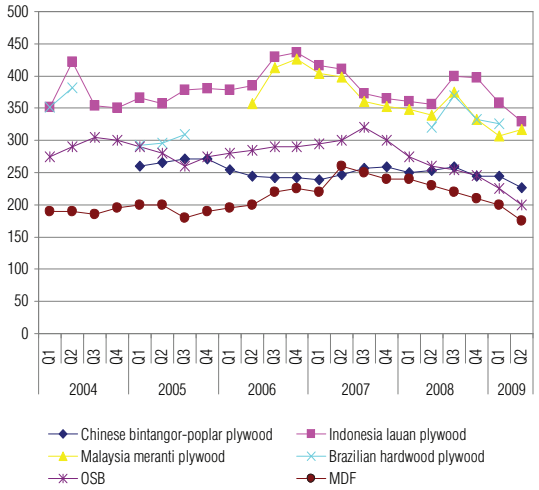
Source: Compiled by the authors drawing on interviews with panel-product associations and traders and product brochures and websites

Figure 5.7 CIF prices for tropical hardwood plywood and competing panels in the EU market, 2004–09 (US$)



Source: Compiled by the authors from various sources including UNECE/FAO Forest Products Market Reports, ITTO and EUWID

Figure 5.8 CIF prices for tropical hardwood plywood and competing panels in the EU market, 2004–09 (€)



Source: Compiled by the authors from various sources including UNECE/FAO Forest Products Market Reports, ITTO and EUWID

- The price gap does not reflect any long-term increase in tropical hardwood prices. In early 2009, Malaysian tropical hardwood plywood was trading at INDO96 Net – i.e. at the same price point (in United States dollars) as Indonesian plywood eleven years before. The price 'gap' is therefore due entirely to the introduction of lower-priced alternatives in the last decade, particularly Chinese combi-plywood. The fact that tropical hardwood plywood prices have not increased substantially in the last decade, a period in which tropical log prices rose significantly, is indicative of much tighter margins in the industry.
- Chinese combi-plywood trades at very low price points in the European market. Over the last four years, it has been cheaper than OSB and little more than those for MDF.
- Relative price volatility, which increases the risk associated with stocking products, is also likely to have contributed to a loss of market share for tropical hardwood plywood. While prices for most panel products have been quite volatile in Europe in the last four years, the price changes for tropical hardwood plywood have been dramatic.
- For reasons that are difficult to explain, manufacturers of Chinese combi- plywood seem to have been relatively more successful than both tropical plywood producers and domestic manufacturers of composite panels in ironing out euro-price fluctuations for their products.

Price series for okoumé and softwood plywood were not available when preparing this chart. In 2009, however, quoted prices for okoumé plywood in France varied from €700–900 per m^3 for unfinished plywood to €1400 for filmed or pre-painted product. This puts okoumé plywood in a very high price bracket, even compared to other tropical hardwood products, a situation only partly attributable to the high value of the euro. In early 2009, prices for spruce plywood in the western European market were being quoted at no more than US$200–250 per m^3, lower than both OSB and Chinese combi-plywood prices.

Quality and product attributes

A large part of tropical hardwood plywood's traditional appeal in the European and United States markets has been its proven ability to perform well in a wide range of applications. It can be used for interior joinery and fittings as well as for external cladding. Compared to spruce or pine it also has a much higher visual appeal and a more even, knot-free surface that gives an excellent finish when painted or varnished. It provides good dimensional stability: for instance, for shop fitters it is important that a shop shelf that supports spotlights does not warp with heat. Moreover,

tropical hardwood plywood is resistant to wear and can be easily repaired: small dents or holes can be masked with putty.

In the past, this versatility encouraged widespread stocking of tropical hardwood plywood. In the words of one manufacturer of okoumé plywood in France interviewed for this study: "okoumé plywood is the material to do anything which you find everywhere". To quote the export manager of another plywood manufacturer interviewed: "force of habit has played a big role in developing demand for okoumé plywood. Many French joiners will have a stock of okoumé plywood always at hand even if okoumé is not entirely appropriate for the job. Joiners tend to consider that a building material, such as okoumé plywood, that is capable of doing much more is also suited to doing less". The same comment could apply to meranti/lauan plywood in the UK and the United States.

This situation changed, however, with the introduction of Chinese combi-plywood at much lower price points. Plywood price expectations have fallen dramatically and tropical hardwood plywood has largely lost this broad-utility-product market niche. The tropical-throughout product has increasingly been confined to those applications where it is specifically required, for example external applications where durability is essential or internal applications where the final visual aspect comes first. Malaysian producers have responded to the challenge presented by Chinese combi-plywood by introducing their own combi-products with a tropical hardwood face and a radiata pine core.

Lower price expectations and tighter margins have led to compromises on quality. Chinese products have been particularly prone to challenge on quality in the past and there are indications that many Chinese plywood mills continue to cut corners with respect to the quality of logs, glues and other raw materials. It would be wrong to suggest, however, that all Chinese plywood manufacturers are supplying low-quality products. Among the many thousands of hardwood plywood mills in China, a select few have gradually begun to improve their factories, processes and quality as their understanding of market demands has improved. Some of the largest importers in Europe and North America have invested significant resources in finding the best mills in China and in building long-term relationships with them. These mills are now producing product fully in accordance with European and North American standards; while not capable of substituting in all tropical hardwood applications they do meet the quality requirements of a significant portion of the market.

Nevertheless, interviews with European traders in early 2009 suggest that the global financial crisis may once again have increased the overall hardwood plywood market focus on price at the expense of quality. The shift away from tropical-hardwood-throughout to combi-plywood seems to have deepened. The trend may even be going a step further, with reports of tropical-hardwood-faced plywood containing a palm or coconut core finding its way into the European market. Contacts suggest that these products have been supplied in the EU by both Chinese and Malaysian mills. As one agent commented: 'the market tends to get what it pays for: and this is an inevitable consequence of current price expectations in Europe.

While this shift to lower-value products might fit with existing market conditions, the hardwood plywood sector could be storing up longer-term problems. Quality issues have already seriously dented plywood's reputation for reliability among European manufacturers and construction professionals. One UK agency interviewed in July 2009 suggested that: "if asked, most customers wouldn't say that hardwood plywood is the most reliable material". The risks of structural weakness and fungal attack potentially associated with these new combi-products may make matters worse. European importers are being advised to check carefully the products supplied against specification.

In addition to these broad concerns about the falling quality of tropical-hardwood-faced plywood, some specific quality issues undermine tropical hardwood plywood's market position in some sectors. For example, the position of okoumé plywood in the cladding sector is being undermined by maintenance issues. Because of constant exposure to weathering, paint finishes or varnishes on okoumé plywood external cladding tend to crack and need to be renewed roughly every three years. Even with multipaint filmed plywood, edge sealing remains an issue and is not entirely maintenance-free. Okoumé plywood for such external applications has a ten-year guarantee. However, insufficient maintenance by homeowners or public services has led to subsequent problems, making architects more reluctant to specify plywood cladding.

Technical standards

The ability to conform to technical standards governing the performance of plywood and other panel products is becoming an increasingly important competitiveness factor in both the EU and the United States. Ensuring full compliance with a range of quality standards has become a key part of the domestic industry strategy in both regions to counter the competitiveness threat from imported products. Domestic industries have been lobbying hard to ensure minimum quality standards are set and enforced.

At the same time, major importers have become increasingly sensitive to accusations of inferior quality and are now going to greater lengths to ensure conformance to tougher quality standards among their international suppliers. In fact, some large importers in Europe and North America working with the largest tropical and Chinese plywood mills are now also actively lobbying for strict enforcement of tough quality and environmental standards. Their aim is to counter the competitiveness threat from cheaper, lower-quality manufacturers and less-conscientious importers.

European standards

In the EU, CE marking of plywood in structural applications became mandatory on 1 April 2004. Since then, under the European Construction Products Directive, plywood supplied for structural applications in the EU has had to conform to European Norm (EN) 13986: 'Wood-based panels for use in construction'. Conformance with the standard requires an initial assessment and continuous surveillance of the plywood manufacturer's factory production control system by an EC 'Notified Body'.

As part of the EN 13986 testing process, individual plywood products are assessed against specific performance standards to determine their appropriate technical class. These classes are shown on the CE mark so that the end-user is aware of the applications for which the product is appropriate. The classes are as follows:

- EN 636-1 Dry – for interior applications with no risk of wetting, defined in hazard class 1, with a moisture content corresponding to environmental conditions of 20°C and 65% relative humidity (12% mc or less). This relates to applications such as joinery, shop fitting, exhibition stands and partitions.
- EN 636-2 Humid – for use in protected exterior applications as defined in hazard class 2, with a moisture content corresponding to environmental conditions of 20°C and 90% relative humidity (20% mc or less). This relates to applications such as partition walls in bathrooms, sink-tops in kitchens and edge-boarding under roof cover.
- EN 636-3 Exterior – for use in unprotected external applications, as defined in hazard class 3, where the moisture content will frequently be above 20%. This relates to exterior cladding and any other application where plywood is exposed to prolonged weathering.

From a competitiveness standpoint, the CE marking requirements have been a mixed blessing for tropical hardwood products. A key competitive advantage of tropical-hardwood-throughout plywood over other plywood and panel products is that if manufactured in accordance with the EN 13986 standard it is capable of complying with all three technical classes. Combi-plywood and most other similar panels typically conform only to EN636-2.

Smaller Chinese plywood manufacturers have particularly struggled to achieve CE marking. In fact, over the last two years Chinese manufacturers have suffered a loss of confidence in their product in Europe because certain mills have falsified CE marks on sub-standard products. This has given rise to concerns about unreliable quality and created nervousness in selling Chinese products into structural markets because of liability issues.

On the other hand, combi-plywood, softwood plywood and various composite panels have all demonstrated their ability to conform to the CE-marking minimum requirements for mechanical performance in structural applications (so called CE2+). This has contributed enormously to the ability of these products to occupy the large market niche for a utility product.

Although many plywood mills in Malaysia, Brazil and Indonesia have now achieved the CE marking requirements, a question remains over their relative level of access to CE marking services. Although some Notified Bodies have satellites outside the EU that perform tests and submit results to Europe

for final approval, all the Bodies are headquartered in Europe. The underlying implication is that the system will tend to favor domestic over external manufacturers.

In addition to the EN standards, some national standards in Europe also remain relevant to the marketing of tropical hardwood plywood. For example, NF-EXTERIEUR CTB-X is a French standard set by the French Wood Research Institute (l'Institut Technologique Forêt Cellulose Bois-construction Ameublement – FCBA), a French timber-testing organization, which guarantees that a plywood product meets required specifications set by the building industry for external applications. Tropical plywood panels that are certified by NF-EXTERIEUR CTB-X have a ten-year guarantee on their durability.

United States standards

Unlike the EU, there are no national mandatory standards in the United States. Instead, a range of voluntary and corporate standards are used by suppliers and product manufacturers to guarantee the quality of product. These include the following:

- The American National Standard for Hardwood and Decorative Plywood (ANSI/HPVA HP-1-2004) published by the Hardwood Plywood and Veneer Association (HPVA), which also provides testing and certification procedures that allow suppliers meeting this and other standards to market product with HPVA's verification stamp. This stamp now appears on the edge of just about every piece of hardwood plywood made in America.
- A voluntary Product Standard for Structural Plywood (PS 1-07) developed by the National Institute of Standards and Technology and issued by the Department of Commerce.
- Marine-grade tropical hardwoods are typically required to meet British Standard Specification BS 1088.

Availability

As in other sectors, the ability to supply orders, both large and small, at short notice and to mix shipments of plywood with other products is an increasingly important factor in competitiveness. This has become even more important in the economic downturn because distributors and manufacturers have become even more reluctant to hold stock. Domestic plywood and panel manufacturers see this as providing them with a marketing edge over imported products. Domestic plywood manufacturers are seeking to exploit their proximity to the consumer by providing special services such as component assembly, special packaging, product or plant engineering support, and logistics support.

On the other hand, this trend is countered by the increased role of large builders' merchants and retailers in the supply of plywood in North America and Europe. The International Trade Commission (2008) suggested that the greater concentration of plywood distribution in the hands of large retailers, combined with their logistical ability to source products internationally, was a factor increasing the competitiveness of imports compared to United States domestic products. Similar market dominance by large firms is evident in the UK, where research has shown that at least 50% of Malaysian plywood imported into the country in 2006 was sold through large distributors and builders' merchants (notably Travis Perkins, Jewson and Wolseley) (FII 2008).

A recent move to the containerization of plywood imported into Europe from China and Southeast Asia is also helping to improve availability and reduce volatility. The market now tends to receive smaller volumes on a more regular basis. This reduces the risks of 'boom and bust' and is more aligned with the existing market focus on just-in-time trading.

Exchange rate

Exchange rate is often perceived as a major competitiveness factor in the industry and is often seen to favor Chinese plywood manufacturers. For example, French manufacturers of okoumé plywood interviewed for this study referred to "monetary dumping". They claimed that they are being doubly penalized – by the low value of the yuan, which is undervalued against the United States dollar by about 25%, and by the low value of the United States dollar, which is undervalued against the euro.

The International Trade Commission (2008) noted that the declining value of the US dollar in the years before 2008 did not affect the major plywood suppliers' currencies equally. The value of the Brazilian real and the Indonesian rupiah relative to the US dollar increased faster than that of the

Malaysian ringgit and the Chinese yuan, giving Malaysia and China an advantage vis-à-vis the other suppliers to the United States market.

However, the International Trade Commission (2008) also highlighted that exchange-rate movements are a double-edged sword. For a supplier like China, which relies heavily on imported raw materials, the weak yuan raises the costs of these raw materials, thus mitigating some of the advantage that China has when selling its final products internationally.

Duties

Import duties are unlikely to have been a significant competitiveness factor for plywood imported into the United States. Depending on the subheading, hardwood plywood imports enter the United States at normal trade-relations duty rates ranging from zero to 8%. Special rates of duty may also apply to hardwood plywood under certain trade-preference programs or free-trade agreements. In the period 2002–06 the annual average duty paid on United States imports of wood flooring and hardwood plywood was only in the range 2.4–2.9% (International Trade Commission 2008).

Tropical hardwood plywood composed of primary species[24] entering the EU under normal trade relations is subject to a duty of 10%, while 7% is imposed on other hardwoods and softwoods. Most tropical countries benefit from import-duty reductions of at least 3.5% under the Generalized System of Preferences (GSP). Prior to the start of 2009, Malaysian hardwood plywood had a competitive advantage over Indonesian plywood because it was subject to a duty of 3.5% compared with 7% for Indonesian plywood. However, this discrepancy was removed as of 1 January 2009.

While certain products of Chinese origin continue to benefit from the GSP system in the EU, wood is excluded from this list because it is regarded as a sector whose competitiveness no longer requires the granting of preferences. In 2004 the EU also imposed an anti-dumping restriction on Chinese okoumé plywood that was due to end at the end of 2009. While this has the effect of greatly reducing EU imports of okoumé-faced plywood, it has no relevance to imports of plywood faced with alternative tropical hardwoods. Combi-plywood imported into the EU is now faced with one of a variety of species including bintangor, meranti and red canarium (EUWID 2007b, 2007d, 2008b).

The EU also offers so-called special incentive arrangements (GSP+) for sustainable development and good governance to a limited number of tropical countries, which allow the duty-free entry to the EU market of all the goods covered by the general GSP agreement. Tropical-hardwood-supplying countries included in these arrangements are Bolivia, Costa Rica, Ecuador, Honduras and Peru, although none is currently a significant supplier of plywood to the EU.

Environment

Forest certification and legality verification

Demand for certified or legality-verified products has been intensifying in recent years, particularly now that so much trade is concentrated in the hands of large retailing groups. As a result, this demand is becoming more important in influencing the direction of trade. In the UK, for example, the demand for certification has played a key role in encouraging a switch from Indonesian and Chinese plywood, generally regarded as reacting slowly to the demand for certified wood, in favor of Malaysian hardwood plywood products. The availability of MTCS-certified plywood from Malaysia has increased in recent times and can be obtained by UK importers on payment of only a small premium of perhaps 2% over the uncertified price (FII 2009). Much of the Malaysian combi-plywood using radiata-pine cores is FSC-certified.

However, efforts are being made to improve the environmental credentials of Chinese products which, if successful, would significantly improve their competitive position in the market. Some UK and United States importers have been working in partnership with Chinese shippers to encourage the development of legality-verified and certified Chinese plywood products. Limited volumes of FSC-certified Chinese plywood began to arrive in the UK in 2007, although only a few of the smaller mills have been able to offer this product and availability remains very restricted. UK-delivered prices for the product are around 20–30% higher than the equivalent uncertified Chinese plywood,

24 Defined as acajou d'Afrique, dark red meranti, light red meranti, limba, mahogany (*Swietenia* spp.), obeche, okoumé, palissandre de Para, palissandre de Rio, palissandre de Rose, sapelli, sipo, virola and white lauan.

but 5–10% lower than uncertified Malaysian plywood (FII 2009).

Interviews with okoumé plywood manufacturers in France suggest that most now recognize FSC certification as a necessity if they are to reverse the steady loss of okoumé plywood's market share. This factor has already influenced big industrial customers such as French railways and FINSA, a leading Spanish panel-manufacturing group, to substitute okoumé plywood for alternative softwood and birch plywood products.

Formaldehyde

In the EU, mandatory CE marking of panels now requires compliance with standards for low formaldehyde emissions, as set out in EN717-1 and EN120. This test gives two classes, E1 and E2. The limit for reaching class E1 is less than 0.124 mg of formaldehyde per m^3 of air. Upper requirement limits for E2 are set in a different way and are dependent on the outcome of specific factory production-control tests. Some EU countries have tougher regulations than those imposed through the CE marking system. The German, Austrian and Swedish governments have national provisions that effectively allow only class E1 products to be sold in the market (EC 2008, EUWID 2008d).

In the United States, formaldehyde emission requirements in line with the ANSI/HPVA HP-1-2004 standard have been adopted by the federal Department of Housing and Urban Development for all funded projects. The regulation of formaldehyde is set to become an even more significant competitive factor due to recent regulations promulgated by the California Air Resources Board (CARB). In April 2007, CARB adopted stringent control measures to reduce formaldehyde emissions from composite wood products, including plywood, and the products made from them. In response, large United States producers have already, or are in the process of, developing formaldehyde-free and low-emitting adhesives. Analysts expect that the CARB regulations will ultimately lead to low-emission products becoming the standard for the entire United States market because California constitutes a relatively large portion of it (EUWID 2008e).

Generally these measures are expected to boost the competitiveness of domestic panel-product manufacturers at the expense of international suppliers, given that the former are often better served by testing facilities and certification bodies and many have abided by voluntary formaldehyde standards for several years. Nevertheless, many of the large Malaysian and Indonesian mills have already succeeded in demonstrating conformance to low formaldehyde emissions standards imposed in the EU and Japan.

In the short term, the main losers in this process are widely expected to be the smaller Chinese mills, which have based production on cheaper adhesives (EUWID 2007g). In the longer term, however, the fact that the Chinese government has also adopted a domestic standard for low formaldehyde emissions very similar to the European E1 model suggests that low-emission products will become standard throughout the international panels trade. A key challenge for all panel-product manufacturers is likely to be the wide variety of standards and testing procedures required in different importing countries.

Emissions trading system

In the longer term, the cost-competitiveness of European plywood manufacturers relative to tropical producers may be affected by the introduction of a revised EU emissions trading system in 2013. Europe's wood-based panel sector is recognized as an energy-intensive industry, implying that industrial producers will have to pay substantially more for their CO_2 emissions. An exception is accorded for industry sectors that are seen as a risk for 'carbon leakage', which is the risk that companies in a sector will relocate to regions outside the EU where there are less stringent CO_2 emission regulations. The panel-products industry has applied for such an industry designation and a quantitative and a qualitative assessment has been performed. Dependent on the outcome of those negotiations, the EU panel-products sector may or may not receive CO_2 allowances for free.

Concluding comments

In the past, the competitiveness of tropical hardwood plywood has been built on ready access to large-dimension logs at relatively low prices. As raw materials have become scarce and log prices have risen, and as temperate producers have become adept at producing higher-value composite panels from domestic softwood resources, the competitiveness of tropical hardwood plywood has

inevitably declined. The introduction of a new, low-priced product from China – combi-plywood – bearing a passing resemblance to tropical hardwood plywood and capable of performing a range of utilitarian tasks speeded this decline.

However a new situation is now developing which could again open up opportunities for tropical hardwood plywood. The competitiveness of Chinese combi-plywood is under threat as costs in China have risen and concerns over quality have mounted, and with the introduction of new formaldehyde emissions standards and demands for legality verification.

Tropical hardwood plywood producers need now to focus on higher-quality niche market products; to look at diversifying into a range of specialist plywood products similar to those developed in birch (e.g. heavy-duty grip flooring panels or fire-retardant-throughout panels); and to emphasize adherence to emerging quality and environmental standards.

6 SOUTHEAST ASIAN PLYWOOD IN JAPAN[25]

Overview

Over the last 20 years the nature of Japan's market for plywood products has shifted dramatically. In the early 1990s Japan was the world's largest importer of tropical hardwood logs, with much of the volume destined for Japanese plywood mills. From the 1990s onwards, however, Japanese manufacturers of tropical hardwood plywood came under severe competitive pressure from overseas suppliers, notably Indonesian and East Malaysian manufacturers who exploited their proximity to the raw-material resource and a cheaper work force. Plywood became the dominant export product for both Indonesia and East Malaysia during this period, with Japan the leading export market. Tropical hardwood plywood came to occupy a very wide market niche in Japan. More recently, tropical hardwood plywood has lost market share to temperate hardwood and softwood plywood and to OSB.

Shifts in Japanese market for panel products

The residential construction sector is the dominant market for plywood and other panel products in Japan and overall consumption closely mirrors trends in that sector. Residential construction starts have generally declined for the last 15 years (Figure 6.1). The market suffered a major downturn in 1997–98 during the Asian financial crisis, from which it never fully recovered. Another major downturn occurred in 2007, brought on by an amendment to the Building Standards Act that required certification of the structural integrity of new residential buildings by qualified architects or structural engineers. It was introduced in response to a building scandal in which some architects falsified structural-strength documents required by the Japanese government. The market only partly recovered from this downturn in 2008. The overall decline, which has combined with a period of significant diversification in the range of construction products available and sources of supply, is indicative of an increasingly competitive marketplace.

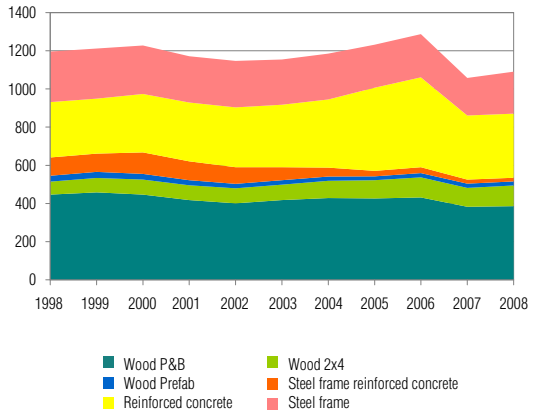
Nevertheless, wood's overall market share in the structural component of Japan's residential construction sector has remained stable at relatively high levels over the long term, (Figure 6.2); for the last 15 years, all types of wood construction have held on to a market share in this sector of close to 50%. Traditional forms of post-and-beam construction continue to dominate the wood component of the market, although 2x4 construction methods imported from North America have been taking a progressively larger share. Concrete construction systems gained market share until 2006 but suffered a major reversal following the introduction of the amended Building Standards Act. This is indicative of concrete's generally poorer performance compared to wood and steel in meeting tough structural requirements in earthquake zones. Market share of both steel and wood-frame construction saw a significant boost in the wake of the amended Act.

While, overall, wood products hold a strong and improving position in Japan's residential construction market, the share of this market occupied by tropical hardwood plywood has declined sharply in recent years (Figures 6.3 and 6.4). In 1996, 60% of all plywood and composite-panel products supplied to the Japanese market by both domestic and foreign suppliers comprised tropical hardwood plywood but by 2008 this figure had fallen to 30%. For tropical manufacturers, the decline in overall market share was masked in the period 1997–2002 because they increasingly took share from Japanese plywood manufacturers. During that period, Japan's production of plywood based on imported tropical hardwood logs fell from more than 3 million m^3 per year to around 0.75 million m^3 per year, while tropical hardwood plywood imports remained broadly level at around 4.5 million m^3. Since 2002, however, imports of tropical hardwood plywood declined consistently and to reach a low of 2.3 million m^3 in 2008.

Figure 6.4 indicates that tropical hardwood plywood has suffered a significant loss in market

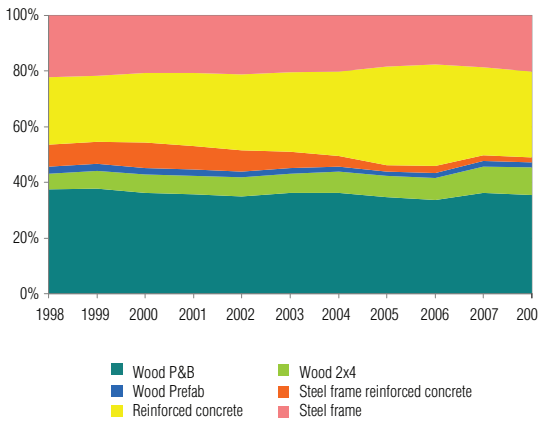
25 This case study was compiled from the following secondary sources: Eastin (2008); FII (2008); ITTO (2004b); ITTO (2005); Japan Lumber Journal (2008, 2009); Ohashi (2009); Osaka (2006); and Roos et al. (2008). Statistics are derived from the Japan Ministry of Land, Infrastructure, Transport and Tourism;; the Japan Lumber Report; the Japan Lumber Importers Association; the ITTO Market Information Service; and the ITTO Annual Review and Assessment of the World Timber Situation.

Figure 6.1 Japan housing starts by construction type, 1998–08 ('000s of starts)



Source: Japan Ministry of Land, Infrastructure, Transport and Tourism

Figure 6.2: Japan housing starts by construction type, 1998–08 (% share of starts)



Source: Japan Ministry of Land, Infrastructure, Transport and Tourism

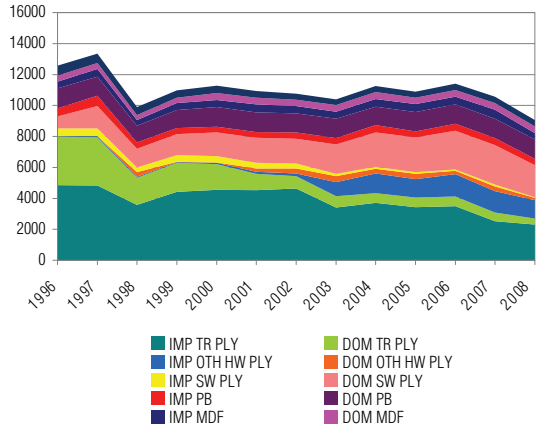
share since 2001 to "other hardwood" plywood (which, in addition to hardwood-throughout plywood in birch and other temperate species, might include certain forms of combi-plywood where temperate species such as poplar and eucalypt are combined with tropical hardwoods). There was also a significant loss in market share to domestically manufactured softwood plywood as domestic mills increasingly switched to Russian logs, at least until 2008 when concerns over the Russian government's phased introduction of log-export tariffs began to bite. More recently, in 2007 and 2008, there were indications that domestically manufactured particleboard (including OSB) and MDF were taking an increasingly significant share of the market.

Figures 6.5 and 6.6 show changes in the main sources of supply of all hardwood plywood (both tropical and temperate) in the period 2003–08 in the Japanese market. While, overall, the market has declined significantly, Malaysia and (to a lesser extent) China have increased their share in the supply of this commodity. Indonesia has borne the brunt of the decline in market share.

The shifts in consumption and supply in the last decade have been matched by significant changes in the end-uses for tropical hardwood plywood in Japan towards an increasing emphasis on specialization and a narrow range of niche markets. As specialization has intensified, the extent of overlap between applications for different panel products and the level of direct competition have declined. In summary:

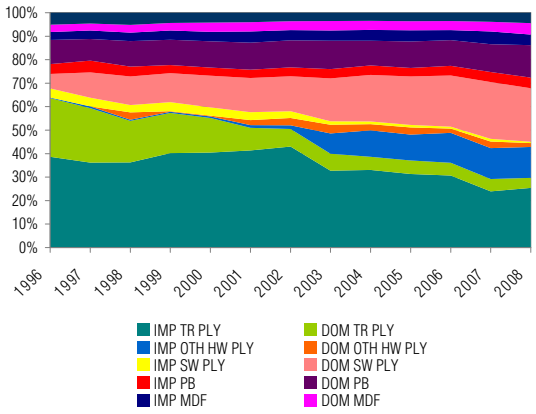
- Tropical hardwood plywood has lost a huge amount of market share in sheathing, formwork and packaging applications to OSB and softwood plywood.
- Indonesian plywood suppliers have moved out of the concrete-formwork market and now focus almost exclusively on the flooring plywood market, which offers higher returns.
- Malaysia is supplying tropical hardwood plywood, both for flooring and concrete formwork. However, as in Indonesia, low price expectations are now discouraging participation in the concrete-formwork market. Malaysia has also partly diversified into a range of combi-products to supply a broader range of applications.
- Much Chinese plywood is still heavily focused on packaging, where it is coming under competitive pressure from OSB and softwood plywood. However, quality has been improving and more Chinese factories have achieved Japan Standards Association (JAS) certification and are looking to enter higher-value markets for flooring and concrete formwork timbers.
- Japan's domestic production now focuses on medium-thick and thin plywood, targeting market niches currently dominated by Indonesian and Malaysian plywood.
- A key outcome of recent market trends is that Japan's wood-flooring sector has become more important as one of the few surviving market niches where tropical hardwood plywood

Figure 6.3 Japan supply of plywood and composite panel products, 1996–2008 ('000 m^3)



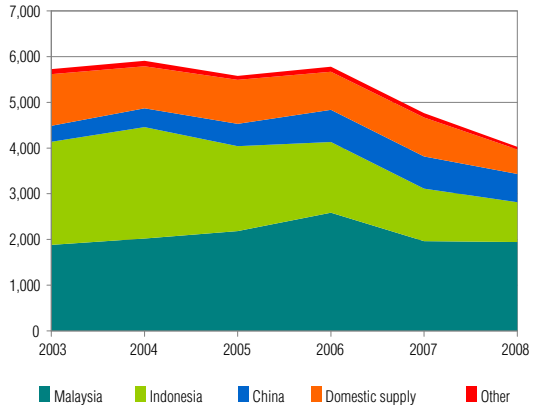
Source: Compiled by the authors from Japan Wood Market Statistics, Japan Lumber Journal, Japan Lumber Report

Figure 6.4 Japan supply of plywood and composite panel products, 1996–2008 (% share)



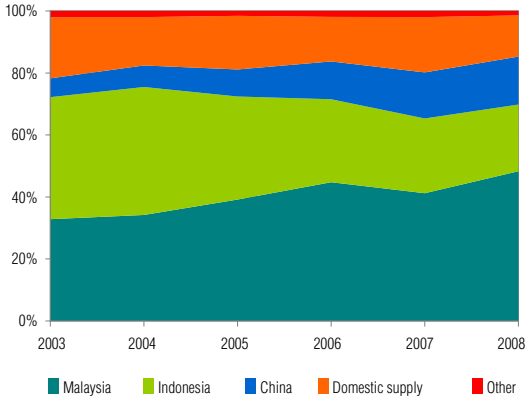
Source: Compiled by the authors from Japan Wood Market Statistics, Japan Lumber Journal,Japan Lumber Report

Figure 6.5 Japan supply of hardwood plywood by country of origin, 2003–08 ('000 m^3)



Source: Japan Lumber Journal

Figure 6.6 Japan supply of hardwood plywood by country of origin, 2003–08 (% share)



Source: Japan Lumber Journal

remains competitive. This market is estimated to use in the region of 1 million m^3 of tropical hardwood plywood per year, around 40% of the total volume of tropical hardwood plywood supplied into Japan.

Competitiveness factors

Prospects for supply of tropical hardwood plywood to Japan

Malaysia: Malaysia's plywood exports have been at 4–5 million m^3 since 2002 and the country seems better placed than its competitors to maintain into the future a reasonably consistent supply of tropical hardwood plywood to Japan. Declining log production in Malaysia is being offset by increased diversion of logs formerly sent for export to domestic mills and by increased log imports, for example of radiata pine and eucalypt for the manufacture of combi-plywood (see Chapter 2).

Indonesia: The long-term prospects for tropical hardwood plywood supply in Indonesia seem poor. Natural-forest production areas are now seriously depleted and a much larger share of the country's future log supply will comprise smaller-dimension material from industrial plantations and community forests. Nevertheless, Indonesia is still host to a large number of JAS-certified plywood mills and there is probably capacity for Japan's imports of tropical hardwood plywood from Indonesia to at least stabilize at their current relatively low levels. Japan accounts for around 50% of Indonesia's total plywood exports.

China: The prospects of China supplying much larger volumes of tropical-hardwood-faced plywood to Japan in the future seem limited for reasons given in Chapters 2 and 5. These include the massive wood supply–demand gap that is opening up in China, rising costs in China, the removal of export credits, and signs that the Chinese plywood-exporting sector is beginning to consolidate around a few larger companies better informed about market requirements and able to provide higher-quality service.

Domestic mills: The decline in the production of tropical plywood by Japan's domestic manufacturers was expected to accelerate during 2009 (to below 400 000 m^3 per year) as mills using tropical logs continue to close in response to a decline in actual demand and as plywood imports continue to climb due to a rise in the yen exchange rate. However, the industry is generally not expected to disappear altogether, as some Japanese mills want to remain diversified as a hedge against the risks associated with an over-dependence on a limited number of suppliers.

Supply of alternative wood products

Softwood plywood: Tropical hardwood plywood is expected to continue to lose market share to softwood plywood, particularly in the concrete-formwork sector. However, after years of generally increasing availability of this product to the Japanese market, supply problems began to emerge in 2008 due to the phased introduction of export duties on Russian logs. Russian log imports into Japan decreased from over 4 million m^3 in 2007 to only 1.86 million m^3 in 2008. During 2009 there were widespread reports of dramatic cut-backs in softwood plywood production. Manufacturers' efforts to increase supply are very heavily focused on the development and marketing of products based on domestic logs, primarily cedar. Currently around 2 million m^3 of domestic softwood logs are used in plywood manufacture in Japan, but this could rise as high as 3 million m^3 in 2–3 years' time.

Other hardwood plywood: A wide range of other hardwood plywood products have been introduced to Japan with the specific objective of providing a cheaper alternative to tropical hardwood plywood, particularly in the flooring sector. For example, Malaysian mills are now supplying plywood manufactured from eucalypt sourced in Australia. There has been growth in imports of Chinese poplar-based plywood into Japan, although there are now signs that the availability of poplar is declining, forcing mills to search for substitutes.

OSB and particleboard: Increased use of OSB was a key factor behind loss of market share earlier this decade for tropical hardwood for sheathing. OSB benefited particularly from the increased adoption of North American 2x4 frame-housing technology in Japan, which created a captive market for this product. OSB is now mainly replacing softwood plywood rather than tropical hardwood plywood in this application. Particleboard, however, continues to substitute for tropical hardwood plywood in the flooring sector. Japan's annual production of OSB and other particleboard remained stable at around 1.25 million m^3 since 2000. Although prices for the domestic product are not always competitive, it benefits vis-à-vis other products from more stable pricing and consistent delivery. OSB is also imported from Canada and Europe, although volumes tend to be less regular and prices more variable due to changing freight and exchange rates.

MDF: MDF is now substituting for plywood, including tropical hardwood plywood, as a base material in veneered flooring systems. Daiken Corporation, for example, announced that it would be switching its floor products away from tropical hardwood plywood to other products, including 'special MDF' with upgraded dimensional stability and water resistance. Japan's domestic production of MDF has remained stable over the last decade at around 450 000 m^3. However, Japanese manufacturers have made significant investments in overseas capacity. Daiken Corporation, for example, recently purchased Carter Holt Harvey Limited's MDF-manufacturing plant in Rangiora, New Zealand, with an annual capacity of 200 000 m^3. Daiken is also sourcing MDF from two factories in Malaysia with a further 220 000 m^3 capacity.

Non-wood alternatives

Overall prospects for wood in relation to non-wood products in Japan remain good, a legacy of Japan's strong cultural attachment to wood. This is strongly reflected in the wood-flooring sector where, due both to an aging population and growing health concerns regarding allergies and indoor air quality, the use of carpet is generally decreasing. The competitive threat from non-wood products is therefore generally regarded to be low in this sector in Japan.

In the concrete-formwork sector, however, significant threats are emerging from non-wood substitutes. Following the enactment of Japan's Basic Law for Establishing a Recycling-Based Society, which by 2010 aims to improve recycling rates by 40% and decrease landfill by 50% compared to the year 2000, subsidies have been made available for the development of new products based on recycled plastics. The establishment of manufacturing plants producing boards to replace tropical hardwood in concrete formwork has been one of several specific targets for these subsidies. A plant in Kawasaki has been established, for example, with a production capacity of 20 000 tons per year.

The development of bamboo plywood for concrete flooring may be a potential competitive threat in the longer term. Some Chinese manufacturers are marketing this product specifically for concrete formwork and are making far-reaching claims about its environmental credentials and superior technical qualities. Volumes still seem to be very limited, however, and production is constrained by the technical challenges associated with plywood manufacture from a product with hollow stems and many nodes.

Price

As elsewhere, prices for tropical hardwood plywood in Japan are significantly higher than prices for softwood plywood, OSB and MDF. This has been a key factor behind tropical hardwood plywood's loss of market share in the sheathing, formwork and packaging sectors. However, tough standards for building quality and formaldehyde emissions have meant that the Japanese market has not been affected by an influx of cheap Chinese combi-products in the same way as the EU and United States markets. As a result, tropical hardwood plywood has been able to date to retain an important share of the market for flooring and interior finishing applications. Nevertheless, price volatility is an increasingly important competitiveness issue for plywood in Japan. The price volatility of tropical hardwood plywood has been significant compared with most other panel products with the exception of OSB and this now threatens market share.

Construction industry standards

Compared with many other countries, Japan's regulatory requirements for earthquake resistance, fire safety and indoor air quality are stringent. These requirements are set out in the Building Standard Law introduced in 1998 and subject to several key amendments since then. Important issues for the competitiveness of tropical hardwood plywood include the following:

- New requirements for building materials to comply with JAS certification standards for low formaldehyde emissions were introduced in July 2003 in response to concerns related to 'sick house syndrome'. Initially there were concerns that this amendment could undermine wood's overall competitiveness due to a heavy reliance on glues and finishes that emit volatile organic compounds (VOCs). A large and growing supply of low-VOC alternatives has since been developed and this wider concern has subsided. However, domestic and several overseas wood manufacturers – notably in North America – responded more rapidly than tropical manufacturers in developing appropriate procedures and establishing JAS certification bodies. In the absence of an approved local certification agency, a plywood mill has to apply to the Japan Plywood Inspection Corporation, which can be a time-consuming procedure. A JAS-registered certifying body was established in Indonesia in 2006, but no certification body has yet been established in Malaysia or any other tropical supplying country. Many Malaysian manufacturers have now achieved JAS certification but Chinese manufacturers are still lagging. Japanese panel-product manufacturers are seeking to build on their success in achieving low-VOC status by cooperating in the development of a voluntary product labeling system that provides consumers with information on VOC emissions.
- There was a revision of the Act in 2007 requiring certification of the structural integrity of new residential buildings by qualified architects or structural engineers. This measure has the potential to significantly improve the competitive position of wood overall due to the strong performance of wood structures in earthquake zones. The new regulation places an onus on suppliers to make appropriate information available on the modulus of elasticity and bending strength of products used in structural support.

- Until recently the use of wood products was generally restricted by a requirement that the walls and ceiling of a room with an open fireplace must comprise non-combustible materials. However, an amendment to the Act has just been introduced to ease the restriction, encouraged by developments in fireproofing methods for wood. Now, wood may be used in such rooms subject to specific requirements with respect to fire-retardant treatment and distance from the fireplace.

Environmental requirements

Energy efficiency

The Japanese government has a wide-ranging policy to reduce greenhouse-gas emissions in the construction sector. These measures are matched by increasing private-sector interest in sustainable design and construction and CSR programs. A voluntary green building certification program – CASBEE – has been developed that has a strong focus on energy efficiency.

There is a significant risk, however, that these measures will be hijacked in order to give preference to domestic wood over imported wood. The CASBEE system is not based on a comprehensive LCA approach and instead incorporates criteria that arbitrarily state that domestic wood is environmentally preferable to imported wood. A recent revision to the 'Law concerning the promotion of the spread of long-lasting and excellent housing' makes specific reference to domestic wood, also hinting that this should be preferred over imported wood on environmental grounds.

A similar message is emerging from some private-sector initiatives. For example, the timber and buildings materials company Sumitomo has announced the introduction of a voluntary carbon-footprint label that will be applied only to domestically produced plywood. Sumitomo suggests that an LCA has shown that, "compared to imported lumber, which requires long-distance transport, the amount of carbon dioxide emissions of the domestic lumber actively used by Sumitomo Forestry Group in Japan is markedly less". Use of the label is explicitly linked to a strategy to "move ahead with the substitution of imported lumber for domestic lumber as raw material for plywood manufactured by the company".

Legality verification

The government sees efforts to combat illegal logging (and therefore to help reduce carbon emissions from deforestation) as a key element of international efforts to tackle climate change. Measures to reduce illegal wood imports into Japan have formed an important part of the government's policy response. In April 2006, Japan introduced a public-sector procurement policy favoring wood products harvested in a legal and sustainable manner. The obligation formally applies to central rather than local governments, although the latter are expected to make efforts to adhere to its prescriptions. They policy essentially establishes a minimum requirement that wood is from a legal source, while sustainability is a "factor for consideration". In contrast to some European-government procurement policies, the Japanese procurement guidelines are relatively short and flexible. There are three mechanisms by which suppliers may verify legality and sustainability: forest certification and chain-of-custody systems; the codes of conduct of wood-industry associations; and the self-established procedures of individual companies. The definition of legality is narrowly focused on harvesting rather than on broader social and environmental legislation. No detailed criteria have been established to assess the credibility of different forms of legality verification and forest certification.

Overall, the potential for the procurement policy to restrict trade in tropical hardwood products relative to other wood suppliers seems low compared to policies introduced in some other wood-consuming countries. In effect, by recognizing codes of conduct and similar initiatives the Japanese government has passed a great deal of responsibility for implementation to the private sector and made reasonable provisions for the evolution of locally appropriate systems.

The public sector accounts for only an estimated 3% of procurement activity in Japan. By encouraging industry associations to develop codes of conduct, however, the government policy is effectively extending efforts to exclude illegal wood to a much larger section of the market. For example, the Japan Federation of Wood Industry Associations (JFWIA) is now playing a leading role in developing interest in and demand for legally verified products. It has developed a specific

'Goho'[26] wood logo to market products that meet industry requirements for legal wood. There are indications that the intent of most industry associations is to mirror the government policy and to retain a flexible and inclusive approach to the recognition of procedures for legality verification. In the absence of clearer guidance, however, there is a risk that individual Japanese associations and corporations will introduce more restrictive policies.

Concluding remarks

The Japanese market for panel products is now very mature and highly differentiated, so that there is less direct competition between tropical hardwood plywood, softwood plywood and composite panels. Significant volumes of tropical hardwood plywood continue to be absorbed by specialist sections of the market, notably flooring and interior finishing. The Japanese market is generally favorably disposed towards the continuing use of wood products. Increased concerns for the health impact of buildings and the need for strong performance during earthquakes, combined with improvements in fire-retardant treatments, are all creating new opportunities for wood products.

On the other hand, significant threats are emerging in the remaining market niches occupied by tropical hardwood plywood. These include low price expectations in the concrete-formwork market, rising concern over the volatility of prices for tropical hardwood plywood, and intensifying competition from MDF and particleboard in the flooring sector. Major emerging issues include increasing concern for the carbon footprint, which is being used to bolster the position of domestic products over imported products, and the increasing need to demonstrate that wood products are derived from legal sources.

26 Goho means 'legal' in Japanese.

7 SOUTHEAST ASIAN GARDEN-FURNITURE SECTOR[27]

Relevance of supply chain

Although the natural forests of Southeast Asia have been seriously diminished in recent years due to conversion for cash crops, over-exploitation, illegal felling and slash and burn, they remain a major source of tropical hardwoods. Meanwhile, wood production from plantations has been growing in several countries, notably Thailand, Indonesia, Malaysia, Viet Nam and the Philippines. The manufacture of garden furniture in Southeast Asia, particularly for markets in North America, Europe and Japan, remains a key end-use for this wood, offering significant potential to add value prior to export.

Specific figures on the size of the Southeast Asian garden-furniture industry are not available. However, the total Southeast Asian furniture sector is estimated to have a production capacity of close to US$14 billion. It is heavily export-dependent, with 60% of the product finding its way into the global market.

While garden-furniture manufacturing is distributed throughout Southeast Asia, various countries have diversified their furniture interests and become more specialized. Wooden-garden-furniture manufacturing is particularly strong in Indonesia, Thailand and Viet Nam. Indonesia and Thailand have benefited in the past from their more ready access to teak, a species that is strongly preferred in the sector. Viet Nam's competitiveness has been built on a combination of low wage rates and reasonable labor productivity. In recent years, all Southeast Asian countries have come under competitive pressure from China, which also combines low labor rates with comparable levels of labor productivity (Table 7.1).

China has competed not only for market share but also for tropical wood supply. With declining regional wood availability and rising demand for FSC-certified products among large retailers in North America and Europe, the Southeast Asian garden-furniture industry has been importing larger volumes of hardwood logs from other tropical regions, including Brazil, Central America, the Solomon Islands and Papua New Guinea. A survey of furniture manufacturers in Southeast Asia in 2004/2005 by the International Furniture Research Group (IFRG) indicated that 41% of all hardwoods used in the sector were imported and 59% were locally sourced (Ratnasingam 2006c). Judging from the numerous anecdotal reports of declining local wood supply and the rising levels of exports to the region by major hardwood suppliers such as the United States, the proportion of imported wood is likely to have increased significantly since then.

Table 7.1 Comparative labor and productivity rates, 2006

	Daily wage rate (US$)	Labor productivity (value added in US$ per worker per year)
Malaysia	7.00	34 000
Thailand	3.50	27 000
Indonesia	3.00	28 000
Philippines	5.00	28 000
Viet Nam	0.80	27 000
China	1.20	27 000

Source: IFRG, Ratnasingam and Mariappan (2007)

Supply of appropriate tropical hardwoods

Forest resources

Wood used for garden furniture needs to have proven long-term weather resistance. Other desirable features are high strength, good machinability, screwing and gluing properties, and consistent color that is resistant to staining. In addition, requirements for forest certification are particularly significant in the garden-furniture sector and have become an important determinant of available supply. The major retailers in the UK, Germany, Holland, Scandinavia and other EU countries, as well as the more responsible United States buyers, will not deal in any non-certified wooden garden furniture (FII 2009). The general preferred demand in the tropical hardwood garden sector is for FSC certification, although some

27 This case study is derived from interviews held with a wide range of garden-furniture manufacturers and designers at furniture trade shows in Europe and Southeast Asia during 2009, together with secondary sources cited individually in the text.

will accept, as an interim measure, wood verified through various phased certification programs such as those operated by The Forest Trust or Smartwood.

From a technical perspective, teak is by far the preferred species. Several garden-furniture manufacturers interviewed for this study indicated that they only use teak. There is considerable difference between plantation-grown teak and natural-forest teak, the latter offering significantly higher quality and yield, so the two are usually considered within the industry as entirely separate and distinct commodities.

By far the largest area of natural-forest teak is in Myanmar. In the early 1990s, Myanmar's natural teak forests were estimated to extend over 16 million hectares (Myanmar Inter Safe Co website 2009). The harvesting of natural-forest teak is now banned in Thailand and Laos and very heavily regulated in India. In 2005, ITTO reported that Myanmar's total area of natural permanent forest estate was 9.7 million hectares and that 34 forest management units covering an area of 470 000 hectares were being actively managed for teak. However, these are now effectively commercially unavailable to the garden-furniture industry in Southeast Asia due to the poor market perception of Myanmar's record on human rights, and trade sanctions imposed on Myanmar by the United States and European governments (Thai Timber Federation President, personal communication, March 2009). A large proportion of the teak exported from Myanmar is now destined for China and India (Thai Timber Federation President, personal communication, March 2009; Deputy Director of Forestry and heads of departments at the Royal Forest Department, Bangkok, Thailand, personal communications, March 2009).

In an effort to close the gap between supply and demand, new teak plantations have been established over the last two decades that are now supplying rising volumes of FSC-certified teak. Apart from its technical properties, a major advantage of teak over other tropical hardwood species is the amount of technical information on plantation production and management that is available for the species, as it has been researched and grown across a wide variety of locations and sites. FAO (2001) estimated that there are 5.7 million hectares of teak plantations worldwide, 5.4 million hectares of which are in Asia. This is a significant increase over the 1.6 million hectares believed to have existed worldwide in 1992 (Myanmar Inter Safe Co website 2009). In addition to Asia, significant areas have also been planted in Costa Rica, Honduras, El Salvador and other Central American countries, which are now only supplying FSC-certified product. New investment is under way in other parts of the world, notably Brazil, which is host to the largest private-sector teak plantation project in the world (Ethical Investors 2007).

While significant, teak plantations have major limitations in the supply of wood to the garden-furniture sector. Plantation teak is generally cut very young (after about 17 years of growth), whereas traditional forest teak is cut after 40–60 years and is of much larger dimensions and produces higher-quality wood.

There are also significant factors constraining efforts to develop plantations. For example, the Thai government has been encouraging farmers through training courses and grants to maintain teak and other tropical hardwood plantations in the country and to resist converting to other cash crops or faster-growing timber species. Since 1995, however, there has been a decline in the number of farmers engaged in the program and in the area of teak plantation established. More farmers are switching land to other crops, such as sugar cane (now highly profitable), cassava, palm oil and rubberwood. Not only do these crops provide a quicker return, there are also no certification issues to contend with (Deputy Director of Forestry and heads of departments at the Royal Forest Department, Bangkok, Thailand, personal communications, March 2009).

Other natural-forest woods have been used occasionally for garden furniture, notably balau/bangkirai and kapur. However, balau is now virtually logged out and remaining supply is extremely expensive. Kapur has a very poor reputation in the industry. When attempts were made several years ago to extend kapur's use in the sector, products suffered from severe leaching problems, leading to massive claims on the suppliers.

Demand for FSC-certified wood has encouraged the use of plantation-grown acacia from Viet Nam and other Southeast Asian countries, together with eucalypt, notably from South Africa, and couboril from Brazil. These wood species are generally very fast-growing and are capable of producing a usable

crop within only seven years. Wile they lack the qualities of high strength, durability, workability and color associated with teak they seem to satisfy the quality requirements of large retailers demanding FSC certification that tend to supply the large-volume, low-value end of the market.

Wood processing

In addition to constraints on forest resources, the availability of wood to the Southeast Asian furniture sector is restricted by inefficiencies in the wood-processing sector. IFRG surveys have indicated that total yield from logs used in the furniture sector is comparatively low in the region (on average only 73%), with yields from natural forest woods considerably higher than yields from plantation woods. IFRG attributed low yield largely to the use of incorrect raw material. To reduce costs, furniture manufacturers tended to compromise on log quality. There is also insufficient understanding of raw materials and handling in the sector. IFRG also suggested that although the wood-processing technology used in Southeast Asia is among the best in the world, it is not used efficiently due to an "inferior-quality workforce" (Ratnasingam 2006b).

The rising dependence on small-dimension plantations is also increasing the challenges of wood conversion. The fast growth of plantation woods in the tropics leads to high internal tensions and defects in the wood. Such plantations do not lend themselves well to the many tried-and-tested harvesting and processing technologies such as mechanized harvesters and fast circular-saw machines that are used widely in Northern Hemisphere softwood forests. The starting price for the most efficient high-capacity machines for sawing small-dimension logs used in Scandinavia and New Zealand is US$1 million and such machines also require equally expensive laser and color-camera-assisted log and lumber sorting lines for input and output operations. Implementing these systems is only practical where significant economies of scale can be achieved and they are simply not cost-effective in the Southeast Asian plantation sector due to high levels of fragmentation (Ratnasingam 2006d). An alternative approach widely applied in temperate forests where there is fragmented ownership is to use small, modern, mobile sawmills. This is discouraged in Southeast Asia, however, because governments, ever wary of the threat of illegal logging, have made field-sawing highly regulated (Ranin 2006).

Alternative wood products

Due to lower levels of durability, temperate hardwoods in their natural form are not generally considered within the garden-furniture trade to be a significant direct competitive threat to the best tropical hardwoods.[28] However, there are now clear signs that mounting problems in the supply of suitable tropical hardwoods is encouraging some Southeast Asian garden-furniture manufacturers to abandon the garden-furniture sector in favor of indoor products, where more readily available imported temperate hardwoods – particularly from the United States – can be used. For example, companies like My Tai and Huong Anh in the Quy Nhon district of Central Viet Nam are considering changing from outdoor to indoor furniture manufacture. It is notable that prices for American hardwood species are often significantly higher than prices for locally sourced tropical hardwoods. However, Southeast Asian manufacturers are turning to these species because they are well known in export markets and among designers, they are available in consistent volumes, and they are marketed in accordance with a set of well-defined industry grading standards.

Thermally treated pine products from northern Europe also offer a competitive threat to tropical hardwoods. An expanding range of these products, generally promoted as direct substitutes for tropical hardwoods, is being offered to garden-furniture manufacturers as production techniques improve. However, concerns still exist amongst furniture manufacturers about the longer-term stability of thermally treated wood, primarily its brittleness and tendency to split. Indications from the 2009 furniture trade shows are that these products are not yet being widely used for garden furniture.

To some extent, thermal treatment is a double-edged sword for tropical hardwoods, since it also offers opportunities to improve the qualities of these woods. In fact the Finnish process now being used to improve pine was originally designed to convert teak sapwood into durable, usable wood for outdoor use, although it ran into problems as the exact temperature setting of the kiln is critical.

28 At the Milan 2009 Salone del Mobile show, however, a few manufacturers were using steamed oak to produce curvaceous lines of outdoor furniture. Teak was not being used in this instance, being regarded as too hard to produce the desired curved effect. One manufacturer conceded that these oak products could not be guaranteed for long-term external use.

Similar experiments being carried out in Thailand have so far proved unsuccessful but are continuing. Meanwhile, heat-treated rubberwood from Malaysia is beginning to make an appearance.

Continuous improvements in paint products and the flexibility offered in color and finishes is also encouraging the use of some lower-durability wood species in garden furniture. Again, this is partly to the benefit of tropical producers. For example, at the Milan 2009 furniture show, the Belgian furniture company Tribu marketed a new line manufactured from Indonesian plantation-grown, FSC-certified acacia treated with nine layers of paint to give it a long service life. Products made form this wood were 15% cheaper than equivalent teak products, despite the extra expense associated with treatment.

Wood versus non-wood materials

According to an IFRG survey, wood was by far the dominant raw material used in the Southeast Asian furniture industry (indoor and outdoor) in 2005, making up 65% of the total value of raw-material inputs. This compares to 12% for metal, 3% for plastic, 13% for rattan, 4% for bamboo and 3% for others. IFRG also reported that 87% of wood raw material used in furniture comprised hardwood and only 13% softwood. IFRG's surveys of Asian furniture manufacturers indicated that wood was particularly valued in the sector for being reliable, easy to work and lightweight (Ratnasingam 2006a).

Although more recent data is unavailable, anecdotal reports and the evidence of trade shows strongly suggest that wood's share in the Asian furniture-manufacturing sector is being eroded and that this decline is falling particularly heavily on tropical hardwoods in the outdoor sector. Key alternative products replacing tropical hardwoods identified during the course of research include:

- Plastics in many forms, including new applications from China of recycled plastics composites with a photograph film coating of various tropical hardwood species being presented as an eco-friendly product. Similar products were being offered from Canada under the slogan "I Am Not Wood" but which provide a convincing appearance and even the feel of wood.
- Acrylic for outdoor furniture coated onto MDF for a no-maintenance, weatherproof material. Claims for this product are that it is very durable and strong.
- Other traditional materials such as glass, aluminium, cast iron and wicker (both natural and man-made), resin and fiberglass are all being offered as maintenance-free or minimal-care for exterior use.
- Bamboo is being used for indoor and outdoor furniture: it is readily available, exceptionally strong and durable, prices are stable, there is no need for certification, and it can be stained or treated to look like hardwood. A number of designers interviewed at 2009 Asian trade shows reckoned bamboo to be a particularly significant new material for outdoor furniture.
- Water Hyacinth and other natural materials are being increasingly offered for indoor furniture with aluminium or bamboo frames and glass table tops.

Competitiveness issues

Overview

The various factors affecting the competitiveness of tropical wood in the Asian garden-furniture manufacturing sector, described below, vary in their significance. Surveys by IFRG, for example, suggest that product price, while clearly significant, should not be over-estimated. Ratnasingam (2006a) noted: "the fact that the decision to purchase a piece of furniture is impulsive and is a matter of 'perceived value' rather than 'actual value' is well established in the world furniture trade." IFRG surveys suggest that factors of quality and design are the main priorities for furniture consumers, while material, service and price are the next most important factors.

Price

In interviews with Thai, Vietnamese and Singaporean garden traders and furniture manufacturers undertaken in 2009 for this study, price was mentioned frequently as a (not necessarily overriding) factor behind decisions to shift to alternative materials. Both the absolute price and its volatility were seen as a problem.

Until the recent global financial crisis, tropical hardwood furniture was being badly affected by a continuous increase in raw-material prices, due both to species exhaustion and rapidly rising

demand for only certified wood. The expectation in the trade is that as soon as there is recovery in demand approaching pre-recession levels, this upward increase in prices will resume.

Prior to the global financial crisis, plantation-teak pricing was following an upward trend similar to that observed for natural-forest teak, but prices have since fallen in line with reduced demand. Natural-forest teak prices, however, have remained stable, even during the recent downturn in furniture demand, due to limited wood availability.

It is hard to generalize about the impact of wood raw-material price on the competitiveness of tropical hardwoods in the Southeast Asian garden-furniture sector. The reality is that the market is highly differentiated between top, middle and low-end products:

- For many years, garden-furniture manufacturers at the upper-end of the market have been willing to pay high prices for natural-forest teak due to its high quality and yield, a lack of any real alternatives, very limited availability, and strong demand from China and India. Grade A Teak ex-Myanmar continues to be traded at about US$5000 per m^3. These prices have been sustained even though, for a high-quality natural-forest teak set, the cost of the wood raw material contributes to approximately 60% of the finished set price. This is due both to the much higher baseline price for Myanmar teak and larger volumes of good-quality wood used in its manufacture. Natural-forest teak products now occupy a very small, high-value niche market that to date has been resistant to substitution. Natural-forest teak retains a certain aura of quality that is hard to replace. As one European manufacturer interviewed in Milan during 2009 noted, "top-end clients like their products to look expensive, which is much easier with the best teak than it is with plastic". The ability of Southeast Asian manufacturers to continue to supply this market in Europe and North America is now greatly limited by trade sanctions.
- Plantation teak remains important at medium price points in the market. Prices for plantation teak are highly variable depending on quality. The best grades of FSC-certified product from Central America generally trade for up to US$2000 per m^3. The lowest grades – generally being bought by Vietnamese producers – trade at US$750–US$1000 per m^3. Interviews suggest that high and volatile pricing in this section of the market has made tropical hardwoods extremely vulnerable to substitution, both by much cheaper FSC-certified plantation woods and by non-wood products.
- The low end of the market is increasingly dominated by cheap, fast-grown plantation species, notably eucalypt and acacia. While inferior in quality, these wood products tend to be offered as FSC-certified. Prices for FSC-certified eucalypt are in the range US$180–500 per m^3 according to type and density, the higher-end prices applying to Solignum eucalypt from South Africa, which most resembles teak. FSC-certified acacia sells at between US$150–300 per m^3. These prices are sufficiently low to make them highly competitive against non-wood products. On the other hand, at this end of the market, raw material costs are relatively insignificant in the final cost of the product. For a typical FSC-certified eucalypt set of six garden chairs and a table, the cost of wood raw material contributes to only approximately 25% of the finished set price. Thus, at this end of the market, wood remains vulnerable to competition from alternative materials which, while potentially more expensive, may offer benefits in terms of superior quality, stable pricing, ready availability and low maintenance.

Availability

The need for product to be readily available for fast shipment has become increasingly important over the last decade. The economic impact of the global financial crisis has further reinforced the need for finished products to be available for fast-turnaround and in small, flexible container loads to offset uncertainty in consumption and prices. Retailers, wholesalers and importers are all increasingly working on a just-in-time basis and maintaining low inventories. Traders and manufacturers interviewed at European trade shows in 2009 indicated that these factors are generally working against tropical hardwoods, which may be difficult to obtain at short notice and at reasonably stable prices.

Quality

Although tropical hardwood, particularly teak, retains a reputation for quality among consumers of garden furniture, certain recent trends may have damaged this reputation. There has been a tendency for low-cost retailers and supermarket chains in Europe and North America to sell species that are unsuitable for the end use, basing their sales and marketing campaigns entirely on price and avoiding the use of higher-priced, more suitable species for outside usage. This strategy accounts for a very large percentage of the growth in low-priced tropical hardwood garden-furniture sales in recent years. The example of kapur, which caused severe leaching problems (see above), is a classic case of using a substitute wood not tested or suitable for the end use.

Quality demands for outdoor furniture have generally been rising, particularly with a trend towards combining furniture for indoor and outdoor use. This is encouraging greater interest in well-finished modular, foldable, and lightweight furniture. Again this trend generally favors alternative materials, albeit with the continued use of small volumes of teak to soften lines (Garden International 2009).

Design, research and development

Research by IFRG suggests that the Southeast Asian furniture sector as a whole remains relatively heavily dependent on contract manufacturing rather than on own-brand furniture manufacturing. IFRG has argued that this will lead to a gradual loss of overall industry competitiveness in the region as the barriers to entry in contract manufacturing are relatively low and there will always be opportunities for manufacturers in lower-cost locations to take market share (Ratnasingam 2005a, 2006a, 2006b, Ratnasingam and Mariappan 2007).

Heavy reliance on contract manufacturing is tied to relatively low levels of investment in research and development and in the design of new products. An IFRG survey of regional furniture manufacturers in 2005 indicated that they invested less than 4% of their total turnover in product research and development activities, while their counterparts in Europe invested 12%. Reluctance to engage in research and development reflects the intangible and painstaking nature of these activities, factors which discourage support from financial institutions. Companies and investors in the region have generally preferred a strategy of production growth to boost market share, rather than the development of innovative own-brand products that add value (Ratnasingam 2006a).

Another factor discouraging investment in design in Southeast Asia, and which has left the field largely dominated by European, North American and Japanese firms, is that the design process benefits strongly from proximity to the customer, which allows for rapid response to changing fashion trends.

One result is that design trends tend to be heavily influenced by Western and Japanese firms, which have little interest in promoting tropical hardwoods and may be actively prejudiced against their continued use. Another result is that Southeast Asian furniture-manufacturing companies fail to benefit fully from the opportunities to add value to regionally available raw materials.

Evidence from furniture trade shows in both Asia and Europe during 2009 suggests that designers are generally favoring a move away tropical hardwoods in the garden-furniture sector and showing greater interest in combining different materials.

Environmental requirements

Environmental issues are affecting the Southeast Asian garden-furniture sector in a number of ways. Most obviously, the sector has long been at the center of the international trade in FSC-certified products. This is due to the high visibility of tropical hardwood in the sector, intense green campaigning that has targeted the sector from the early 1990s onwards, and the growing importance of large European retailing groups in the sale and distribution of garden furniture. An increasing number of retail groups will no longer directly purchase or offer any uncertified wood products. As in other sectors, the drive for certified products has come more from the large retailers wanting to protect their corporate images, and also from Western designers concerned about environmental impact, and less from pressure from the buying public (FII 2009). Consumer surveys regularly put environmental concerns relatively low in the list of factors contributing to purchasing decisions on wooden furniture (Ratnasingam 2006a). Demands vary between countries: for example, interest in these issues in considerably greater in the UK

and the Netherlands than it is in Italy or Spain. Nevertheless, the underlying trend has been towards a progressive strengthening of demand for the FSC certification of all tropical woods used in the sector (FII 2009).

The strong emphasis on FSC certification is expected to continue to create supply challenges. The President of the Thai Timber Trade Federation, for example, noted that the small players who dominate the plantation-teak sector in large parts of Southeast Asia continue to struggle with the bureaucratic requirements of FSC certification (Thai Timber Federation President, personal communication, March 2009).

On the other hand, the fact that so many teak plantations are already FSC-certified is a source of marketing strength. Progress is also being made to gradually increase the area of teak plantation that is FSC-certified. For example, five Perhum Perhutani districts in Java are now actively engaged with The Forest Trust in a phased program of FSC certification. Audits have already been undertaken and efforts are now being made to close various corrective action requests, the last stage prior to the awarding of an FSC certificate (The Forest Trust website 2009).

Another issue that is coming to the fore and which was raised by European furniture designers interviewed for this study is the carbon footprint associated with transport. For some, this is as significant as FSC certification. A Danish designer, for example, noted that he would not design products in FSC-certified wood because "these woods come mainly from Brazil and are shipped half way round the world, made into furniture in Viet Nam and other low-cost countries in Asia, and shipped from there to Europe and/or back to America". This designer would, however, consider specifying FSC-certified hardwood if the raw material were to be sourced locally in Southeast Asia.

Concluding comments

Southeast Asian countries have built a formidable reputation within the garden-furniture industry as the world's best low-cost production area capable of manufacturing the full range of garden furniture from high-quality designer brands to high-volume, low-cost items sold under the retailers' own brands. Nevertheless, this review highlights that that there are factors acting to undermine overall industry competitiveness, particularly the heavy focus on a 'volume-driven' rather than a 'product-and-design-driven' industrial strategy.

Moreover, there are very significant obstacles to the continued use of tropical hardwoods within the Southeast Asian garden-furniture sector. Mounting supply difficulties, environmental concerns and changing consumer tastes in favor of light, low-maintenance products that may be used both indoors and outdoors are driving a shift away from tropical wood in favor of non-wood products such as plastics, wicker and bamboo.

Examples of this switch in emphasis abounded at the trade shows visited for this study. For example, the General Manager of Royal Botania, a Belgian company, noted that "we used to use 100% teak, but now only 10–15% of our product is made of teak. There has been a trend away from teak products, partly because it has become so expensive but also because the market became saturated, everybody had it, and this tended to reduce its desirability. Although slightly more expensive, we're now making more product in steel".

Meanwhile, garden-furniture manufacturers looking for ways to maintain profitability are increasingly moving into the interior-furniture sector where they can exploit the greater availability and popularity of temperate hardwoods, particularly from North America.

The trend away from tropical hardwood may only be addressed through a design-led marketing initiative aimed at returning it to fashionable status. This needs to target both Western and Japanese designers – who are influential in global design – and up-and-coming Southeast Asian designers who can act as ambassadors to promote new regional styles based on locally derived tropical hardwoods. The success of such an initiative will depend on measures to improve the availability and surety of supply and, above all, on consistent, affordable pricing.

8 SAPELE AND MERANTI FOR WINDOW FRAMES IN EUROPE[29]

Background

Sapele and meranti sawnwood is widely used in the European joinery sector. An analysis of Eurostat trade data suggests that, in 2007, total EU imports of sapele (logs and sawnwood) were around 350 000 m^3 and total imports of meranti (sawnwood and laminated scantlings) were around 250 000 m^3. The main application of meranti is in window frames in northwestern Europe – in solid form and often painted in the Netherlands and UK and increasingly as engineered wood in central Europe, particularly Germany. Sapele is used widely for window frames and door frames and for staircases, particularly in the UK, the Netherlands, Belgium and Spain. The competitive issues surrounding the use of tropical wood in interior applications in Europe is considered separately in Chapter 9; this section focuses on the western European window market. Taking into account all products (wood, plastics and steel), this market was estimated to be worth US$18 billion in 2008, of which wood contributed US$4.4 billion (24%).

There is significant overlap in European markets for sapele and meranti and the two species often compete directly with each other, the choice depending on prices that fluctuate widely depending on availability of supply and exchange-rate movements. A few other tropical species also vie for the same European market niche. Some, such as Brazilian and African mahogany and Brazilian cedar, were formerly major players but have fallen away dramatically as commercial availability has declined. A few other species are still used under specific circumstances where there is a willingness to pay slightly more for better quality; these include African sipo and Brazilian sapupira/angelim pedra – when it can be obtained at competitive prices or it is FSC-certified. However, the volumes involved are significantly lower than for either meranti or sapele.

29 This chapter draws partly on semi-structured interviews held with timber-trading companies and window manufacturers in Europe in the first half of 2009, notably at the Ecobuild trade show held in London on 3–5 March 2009, together with a range of secondary sources cited in the text.

Alongside ayous, sapele is the dominant export species of the northern Congo region. In 2007, sapele's share of total sawnwood exports from Central African Republic, the Republic of the Congo and Cameroon was 60%, 72% and 22% respectively (Table 8.1). A large proportion of sapele exports end up in the EU. For example, 77% of all sapele sawnwood exports from Cameroon in 2007 were destined for the EU.

Meranti is the single largest species group exported in sawn form from Malaysia. Of the 752 000 m^3 of sawnwood exported from Peninsular Malaysia in 2007, 182 000 m^3 (25%) comprised meranti species. Overall, the EU accounted for 157 000 m^3 of sawnwood exports from Peninsular Malaysia in 2007 and for a further 80 000 m^3 from Sabah (FII 2008). Eurostat data indicate that, in 2007, over 90% of the tonnage of EU-25 imports of Malaysian sawnwood comprised dark and light red meranti.

Meranti encompasses a wide range of wood types and the specific type used varies by EU country. For example, the UK mainly imports light red meranti tembaga sawnwood from Peninsular Malaysia and only small volumes of seraya majau sawnwood, a more expensive and higher-density product from Sabah. The Netherlands buys a wider range of dark red meranti, referred to in the trade variously

Table 8.1 Volume of exports from countries in the northern Congo region, 2007

			Central African Republic	Republic of the Congo	Cameroon
			('000 m^3)		
Logs	Total		193	527	266
	Of which	Sapele	116	74	0[a]
		EU	83	141	63
Sawnwood	Total		76	210	613
	Of which	Sapele	46	151	132[b]
		EU	44	128	157

a Export of sapele logs from Cameroon is prohibited.
b 102 000 m^3 of the 132 000 m^3 of sapele sawnwood exported from Cameroon in 2007 actually comprised sapele.
Source: ATIBT (2008)

as bukit, seraya and nemesu depending on origin and the particular species of *Shorea* involved. Most meranti imported into the Netherlands is in window-frame specifications (relatively high durability, pin-hole no-defect, and standard sizes, notably 3"x5"). Meranti also enters the EU market in the form of window scantlings from Malaysia and Indonesia. Eurostat data indicate that, in recent years, EU imports of these products from those two tropical countries have totaled 60 000–70 000 m^3 per year, the majority destined for the Netherlands and Germany.

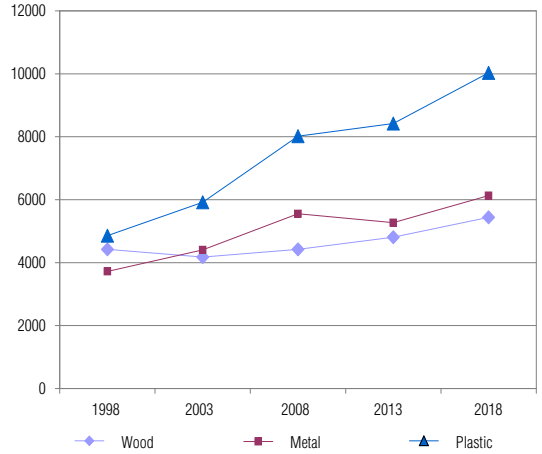
Market position in the European window sector

Indications are that, overall, wood products have lost market share in the European window market to non-wood products, particularly plastics and to a lesser extent metals. Figures 8.1 and 8.2 present estimates of the past and future share of the western European window market held by wood compared to metal and plastics in the period 1998–2018. Derived from a Freedonia report on global demand for windows and doors (Freedonia 2009), the data draw on analysis of the activities of the region's largest window manufacturers. They show that wood-framed windows lost out to plastics and metals in terms of both total market value and share of the total market in western Europe in the period 1998–2003. In the period 2003–08, sales of wood-framed windows increased in line with overall increases in construction activity, but share continued to be lost.

On the other hand, there are indications that the prospects for wood-framed windows are improving again. Recent improvements in the quality of products and services provided by the wood-framed-window sector, particularly a concerted shift to fully-factory-finished units combined with emerging concern for environmental issues and energy efficiency, have improved competitiveness and are already boosting market share. The Freedonia report (Freedonia 2009) suggested that these factors will, over the next five years, increase wood's market share, mainly at the expense of metal products. However, Freedonia analysts were more skeptical of wood's ability to make significant inroads into the dominant market position now held by the plastics sector, a position that is expected to be consolidated through the combination of low-priced product, strong marketing and distribution networks, and constant innovation to improve thermal insulation, aesthetics and recycling.

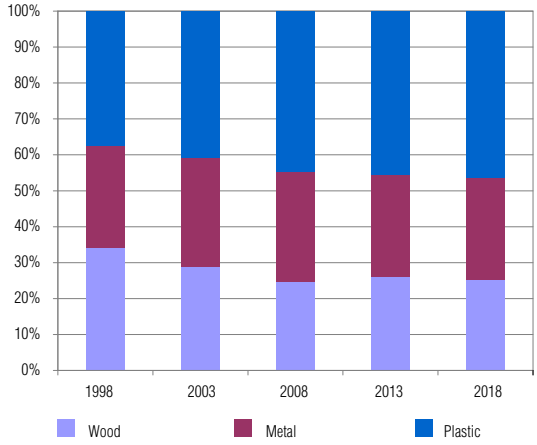
Other reports confirm this picture of wood losing market share in the European window sector in the early years of this decade and then, in the last two or three years, showing signs of a renaissance as consumers respond to improvements in the wood product. For example, a report by Palmer Market Research (2009) noted that timber glazing products in new residential construction shot up by 28% in installed-value terms in 2006, compared to a 10% gain for aluminium and only 3% for uPVC. Wood benefited from a marked shift to more up-market products and materials in this period,

Figure 8.1 Value of western European window market, by product (US$ million)



Source: Freedonia (2009)

Figure 8.2 Share of western European window market, by product (US$ million)



Source: Freedonia (2009)

with hardwood growing more strongly (20%) than softwood (15%). Full factory finishing, which increased its share of the UK wood-framed-window sector from 50% in 2005 to 67% in 2006, was identified as a key factor.

A lack of wood end-use surveys in Europe means there is no way of estimating the share of tropical wood versus other wood products. However, interviews and anecdotal reports and an analysis of factors affecting competitiveness strongly suggest that tropical wood is increasingly restricted to a small-volume, high-value niche, accounting for only a few per cent of total wood-framed-window production volume. Moreover, tropical wood's position in this niche is coming under considerable and intensifying pressure from alternatives.

An insight into the current market position of meranti and sapele is provided by Table 8.2, which summarizes the strengths and weaknesses of the wide range of window-frame options now available to European consumers.

Competitiveness factors

Price

Price is a major issue in the window market and has been an important factor both in driving consumers away from wood in general and in encouraging a move away from tropical hardwoods. There is a considerable and widening price gap between sapele and meranti on the one hand and the key softwoods used in the window sector on the other. For sapele, the price gap is even larger when the requirement for certification is taken into account (Table 8.3).

Source: Compiled by authors from FII (2007) and *EUWID*

Interviews with UK joinery companies at Ecobuild 2009 suggest that while the additional price of using sapele or meranti is significant a limited number of clients are still specifically requesting tropical hardwood window frames because of their qualities of strength, durability and color. Since the wood raw material typically accounts for no more than 30% of the total cost of manufacturing a window unit, and even less at the higher-quality end of the market, even a fairly significant increase in the price of the wood need not lead to a significant increase in the price of the finished product.

Nevertheless, high-spec hardwood window frames tend to be more expensive than softwood window frames and considerably more expensive than uPVC. For example, figures supplied by Boyland Joinery Ltd in the UK suggest the following comparative prices for a 'typical' factory-finished window unit: uPVC, £330; painted softwood, £358; laminated redwood, £453; sapele, £587; and laminated European oak, £805.

This is a highly competitive environment and the extent of the price gap between tropical hardwood-framed windows and alternatives is high enough to lead inevitably to a further loss of market share. Moreover, the prospects for tropical hardwoods in this sector may be even more challenging than suggested by the manufacturers interviewed at Ecobuild. At the time of the interviews (March 2009), EU wholesale prices for sapele had been severely dented by a short-term glut in landed stock that had emerged at the onset of the global financial crisis in the third quarter of 2008. Interviews with European hardwood agents in early 2009 suggested that these prices were well below replacement cost and were very unlikely to be sustained in the long term.

Reason for price gap between wood and plastics

While commodity prices for uPVC are generally no cheaper than those for wood, uPVC window frames tend to be cheaper because less processing is required. This price gap is not easily closed. The manufacture of a window frame from a PVC extruded profile requires only mitering and heat-welding using relatively low-cost equipment. By contrast, even the simplest wood frame has to be jointed, profiled, end-grain sealed, cramped and glued up, resanded and coated. Additional costs are associated with the lamination of engineered products and preservative treatment, where required. Many wood-framed-window manufacturers also bear the costs of performance-testing, whereas the costs of PVC performance-testing are typically carried by the profile manufacturer. On top of this is the cost of forest certification, which is increasingly required for wood but not for plastics.

Capital expenditure in machinery can reduce labor costs in the wood-framed-window sector but to date it has proved impossible to match the plastics manufacturers. WPCs offer potential for the wood sector as a whole to close this gap, but these will not open new opportunities for tropical hardwoods.

Table 8.2 Window-frame options in the European market

Material	Origin	Strengths	Weaknesses
Meranti	Malaysia (sawnwood and laminates) Indonesia (laminates)	Superior strength, durability and stability to softwoods. Some denser species very durable Good insulation Available both as sawnwood and as laminate Held in stock by EU importers Malaysia has strong reputation for prompt delivery and ability to supply to specification Good availability MTCS/PEFC Certified durable hardwood window rated A+ in BRE Green Guide	High up-front price compared with softwood/ plastics Wood-product prices subject to exchange rate fluctuations Very limited supply of denser, durable varieties Variable wood quality supplied to the EU has damaged image (sapele now tends to be preferred on wood-quality grounds) No FSC-certified product Poor green image compared to softwoods Perceived high carbon footprint Environmental LCA data not readily available
Sapele	Mainly Cameroon, Congo, Central African Republic	Very strong (bending strength 105 N/mm2) Superior stability and less shrinkage than either meranti or softwoods Good insulation Moderately durable (class 3) Held in stock by EU importers Some FSC-certified material available Certified durable hardwood window rated A+ in BRE Green Guide	High up-front price compared with softwood/ plastics FOB and wholesale price volatility Long lead times for shipment from Africa Machining more difficult than other redwoods Durability falls short of toughest standards required in some sectors Only tiny volume of laminates available No FSC-certified product Poor green image compared to softwoods Perceived high carbon footprint Environmental LCA data not readily available
Scandinavian redwood	Mainly Sweden, Finland	Readily available in Europe in appropriate specs Ready availability of laminates that provide greater stability and strength and less wastage Low price compared to other wood types Easy to work Heartwood can achieve durability class 3-4 without preservative treatment Good insulation Perceived low carbon footprint Environmental LCA data readily available Certified softwood window rated A in BRE Green Guide	Prices higher than plastics More variable and generally lower durability compared with hardwoods Preservative treatment may be required Less stable and lower strength in solid form than hardwoods (but laminates have better performance)
Eucalypt	South America, South Africa	Fast growing, rapidly renewable compared to other hardwoods Good workability Readily available as FSC-certified Significantly cheaper than tropical hardwood	Low familiarity with working and performance properties in the EU market Lack of information on durability Perceived high carbon footprint
Oak	Central/ Eastern Europe	Local availability, including as laminate Good workability and familiarity Good insulation Aesthetics Perceived carbon footprint Moderately durable	Very high prices Lower yield and high wastage during processing than other species

Material	Origin	Strengths	Weaknesses
Thermally treated wood	Finland, Germany, Austria	Good technical performance, particularly stability and durability (class 1) Longer-life guarantees than any other product All FSC-certified or PEFC-certified Price comparable to MTCS-certified meranti and uncertified sapele windows	High up-front price compared to softwoods/ plastics Lack of availability in large commercial quantities (total EU capacity about 200 000 m^3) Technical challenges (e.g. thermal treatment associated with increased brittleness) Perceived high carbon footprint
uPVC	Europe	Low price Readily available – suppliers everywhere Very strong marketing Good strength and insulation Perceived to be low maintenance Wide choice of finishes Increasing volumes of PVC are recycled Rated A in BRE Green Guide (due to recycling record)	Poor aesthetics Needs replacing more regularly than wood or aluminium Regular cleaning required to avoid discoloration Turns yellow and brittle in sunlight and may develop hairline cracks Needs repairing by specialist Poor LCA performance and environmental image 'Cheap' image
Aluminium	Europe	Very high structural strength Allows narrow frame and more window space High durability, long service life and low maintenance Readily available	More expensive than plastics or softwoods. Needs repairing by specialist Very poor natural insulator (although modern, generally more expensive designs have overcome this problem) High carbon footprint Rated B–D in BRE Green Guide
Aluminium–wood	Europe	Combines high structural strength, long service life and durability of aluminium with insulation properties of wood Readily available	More expensive than plastics or softwood Needs repairing by specialist High carbon footprint Rated B–D in BRE Green Guide

Sources: Compiled by the authors drawing on interviews with window manufacturers and on product brochures and websites

Table 8.3 Prices for wood raw materials used in European window-frame manufacture

	Certification status	Unit price	February 2005	February 2006	February 2007	February 2008	February 2009
Species (UK-delivered prices)							
Sapele	Uncertified	£/m^3	428	456	588	570	530
	Verified legal origin	£/m^3	na	463	606	585	550
	FSC-certified	£/m^3	na	na	na	na	630
Meranti	Uncertified	£/m^3	352	409	502	475	560
	MTCS/PEFC-certified	£/m^3	360	419	512	475	560
Iroko	Uncertified	£/m^3	577	572	552	560	620
	Verified legal origin	£/m^3	na	583	568	575	635
European oak	Uncertified	£/m^3	691	728	720	720	670
	FSC-certified	£/m^3	712	728	710	720	670
Scandinavian redwood joinery grade	Uncertified	£/m^3	165	174	206	180	150
	FSC-certified	£/m^3	165	174	206	180	150
Scantlings (Germany-delivered prices)							
Meranti full log	450+ kg/m^3, 72x86mm	€/m	4.40	5.20	6.65	6.00	6.25
Meranti	450 kg/m^3, 72x86mm	€/m	3.40	4.60	5.60	4.90	5.50
Pine one piece		€/m	3.50	3.75	5.05	4.30	3.60
Spruce one piece		€/m	4.00	4.15	5.00	4.45	4.10
Siberian larch		€/m	5.65	5.65	5.75	5.35	5.75
White oak		€/m	8.80	9.35	9.65	9.65	9.00

na = not applicable

Whole-life costing

A partial answer to the problem of rising raw-material costs could lie in whole-life costing. This is a key part of the strategy adopted by suppliers of thermally treated softwood to develop market share and is also relevant to the tropical hardwood sector. It relies on the simple observation that while up-front prices may be higher for wood, very significant savings can be made in the longer term through the purchase of low-maintenance and energy-efficient products. Interest in whole-life costing is rising, particularly in the public sector as government authorities seek to comply with value-for-money procurement guidelines. It is also now the subject of an international standard – ISO 15686 on Service Life Planning of Buildings and Constructed Assets.

Table 8.4 shows the results of a whole-life costing performed for Accoya, a supplier of acetylated wood, using a model developed by the Paint Advisory Bureau in the UK. They are not particularly favorable for to sapele, but they are very sensitive to the assumptions made about the products used. In this instance it was assumed that the sapele would be painted and would need at least as much maintenance as a laminated softwood frame, while Accoya would need less maintenance than any other product. Studies making more realistic assumptions about the relative performance of tropical hardwoods and softwood alternatives may give a different and more positive result.

Technical performance and standards

Table 8.2 demonstrates that each window-frame option has technical strengths and weaknesses. The signs are that while meranti and sapele have been favored for their technical attributes, innovation and the development of new products means that some alternatives are already ahead of tropical wood with respect to specific technical qualities. For example, thermally treated wood may conform to durability class 1 and is now regularly offered with significantly longer life guarantees than either sapele or meranti.

The move to fully-factory-finished window frames is also tending to increase the focus on consistent compliance with very tight size specifications to avoid wastage and to meet technical standards on strength, durability and stability. This is becoming progressively more important than factors such as versatility and ease of on-site working, which have often favored tropical hardwoods in the past.

These latter trends have particularly encouraged the increased use of EWPs in the sector. Malaysian and Indonesian manufacturers have adapted to this trend through the development and supply of laminated products, which is helping to maintain position in the market (although current price trends are not favorable). A lack of production capacity for similar EWPs will be a major source of competitive disadvantage for African suppliers in this sector in the future. One French importer

Table 8.4 Whole-life costing of various window-frame types in the UK

Window-frame type	No. of units	Whole-life cost (£)	Evaluation period (years)	Initial cost (£)	Maintenance interval (years)	Window-frame life (years)	Maintenance escalation factor	Discount rate
Laminated redwood	15	12519	60	6797	6	30	0.1	0.02
Painted sapele	15	15642	60	8809	6	30	0.1	0.02
Laminated and painted European oak	15	20710	60	12075	6	30	0.1	0.02
Accoya	15	8875	60	7862	10	60	0.1	0.02
uPVC	15	14385	60	4950	1	40	0	0.02
Painted softwood	15	9510	60	5370	8	30	0.1	0.02
Accoya (Boyland example)	15	8115	60	7500	12	60	0.1	0.02

Note: the whole-life cost model is highly sensitive to project-specific input data. The data presented in this table is based on publicity material contained in brochures prepared by Boyland Joinery and Accoya Limited, which in turn draws on default data provided by the Paint Advisory Bureau. It is also noted that many softwood windows require painting and rot repair more frequently than the periods used in this example. This causes a dramatic increase in whole-life costs. The one-year maintenance interval for uPVC assumes adherence to the required cleaning regime for uPVC surfaces.

Source: Product brochures from Boyland Joinery and Accoya Limited

interviewed for this study commented that: "species such as sapele are quite technical to machine … market demand can only be developed if these species are sold semi-finished in standard dimensions either glue-lamed or in solid blocks". Some limited lamination capacity has been developed in sapele-supplying areas (e.g. by CIB in the Republic of the Congo) but volumes are still very restricted.

Availability and delivery time

Most window manufacturers require wood of consistent quality to be readily available, increasingly on a just-in-time basis. Interviews with joinery manufacturers suggest that unlike most other tropical hardwood species (which for this reason are not competitive in the window sector), the availability of meranti and sapele is not a limiting factor in their use. Importers typically hold large volumes in stock, with some of the bigger distributors in Belgium, the Netherlands and Luxembourg now capable of supplying a large region at relatively short notice. On the other hand, the need for FSC-certified wood is of increasing importance in certain market sectors and this has led directly to the substitution of tropical hardwoods.

For the manufacturer, potential supply problems associated with sourcing meranti and sapele have been ironed out to a large extent through the development of large concentration yards in northwestern Europe. Interviews with importers in this region also suggest high levels of satisfaction with Malaysian shippers, who have acquired a strong reputation for delivering product on-time fully in line with agreed price and contract specifications. There are notable exceptions, but the overall performance of African sapele shippers is generally regarded as more mixed. Delivery times can be very extended, the range of specifications available is relatively limited, and the product quality can be variable. This means that the risks associated with stocking sapele are considered to be relatively high. The sensitivity of importers to these risks is likely to be heightened by recent volatile trading conditions and rising FOB prices for sapele.

The greater availability of sapele and meranti has been a key factor boosting their competitiveness in relation to thermally treated wood. A UK manufacturer interviewed at Ecobuild noted that thermally treated wood cannot yet be obtained regularly and reliably and that it would not be possible to satisfy large orders using this product. This situation is gradually changing, however (See Chapter 2).

Environmental issues

Environmental issues are affecting the window sector in several ways. Energy-efficiency measures driven by rising energy costs and government commitments to greenhouse-gas emission targets are having a profound effect on the overall market. The ability to supply product with high U-values and low embodied energy at reasonable cost is becoming a major competitiveness issue. Wood's inherently good insulation properties and unrivalled record on carbon sequestration should benefit its overall position in this market. These messages now lie at the heart of European wood-framed -window marketing campaigns. At the Ecobuild show in London in March 2009, wood-framed-window companies were offering triple-glazed products with superior insulation performance to other window types. For example, the Norwegian company NorDan's triple-glazed, wood-framed windows have U-values as low as 0.7W/m^2 Kelvin. Similarly, Jeld-Wen launched DreamVu, the UK's first volume-made, wood-framed window with a U-value of 0.7–1.0W/m^2 Kelvin.

But nothing can be taken for granted. uPVC-framed windows also score well on heat-insulation criteria and the plastics industry is trying to push the environmental agenda towards issues where it performs well – such as recycling. uPVC-framed windows were recently awarded an A-rating in the BRE Green Guide, a key reference for procurement in the UK construction sector. The A-rating means that uPVC-framed windows are now regarded by BRE as just as environmentally friendly as wood-framed windows. BRE has justified the A-rating by referring to the efforts of the plastics industry to recycle a higher proportion of windows at the end of their functional life (BRE 2009).

Interest in energy efficiency is impacting directly on the types and specifications of wood. For example, demand for triple-glazed units has been rising rapidly; in Germany these units now account for around 30% of the total window market. In theory the need for greater stability and strength in the frame material to carry the triple glazing could boost prospects for tropical hardwoods. In practice,

however, most market players expect EWPs and metals to be the main beneficiaries. One immediate effect of this trend in Germany is that standard 72x86-mm scantlings have been losing market share to thicker-dimension product.

For wood there is the additional complication of forest certification. As in other sectors there is considerable variation across Europe in the extent to which certification is currently demanded, with particularly strong demand in the UK and the Netherlands, emerging demand in Germany, France and Belgium, and only low levels of demand in Spain and Italy. The general trend in overall market demand for certified wood has been rising among window manufacturers, however, although such demand is not necessarily matched by a willingness to pay.

UK and Dutch window manufacturers have been encouraged to demand certified wood both by emerging end-user demand and by internal management issues that mean that if certified wood is supplied to one major customer and certified raw material is sufficiently available it is simpler to switch to 100% certified production. An interview at Ecobuild with a representative of one company accounting for a sizeable chunk of the UK wood-framed-window market highlights the extent to which large institutional and corporate buyers of window units are now demanding certification. This interviewee suggested that 100% of customers in the public and retailer sectors (together accounting for 40% of sales) require products to be independently certified; around 50% of customers in the merchant sector (accounting for 50% of sales) want certified as standard and 50% want certified on an occasional basis; and, in the house-building sector (accounting for 10% of sales), all the large construction companies want certified.

For many UK window manufacturers, the requirement for certification that specifically meets the UK government's criteria for legal and sustainable wood has been an important additional reason encouraging a shift away from tropical woods in favor of substitutes that are more readily available as FSC-certified or PEFC-certified – such as plantation-grown eucalypt from South America and South Africa and EWPs from Germany.

The recent endorsement of the MTCS under the PEFC umbrella should help overcome this obstacle for Malaysian meranti, particularly as MTCS-certified products are regularly available in the EU market at little or no premium vis-à-vis the uncertified product. The situation remains more challenging for sapele, since only limited volumes of FSC-certified wood have so far been offered in the EU market, typically with premiums in excess of 20%. However, the commitment of a large number of large African shippers to move progressively to legality-verified and certified wood products is expected to ease this problem.

Concluding comments

Overall the European window sector is becoming a more challenging one for sales of tropical hardwoods. Even as wood-framed windows are beginning to reclaim market share lost to uPVC earlier this decade, most of those gains are expected to be achieved by softwoods and EWPs manufactured in northern European countries. WPCs also have the potential to help close the significant price gap that still exists between wood and uPVC. Key challenges for tropical hardwoods are the large and expanding price gap with other wood products and the continuing constraint on the supply of certified wood products.

Nevertheless, a small but significant number of manufacturers and end-users still favor the look of tropical hardwoods and appreciate their qualities of durability and stability. If sufficient resources were to be committed to proactive marketing – focusing, for example, on the whole-life costs and benefits of tropical hardwoods – and to ensuring rising availability of certified sustainable product, there is potential to maintain and even extend this market.

9 TROPICAL HARDWOOD VENEERS IN THE EUROPEAN INTERIORS SECTOR[30]

Background

The European surface materials market is relevant to the tropical hardwood sector for several reasons. The European door, flooring and furniture sectors continue to absorb reasonable volumes of sliced veneer from tropical countries, particularly in Africa. Sliced veneer forms an important component of value-adding wood industries in several tropical countries. In addition, a significant proportion of high-value logs exported from Central Africa are destined for European veneer-slicing facilities. Moreover, European furniture designers and manufacturers are influential in setting fashions for interiors worldwide, affecting the choice of all – wood and non-wood – materials.

Market development

The fortunes of real-wood veneers have fluctuated in Europe in the last two decades. From the early 1990s onwards, western European wood-products manufacturers have faced mounting competition, first from eastern Europe and then from East Asia, which encouraged a major shift from solid wood towards reconstituted wood panels covered with a decorative veneer and there was strong growth in the European supply of composite wood panels. Between 1996 and 2006, annual EU-27 production of particleboard increased from 28.9 million m^3 to 42.6 million m^3 and annual production of MDF increased from 6.3 million m^3 to 16.5 million m^3.

Another, much more negative trend for real-wood veneers has emerged and progressively deepened in the last 20 years. As cost pressures have mounted and with the development of a range of new technologies, real-wood veneers have progressively lost market share to non-wood alternatives.[31] A wide range of surface-finishing technologies are now available that have been developed with the intent of replicating the look, feel and performance of real wood. These include impregnated décor paper, vinyl foils (PVC), and direct printing. At the same time, the utility of and range of applications for these technologies has greatly expanded as a result of substantial improvement in the dimensional accuracy and surface properties of wood-based panels and the development of HPCs that greatly enhance levels of durability, wear and mechanical and thermal resistance (Surface and Panel Magazine 2009).[32]

European manufacturing capacity for many of these alternative products is now substantial and, in some cases, has significantly overshot the level of demand. For example, the supply of laminate flooring increased from near zero in 1995 to 275 million m^2 in 2001, and it hit 507 million m^2 in 2007. In January 2008, just before the onset of the global financial crisis, it was reported that: "competitive pressure in the décor printing and finishing foil industry increased considerably during the course of 2007. Meanwhile the investments made in the last few years have resulted in substantial surplus production capacity which is having an ever increasing effect on market and price development" (EUWID 2008f) (see also Chapter 2).

These various pressures have meant that the European market for surface materials is intensely competitive. There is considerable pressure on all manufacturers to cut costs while at the same time to maintain high and consistent quality and service reliability. Increasingly, all suppliers must bring to market new and innovative products backed with appropriate technical information and design recommendations if they are to maintain market

30 This case study draws on a range of secondary sources together with semi-structured interviews held with market participants, including veneer companies, furniture companies and product designers at the following trade shows during 2009: Milan International Furniture Show (22–27 April); Interzum, Cologne (13–19 May); Malaysian International Furniture Fair, Kuala Lumpur (3–7 March), the International Furniture Fair (Singapore 9-12 March) and the Thailand International Furniture Fair (Bangkok 11–15 March 2009).

31 Accurate, up-to-date statistics on the market share of different surface materials in the European market could not be obtained for this report. In 1999, however, the European wood-veneer sector could claim only 18% (775 million m^2) of Europe's 4.3 billion m^2 market for surface materials. The market shares of other materials at that time were: LPM (51%); paper foils (13%); HPL (7%); and paint (7%).

32 Developments in HPCs have also facilitated the development of new forms of 'real-wood' flooring that use extremely thin veneers (0.7 mm thick) protected by an HPC.

share. In turn, this implies very high barriers to market entry requiring considerable capital investment, product and market knowledge. The essential need to be close to the consumer means that a very high proportion of value-adding associated with the veneer sector is carried out in Europe itself rather than in supplying countries.

Market sectors

From the perspective of tropical veneers, key sections of the European market for decorative surfaces include:

- Germany, which for long has been at the very heart of Europe's market for all decorative surfaces. Although much manufacturing capacity has recently shifted to eastern Europe and further afield into Asia, German-owned veneer companies remain dominant on the world stage. Other German companies have led the charge to develop non-wood foils and laminates.
- The Italian furniture industry. Overall, the furniture sector accounts for around two-thirds of veneer consumption in Europe. The Italian furniture industry is particularly significant because of its sheer size and influence. Although recently overtaken by China as the world's largest furniture-manufacturing country, Italy still accounted for 9.1% of total world production capacity in 2007. The Italian furniture sector's competitive position has been built on the basis of a strong emphasis on quality production, design and marketing and it has a huge impact on fashion trends in all areas of the world. This, combined with Italy's long-term woodworking tradition, means that there remains a particularly strong commitment to the continued use of real wood in Italy's furniture sector.
- The wood-flooring sector. Europe's wood-flooring sector has seen huge growth in recent years. According to the European Parquet Industry Federation (FEP), European production grew from 2 million m^2 in 1987 to 100 million m^2 in 2007.
- The southern European door industry. While other parts of the European door-manufacturing industry have shifted heavily to MDF or hardboard with artificial surfaces (including paint, foils and laminates), manufacturers in parts of southern Europe, particularly Spain, have remained more committed to real-wood veneers.

Extent of tropical wood market access

Trade data

Interpreting European veneer production and trade data to assess market share in the decorative sector is problematic due to difficulties in distinguishing between rotary veneers (for plywood) and sliced veneers (for decorative uses). Careful analysis of the available information, however, provides some insight.

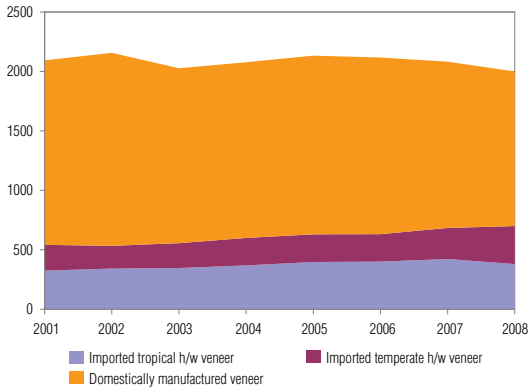
Drawing on Eurostat data, Figures 9.1 and 9.2 show the volume and proportion of EU-25 veneer supply, respectively, by main source region in the period 2001–08. These data suggest that, overall, veneer supply remained broadly level at slightly more than 2 million m^3 per year. They also suggest that imported veneer has taken a progressively larger share of the veneer market at the expense of domestic manufacturers, with imported temperate hardwood veneer (mainly from the United States, Russia, Croatia and the Ukraine) growing more strongly than tropical hardwood veneer (mainly from Gabon, Côte d'Ivoire and Cameroon).

There are also signs that the proportion of EU domestic sliced-veneer production based on tropical hardwoods may have declined during the period. This is implied by data for European imports of tropical logs (excluding okoumé, which is used primarily for plywood), which showed a big fall – although this decline was also driven by shifts in European markets for custom-cut wood (Figure 9.3).

Overall, the impression is one of fairly static consumption of real-wood veneers in the EU in the period 2001–08. Given that this was a time of significant growth in EU manufacturing of wood-based panels, furniture, building materials and non-wood surface materials, it seems likely that real-wood veneer lost significant of market share to non-wood surfaces.

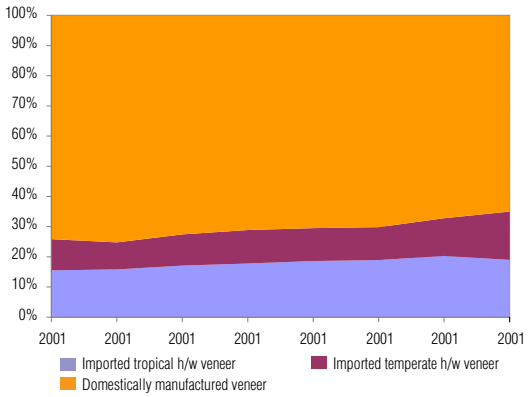
It is likely that while some tropical countries increased exports of sliced veneer to the EU-25, this was more a result of policy measures to restrict log exports from those countries than an indication of a strong increase in the relative competitiveness of tropical sliced veneers. The fact that the import

Figure 9.1 European veneer supply by main species group, 2001–08 ('000 m³)



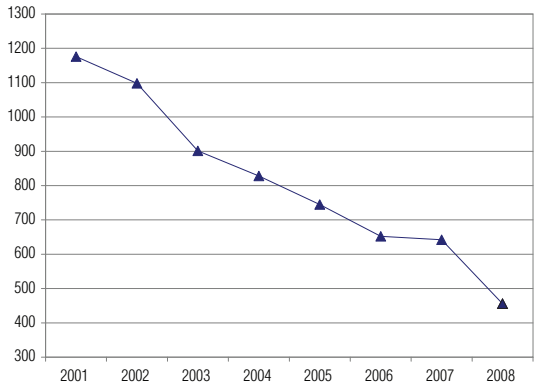
Source: Authors' analysis of Eurostat

Figure 9.2 European veneer supply by main species group, 2001–08 (% share)



Source: Authors' analysis of Eurostat

Figure 9.3 EU-25 imports of tropical logs, excluding okoumé, 2001–08 ('000 m³)



Source: Authors' analysis of Eurostat

share of tropical hardwood veneers increased at a slower rate than the import share of temperate hardwood veneers hints at an actual fall in competitiveness.

The limited species-specific data available on particular sections of the EU wood-surfaces market also suggest relatively low levels of competitiveness for tropical hardwoods. For example, annual surveys of German veneer traders undertaken by GD Holz indicated that tropical wood contributed around 23%, 10% and 18% of total revenues in 2004, 2005 and 2006, respectively. In 2006, European species accounted for 54% of revenues and North American species for 19% of revenues. The 2006 survey indicated that 42% of tropical veneers sold comprised African mahogany, sipo, sapele or wenge; 12% comprised limba and abachi; 14% comprised zebrano; 4% comprised palisander; 9% comprised makassar; and 14% comprised other tropical wood (EUWID 2007k).

Annual surveys by FEP suggest that tropical hardwoods consistently account for around 15% of this market, with no significant trend either up or down. The market is dominated by oak, which has a share of 50–60%. Key tropical species used in this sector are merbau, doussie, jatoba and wenge (FEP 2009).

Species trends

Further insights into the relative competitiveness of tropical hardwood veneers in the European market were provided by conversations with designers and other contacts at trade shows during 2009 and by a review of trade and design literature.

A requirement for large volumes and consistency in large sections of the European surfaces market has increasingly focused attention on a limited range of temperate species, particularly oak. Oak is the most available and variable temperate hardwood and is now almost universally preferred in the world's furniture markets. Oak comes in all shapes and sizes, colors and grains and is capable of producing great character. Oak can also be treated in many ways and offered in light, dark and 'used' shades (Buckley 2009).

Ready availability, versatility and familiarity have meant that designers have continued to favor oak, even as fashions have shifted over the last decade from lighter to darker colors – a trend that would otherwise have been expected to favor many tropical

species. In fact, there were strong indications at the Domotex, Interzum and Ecobuild shows in 2009 that oak flooring is increasingly replacing tropical species, even in products in the darkest shades.

Although oak dominates the market there were significant localized shortfalls in supply in European countries in the years leading up to 2008 that led to dramatic rises in prices. This encouraged the development of staining and finishing techniques to improve the look and application of cheaper and more abundant temperate species, notably birch, beech and tulipwood. Nowadays, alternative temperate species are being used as a substrate for the production of a wide range of looks.

Another parallel trend, which also aims to greatly expand the versatility of readily available species, is the development of reconstituted veneer products by the traditional veneer suppliers. This represents an attempt by wood-veneer manufacturers to combine the natural benefits of wood veneer with the variety and flexibility of laminates. Using raw materials originating from plantations and other abundant forest resources, backed in most cases by some form of certification, procedures have been developed to reconstruct high-quality woods through a precise industrial process. The aim of products like Danzer's 'Vinterio', Alpi's 'Alpilignum' and Decospan's 'Shinnoki' is to offer the furniture industry with top-quality, environmentally certified semi-finished products with dimensional and physical/mechanical characteristics superior to those of natural products and that can be readily adapted to deliver a huge range of individual, exclusive surface designs.

One view of these new products is that they may increase the competitive pressure on tropical hardwoods and encourage further replacement with alternative temperate species. But this may be short-sighted. It is increasingly recognized in the European veneer industry that these new versatile designer and environmentally friendly products are an essential component of a strategy to regain overall market share. Nor does the development of these products necessarily imply the replacement of tropical hardwoods. For the production of Alpilegnum, Alpi is using both poplar from Italian plantations and ayous from the company's concessions in Africa as the base material.

While oak dominates the volume market in Europe, the Milan show gave insights into the low-volume luxury market. These are important not only because this sector generates huge amounts of value from a small volume of wood, but also because the volume manufacturers often want to mimic the look of the most expensive brands. The Milan show demonstrated that at the top end of the market there is huge commitment to the continued use of real wood. If something *looks* like wood in Milan, it always *is* wood. An increasing number of Italian furniture firms are participating in the Vero Legno (Real Wood) campaign, which certifies and labels products composed of real wood.

On the downside, there was no tropical redwood on display in Milan. Clearly, the traditional look offered by tropical hardwoods is very much out of fashion. Some teak was on show, favored for its darker-brown, grainy look, which is in fashion – but this section of the market was hugely dominated by walnut.

More positively, a dominant feature of the Milan show from the perspective of wood products was the widespread use, in veneer form, of various rosewood species – including Indian rosewood (*Dalbergia latifolia*) and South American Santos Palisander (*Machaerium scleroxylon*) – to produce a highly exotic and glossy striped finish on more classic furniture lines.

Competitiveness factors

Price

Price has clearly been an important factor in the shift from real-wood veneers to non-wood substitutes. This is particularly obvious in the flooring sector, where high-street prices for laminates have been driven as low as €/m 5–10 per m^2, with little variation in look and specification. Excess capacity and ongoing moves by manufacturers to replace décor papers with direct printing may drive prices even lower. Meanwhile, prices for engineered wood flooring, even with the thinnest of real-wood veneers, start at prices at least double those for laminates and escalate rapidly depending heavily on the thickness of the veneer and other factors such as substrate quality and brand. Against this background it is clear that the successful marketing of real wood products will depend heavily on factors other than price.

Assessing the price competitiveness of different hardwood species within the real-wood veneer

sector is extremely difficult due to a lack of long-term price series data and the huge variety of specifications involved. A general observation is that this sector is likely to be significantly less price-sensitive than other sectors of the tropical hardwood market due to the fact that the cost of purchasing veneers often makes up only a small proportion of the final sale price of the product. This is true in those lower-end sectors where only very thin veneers are used – such as in cheaper engineered wood flooring, where a veneer as thin as 0.6 mm may be protected by an HPC layer. It is also true at the high end of the market, where the price of raw material is dwarfed by other price factors associated with strong design and the quality of manufacture. The selling price of Santos Palisander veneer (US$10 per m^2 for highest panel grade A), considered a "very expensive" veneer by a Bolivian supplier interviewed at the Interzum show, is unlikely to significantly influence the material selection decision of a designer of a table or chair retailing for several hundreds or even thousands of dollars.

Nevertheless, wood price cannot be entirely discounted as a factor, and it is important in those high-volume sectors where durable quality veneers are required, such as doors and higher-quality engineered wood flooring. One major European veneer manufacturer interviewed at Interzum noted that there has been a noticeable trend in favor of sapele veneers during the current economic downturn, partly driven by extremely low prices – quoted at €0.55 per m^2 for short lengths to €2–2.5 per m^2 for the highest-quality products. Although more expensive than beech (€0.15–1.9 per m^2), these prices are comparable to those for oak (€0.3–3.25 per m^2).

Product quality

Product quality is a key area of concern in the decorative veneer sector. Log quality is obviously a critical factor, and the long-term decline in the overall availability of tropical hardwood logs will undermine the overall competitiveness of tropical hardwoods in the long term.

Competitiveness in the decorative-veneer sector is heavily dependent on the ability of firms to offer an appropriate quality of selection, processing and packaging. The huge and growing emphasis on quality has been a critical reason behind the concentration of supply within a few large, vertically and horizontally integrated companies capable of sourcing logs over a large area and controlling every aspect of the supply chain all the way from forest to final consumer. Several large European-based companies that offer this scale and diversity of service are heavily engaged in Central African countries.

The competitiveness of tropical hardwood veneers in the European market is now closely tied to the ability of these large companies to secure long-term access to forest concessions. Moreover, the requirements for quality and scale dictate that greater engagement in the decorative-veneer sector by suppliers in developing countries demands an extensive technology-transfer program.

Specific demands for quality and technical performance vary widely between the sectors. Supplying the sector is complicated by the fact that there are no universally recognized grading rules in Europe's sliced-veneer sector. The large companies operate their own proprietary procedures and systems. Again, this is partly a consequence of the huge diversity of decorative veneers, each flitch providing a unique pattern of figure and grain.

Availability, delivery time and reliability of service

Consistency and immediacy of supply and the ability to adjust rapidly to consumer preferences are increasingly critical factors in supply to the European surfaces industry. This reinforces the value of scale and proximity to the final consumer.

In recent years the declining availability of certain tropical hardwood species has reduced competitiveness in some parts of the interiors sector. For example, merbau has occupied an important position in the European door, stair and flooring sectors, but recent supply problems have encouraged a search for alternatives. This has only been partially successful because other species that share some of merbau's particular characteristics of hardness, durability and aesthetic appeal – such as afzelia and iroko – have also been difficult to obtain.

Another issue, particularly in the higher-volume sector, is the need to have products available both as solid and veneer for matching. For example, it may be necessary to match solid wood for table or bed legs with a table top or headboard requiring the use of veneer on MDF or plywood. Many species are

available in one form or the other but not always both. The use of readily available species is the key solution to this (Buckley 2009).

Tropical hardwood species are often less easily matched than temperate species like oak and birch for lumber and veneer. There are some exceptions – notably sapele, teak and wenge – but, overall, this factor is an important source of competitive disadvantage (Buckley 2009).

Design requirements

Design requirements are another important factor in the choice of veneer and alternative materials and they also vary widely depending on the sector. At one end of the spectrum could be a mass producer needing to combine a low-cost material with consistency of product for a long-term production program. For example, German furniture retailers are renowned for demanding defect-free, color-consistent veneer for furniture catalogues that allow customers to return after long periods to add to their furniture collection. A few natural forest tropical species lend themselves well to these requirements, including grain-less white species such as ayous, idigbo and jelutong and some dark species such as dark red meranti and sapele. In Europe, however, wider availability and greater familiarity typically mean that locally derived species have a significant advantage (Buckley 2009).

At the other end of the spectrum is the custom designer, who may select a flitch of veneers with which to produce a work of art to satisfy the design brief of a particular client. In this part of the market, a significant premium may be placed on the range of species to choose from, natural characteristics, and the 'narrative' and environmental qualities associated with each species. The sheer range and variety of tropical hardwoods compared to temperate hardwoods suggests real opportunities to expand market share in this part of the market (Buckley 2009).

Environment

Interest in environmental issues is rising in the veneer sector, although how this interest manifests itself in demand for different product labels and marketing initiatives varies widely both by European country and end use. For example:

- In the furniture sector, demand for forest certification labels such as FSC and PEFC is still poorly developed overall, with much of the demand still coming from large retailers in northwestern Europe, particularly the UK, the Netherlands, Belgium, France and Germany (FII 2008, 2009).
- While demand for certificates and product labels is relatively undeveloped among end-users and distributors elsewhere in Europe, there is considerable interest amongst furniture suppliers in the marketing benefits of environmental messages associated with wood products. At the Milan show, for example, brands like FSC and PEFC were completely invisible. On the other hand, numerous companies supplying real-wood furniture were emphasizing the inherent 'sustainability', 'naturalness' and 'environmental friendliness' of wood.
- This situation contrasted strongly with the German Interzum show – a show which targets the furniture-supplying trade rather than the general public – where FSC and PEFC labels were everywhere. This highlights the extent to which demand for these labels is driven internally by the European trade and industry as a mechanism for protecting brands and improving the overall image and market prospects of wood products. The large veneer companies are deeply engaged in this process, for example by heavily promoting recent FSC certification of African concessions.
- There is an emerging trend among central European flooring companies to avoid tropical wood flooring. This is being adopted as a marketing tool and again particularly targets northwestern European markets recently influenced by NGO campaigns that focused on the legality and sustainability of merbau. Nevertheless, the trend has not yet penetrated everywhere and tropical wood flooring remains very popular in southern European countries such as Spain, Italy and Greece.
- There are widespread expectations that recent regulatory measures to combat illegal wood products announced by the European Commission will significantly increase demand for certified products throughout the European veneer sector.

Concluding remarks

The rapid progress and expansion of non-wood substitutes in high-volume, low-end sectors of the European market for surface materials suggests that opportunities for the expansion of markets for standard tropical hardwood veneers in these sectors must now be negligible. There may once have been some potential to expand lower-end markets for veneers in the southern European door sector, but the recent economic downturns in Spain, Portugal and Italy and the mounting competitive pressure from non-wood substitutes suggests that this is no longer a viable option.

Maintaining and increasing access for real-wood veneers to relatively high-volume markets in Europe is likely to be heavily dependent on the success of innovative products like Danzer's Vinterio and Alpi's Alpilignum. The latter, which includes ayous in the mix of wood species used as a substrate, suggests that there could be a role for some higher-volume tropical hardwoods in such products. However, this will require further technical development in association with large veneer companies and will also be dependent on reliable forest certification.

Even at the upper end of the market there is no doubt that competitive pressure from non-wood substitutes will continue to intensify for real-wood veneers as technical developments improve the look and feel of these substitutes. But the industry can build on the fact that the desire for the look of wood is strong and indications that consumers and designers at the high end of the market still seek the naturalness, sustainability, warmth and performance of real wood. The obvious popularity and visibility of santos palisander at Milan, and the apparent determination to use only the real-wood product, suggests that there is continuing willingness to show off the aesthetic qualities of tropical hardwoods in the most influential section of the European furniture industry. But this cannot be taken for granted. There is a critical need for active engagement with the European design community to maintain and rebuild market share.

10 SWOT ANALYSIS

Strengths

Strengths associated with wood supply

- **High-quality wood:** The conditions in natural tropical forests mean they are capable of producing the world's highest-quality wood. Natural tropical forests produce a very high diversity of tree species, the wood of which ranges widely in technical characteristics, color and textures. The key characteristics of many tropical hardwoods are their high durability, density, strength and aesthetic appeal relative to temperate wood species.
- **Competing forest resources lack range of decorative species:** While tropical hardwood supplies are generally declining relative to temperate supplies, tropical suppliers have some competitive advantages over their temperate counterparts. For example, the recent expansion in wood production outside the tropical zones has been heavily concentrated on softwoods rather than on durable decorative species that would compete directly with tropical species.
- **Standard stock items:** A limited number of tropical hardwood species remain standard stock items in key markets and have well-developed distribution networks. They include Malaysian meranti and sapele sawnwood in Europe and meranti/lauan plywood in Japan, the United States and Europe.
- **Programs in place to tackle forestry problems:** ITTO, FLEG and various other international and regional initiatives have improved the coordination of international policy in relation to tropical forests and encouraged campaigns at the national level to eradicate illegal logging, reduce deforestation and promote sustainable practices.
- **Existence of models of SFM practice:** Some excellent models of the practice of SFM in natural tropical forests now exist. Various initiatives are under way that have significant potential to encourage the continued expansion of sustainable tropical forest management. These include the introduction of sustainably managed concessions in Brazil's national forests, the phased introduction of forest management planning and certification in Central Africa, the FLEGT VPA process, and the MTCS.
- **Profitability of forest management regimes that combine income from a range of natural-forest services:** There are practical examples that show that tropical forest management regimes that combine sustainable wood production with income from a wide range of environmental services, including but not limited to carbon sequestration, may be very profitable and potentially economically competitive with many alternative land uses.
- **Potential for high-yielding plantations:** Yields from tropical plantations are often in the range of 10–30 m^3 per hectare per year and, with further research and development, could be considerably higher.
- **Progress in the development of FSC-certified plantations of teak and other products suitable for garden furniture:** There has been notable progress to develop and expand teak plantations worldwide, many of which have now achieved or are progressing towards FSC certification and are key suppliers to the garden-furniture sector.

Strengths associated with industrial structure

- **A few tropical countries high in competitiveness rankings:** Malaysia and Thailand stand out for achieving relatively high global rankings across a wide range of competitiveness criteria (e.g. knowledge and connectedness).
- **Low wage rates:** Wage rates in tropical-wood-supplying countries tend to be low by international standards.
- **Southeast Asia's reputation in the furniture industry:** Southeast Asian countries have built a formidable reputation within the furniture industry as the world's best low-cost production area capable of manufacturing a wide range of items, from high-quality designer brands to high-volume, low-cost items sold under the retailers' own brands.

- **Strengths associated with small enterprises:** Industrial structure in tropical countries is heavily fragmented. Although this is a competitive disadvantage in many ways, there may also be benefits. A predominance of smaller enterprises can lead to the accrual of wealth locally; reduce conflicts due to external resource appropriation because decisions are made closer to home; help in the development of 'cultural' products c for niche markets; strengthen local environmental accountability; and encourage the spread of entrepreneurship.
- **Potential economies of scale for large tropical concession holders that are not available to temperate hardwood producers:** The tropical hardwood industry is no more fragmented than the temperate hardwood industry, the latter being heavily dependent on resources that are distributed among numerous small private forest owners. Larger concessions in tropical regions can at least benefit from economies of scale, for example in forest certification, that are unavailable to the vast majority of temperate hardwood suppliers.

Strengths associated with product marketing

- **Prices no higher than for some competing products:** Prices for temperate hardwoods and thermally treated softwoods are often at least as high as prices for tropical hardwoods.
- **Gap in performance between tropical woods and technological innovations:** Despite recent progress, technical innovations have yet to fully close the gap in performance of alternative wood and non-wood products compared with tropical hardwoods: WPCs look relatively bland and lifeless; OSB lacks the durability and look of tropical hardwood plywood; composite panels tend to be relatively heavy; artificial surfaces may look like wood but don't necessarily feel or smell like it; preservative treatments may only penetrate a few millimeters into the wood; heat-treated products can still suffer from excess brittleness and they require considerable energy in their manufacture.
- **Presence in high-value niche markets:** Tropical hardwoods retain a significant presence in some relatively high-value niche markets, including high-end windows, external joinery, boat-building and marine works, and decorative veneers for quality furniture.
- **Low maintenance:** The ability of some tropical hardwood products, such as ipe decking and cladding, to maintain their aesthetics and performance with minimal maintenance is strengthening their market position, particularly in large public-sector projects.
- **Huge range of species and looks:** The sheer range and variety of tropical hardwoods compared with that of temperate hardwoods provides opportunities to access a wide range of niches and offers diversity for designers.
- **Desirable qualities shared by all wood products:** Tropical wood shares with other wood products some key marketing advantages over non-wood alternatives. Wood performs particularly well on issues of energy content, aesthetics, thermal insulation and health. Solid-wood products can also perform well on recyclability when networks are in place to collect waste wood.
- **Consumer surveys that suggest people like wood for interiors and furniture:** Surveys of consumers and architects indicate that wood is valued as an authentically natural material; consumers like wood in furniture and interior applications; wood is generally regarded as environmentally friendly; tropical wood's environmental profile is better than that of plastics; and certification has the potential to offset concerns about illegal logging and deforestation.
- **Strong environmental credential across the product life cycle:** The very few environmental LCAs undertaken on tropical wood indicates a strong overall environmental profile compared to other wood products and to non-wood products, particularly owing to the relatively low requirements for energy in processing, a long product life, and ease of disposal.
- **Examples of more effective marketing and lobbying activities:** Existing marketing initiatives and organizations provide a framework on which to build a marketing strategy. These include the Malaysian Timber Council, the IWPA (whose publication *International Wood* is showing a way forward in design-led marketing), and the Inter-African Forest Industries Association, which is becoming a more visible lobbying presence, particularly in the European market.

Weaknesses

Weaknesses associated with wood supply

- **Heavy dependence on unsustainable resources:** The continuing conversion of natural tropical forest and the dependence of large sections of the industry on unsustainable wood supplies (in contrast to the expansion of forest resources and availability of essentially sustainable sources of supply in temperate forest regions) implies an inevitable shift in the balance of competitiveness away from natural forest tropical hardwoods in favor of alternative wood products. The declining availability and quality of primary tropical wood species is becoming increasingly evident in international trade.
- **Relatively low productivity:** Natural tropical forests produce lower sustainable yields of saleable timber per unit of area compared with temperate forests and plantations (yields tend to be even lower in certified natural tropical forests). Another challenge for the tropical hardwood industry is the gap that exists between the species that natural tropical forests are capable of producing in commercial volumes and market demand for particular wood types. The huge diversity of species means it is difficult to supply large commercial volumes of species in consistent sizes and grades.
- **Relatively low financial yield:** The relatively low yield of saleable wood is matched by low projections of financial yield from the sustainable management of tropical forests for wood production. This in turn significantly reduces incentives for investment in wood-production operations in natural tropical forest and implies continuing lose of forests to more profitable land-uses such as large-scale industrial agriculture.
- **Weak prospects for improved tropical forest management:** The prospects to expand sustainable tropical forest management remain weak in many areas due to a generally unfavorable investment climate; severe institutional, financial and technical constraints that hinder the ability of forestry administrations to manage logging concessions; and illegal activities and corruption.
- **Lack of certified tropical forest products:** Over 97% of the world's certified industrial roundwood derives from forests in temperate and boreal regions. Economic incentives for the operation of certified forest operations in the tropics remain weak.
- **The need for the reform of forestry regimes in some tropical countries:** In some areas the industry complains of heavy-handed and overly bureaucratic responses to the challenge of illegal logging, while, in others, NGOs complain that forestry regimes reflect the interests of large operators and do not accommodate small-scale community operations. Both cases highlight the continuing urgent need for forest law reform in some tropical wood-producing countries, a process that might involve deregulation and efforts to simplify forest legislation combined with a more structured approach to enforcement, a clearer definition of rights and responsibilities, and the strengthening of social contracts.
- **Plantations mainly established outside tropical areas:** New planted forests that could offset the reduction of natural wood-production forests are primarily being established outside the tropics. Moves to establish new plantations in tropical countries are being discouraged by a poor investment climate and the high yields that can be achieved with alternative commercial cash crops.
- **High transport costs and long lead times:** The lack of international connectedness of many tropical countries means that the cost of delivering products is high and lead times are long.

Weaknesses associated with industrial structure

- **Poor socioeconomic environment in many producer countries:** Many tropical wood-supplying countries lack fundamental institutional and infrastructural requirements for the development of internationally competitive industries.
- **Inefficient wood-processing industries:** Many tropical countries, even in more developed parts of Southeast Asia, are characterized by relatively outdated and inefficient wood-processing sectors. In addition to a lack of modern

technology, there is lack of high-quality operators and insufficient understanding of the handling of raw materials.

- **Challenges of converting tropical plantation wood:** Rising dependence on small-dimension plantations is increasing the challenges of wood conversion. The fast growth of plantation woods in the tropics leads to high internal tensions and defects in the wood. Such plantations do not lend themselves well to many tried-and-tested harvesting and processing technologies that are widely used in Northern Hemisphere softwood forests.
- **High level of fragmentation in the wood-processing sector:** The large numbers of small operators in the tropical wood-processing sector, commonly not offset by strong trade associations or forestry cooperatives, greatly undermines competitiveness across a wide range of issues, including reduced access to capital; reduced negotiating power with major customers and policymakers; a reduced ability to coordinate financing for research and development, marketing and political lobbying; and a reduced ability to benefit from economies of scale in certification and labeling.
- **Lower labor standards in developing countries:** Demands for higher labor standards are becoming more prominent among consumers, which tends to undermine comparative advantages built heavily on low labor costs.
- **Lack of own-brand furniture manufacturing:** The Southeast Asian furniture sector remains heavily dependent on contract manufacturing rather than own-brand furniture manufacturing. Key decisions relating to design are made outside the tropics and much of the generated value is retained elsewhere. Industries built on contract manufacturing are continuously susceptible to being undercut by lower-cost manufacturers in other countries.
- **Low levels of investment in research and development:** Investment in innovative design and research and development is very low in the tropical hardwood industry. This weakness is becoming more of an issue as increasingly competitive markets demand product diversification and the regular introduction of new product lines.

Weaknesses associated with product marketing

- **High-priced commodity:** Tropical hardwood is a relatively high-priced commodity compared to composite panels, softwoods, plastics and metals.
- **New products have lowered price expectations:** The development of new products such as composite panels and combi-plywood and the emergence of new supply sources, notably China, at lower price points has significantly lowered price expectations in large commodity markets previously dominated by tropical hardwood products and squeezed margins, reducing opportunities for long-term investment and further market development by tropical suppliers.
- **Volatile pricing:** Prices for tropical hardwood products are often relatively volatile, heightening trade risk and undermining the ability of traders and manufacturers to plan for the future.
- **Wood's technical constraints:** All wood products have certain technical and performance constraints compared with other materials. For example, they cannot match the toughness of steel or composites, they lack the strength-to-weight ratio of aluminium, they are more difficult to recycle than most metals, and they cannot be extruded or moulded.
- **Perception of poor performance in construction applications:** Often the real technical constraints on wood are inflated in the minds of architects and consumers. Surveys indicate that many people remain uncomfortable with the widespread use of wood in structural applications and have a greatly exaggerated perception of wood's structural weakness and poor performance in fire.
- **Influential designers, architects and manufacturers unfamiliar with tropical hardwoods:** Many tropical hardwood species are unfamiliar to architects, designers and manufacturers in industrialized countries who are very influential in global fashion and design. Partly for this reason, many manufacturers located in the tropics are turning to common temperate species, even though these may be more expensive.

- **Lack of information on tropical species characteristics:** The existing level of testing of many tropical hardwood species has been insufficient to provide comprehensive information on the design properties of particular species. The work that is being carried out is often in response to new regulations in consumer countries rather than a positive effort to develop new products.
- **Lack of access to knowledge:** The domination of large corporations in industrialized nations in global research and a lack of access to knowledge is becoming a more significant competitiveness factor given the increasing impact of high-tech and capital-intensive forms of research such as biotechnology, nanotechnology and information and communication technologies on the wood sector and other materials sectors.
- **Lack of diversity and volume in product supply:** In higher-volume commercial furniture sectors there is often a need for products to be available as both solid and veneer for matching, and for long-term consistent supply so that customers can return to product ranges after long periods to add to their collection. This tends to focus markets narrowly on large-volume, readily available species. To date this has tended to benefit a few temperate hardwood species, particularly oak, over tropical species.
- **Lack of data on the carbon implications of sustainable tropical wood production:** Research is bolstering the case for the recognition of harvested wood products from temperate regions as carbon stores and of sustainable temperate wood production in carbon trading schemes. Equivalent research work in tropical regions is lacking.
- **Consumer misconceptions about SFM:** Consumers are generally unsure about whether the cutting of more forests and trees to substitute for other materials is the right thing to do. There is a low level of awareness and knowledge of SFM and a general assumption among consumers that using more wood inevitably means more destruction of forests.
- **Image created by illegal logging and tropical deforestation:** The widespread perception among manufacturers, designers, consumers, specifiers and policymakers that a large proportion of exported tropical wood derives from illegal sources and that the use of this wood contributes to deforestation is a constant drag on marketing. It means that tropical hardwoods struggle to exploit one of wood's greatest marketing strengths – the link between wood and forests as a potent symbol of nature. Consumer surveys indicate a very marked difference in the perceived environmental friendliness of domestic wood (high) compared with tropical wood (low). Positive messages about sustainable tropical forest management continue to be overwhelmed by single-issue environmentalist campaigns.
- **Lack of LCA data:** ITTO's review of tropical wood LCAs (Murphy 2004) identified only one comparative LCA involving tropical hardwoods conducted in full accordance with the ISO 14040 series of standards. The review recommended that the tropical-wood industry undertake further work on LCAs to avoid losing the initiative to temperate species and non-wood products. There is little evidence of effective follow-up either to promote the results of the LCA or to carry out further LCAs on a wider range of tropical wood products.
- **Lack of information on market perceptions of tropical hardwoods:** There is a shortage of hard information about the underlying market perceptions of tropical hardwoods and acceptable methods of addressing the issues. Very few comprehensive studies have been undertaken to determine designer and consumer attitudes to tropical hardwoods, particularly outside Europe and North America.

Opportunities

Opportunities associated with wood supply

- **High political profile of tropical forest issues:** Concern for climate change has given forests a political profile that is unprecedented in recent times. Forests are near the top of the international agenda, forming a key part of discussions and commitments of the G8 and the UNFCCC. This creates a real opportunity to add momentum to international and national measures for countering deforestation, improve forest law enforcement and governance, and promote SFM. Some forest-policy measures have the potential to boost the competitiveness

of tropical woods in a very direct way. For example, bilateral development programs such as the FLEGT VPA process are contributing resources to developing countries to assist in the strengthening of forest governance.

- **Potential influx of new finance for tropical forest conservation and management to meet climate change objectives:** Money potentially channeled into the forest sector to meet global climate change objectives could amount to tens of billions of dollars, ultimately dwarfing the money generated by the timber trade or contributed through existing forestry programs. Finance generated from provision of carbon storage services may be combined with income from other environmental services and reduced impact logging so that managed tropical forests provide immediate and viable economic returns comparable to those provided by alternative land-uses.
- **Potential carbon-sequestration benefits of harvested tropical wood products:** The management of natural tropical forests for the production of long-lasting, durable wood products that can substitute for more energy-intensive products such as steel or plastics may prove to be a better carbon-sequestration strategy than forest protection and preservation.
- **Developing plantation resources:** Potentially very high growth rates, the availability of large areas of degraded land, and the promise of continued increases in global wood consumption suggest significant opportunities for encouraging investment in plantations in tropical countries.
- **New technologies to improve the performance of wood products:** The development of plantations can be combined with opportunities to exploit technologies that have evolved for temperate products to improve the performance of fast-growing species. Examples include lamination, finger-jointing, heat treatment (particularly of plantation teak and rubberwood), the production of composite panels from wood residues and other natural fibers, new paint treatments (e.g. for acacia), and reconstituted veneer products (e.g. Alpi's Alpilignum, which includes ayous in the mix of wood species used as a substrate). Longer term there may be potential to alter the physical characteristics of plantation wood and more-widely-available but low-utility hardwoods woods through new biotechnologies and nanotechnologies.
- **Ongoing forest research:** Several areas of ongoing research and new technologies in forestry are likely to contribute to improved competitiveness. They include work to develop high-yield plantation crops, prevent deforestation, and facilitate the demonstration of legal and sustainable forestry practices (e.g. satellite imagery, GIS, smart-tags and other tracking technologies, and new RIL systems).

Opportunities associated with industrial structure

- **Globalization of the wood industry and the role of wood-processing hubs:** The emergence of China, Southeast Asian countries and, potentially, India as major wood-processing hubs and suppliers of commodities to the global market can increase the competitiveness of tropical hardwood products by helping to make them available to consumers in many areas of the world at highly competitive prices.
- **Consolidation in the importing and merchants sectors in major consuming countries:** The greater concentration of tropical hardwood distribution in the hands of large retailers, merchants and wholesalers in major consuming markets, combined with their logistical ability to source products internationally, is increasing the competitiveness of imports compared to domestic products. The development of large concentration yards in these markets also helps to iron out fluctuations in the availability and price of tropical hardwood products for distributors and manufacturers further down the supply chain.
- **Increased containerization:** Moves to containerize certain tropical hardwood products, such as plywood supplied into Europe from Southeast Asia, is helping to improve availability and reduce volatility, allowing the market to receive smaller volumes on a more regular basis. This reduces the risks of 'boom and bust' and is more aligned with the existing market focus on just-in-time trading.

Opportunities associated with product marketing

- **Increasing global consumption:** The projected substantial increase in the size of the global population in coming decades implies significant underlying growth in global demand for all commodities, including wood of all types. Much of this increase will be in new emerging markets, including the domestic markets of many tropical wood-producing countries.
- **Increasing urbanization, which creates demand for natural materials to humanize space:** The increasing urbanization of the world's population is contributing to the emergence of a trend in architectural and interior design to introduce wood materials in order to soften, 'humanize' and 'naturalize' harsh urban environments.
- **High-value niche markets:** Key opportunities for tropical hardwoods lie in the development of higher-value niche markets. Seeking to compete in large-volume, low-value commodity markets, where softwoods and other cheaper commodities dominate, is unlikely to be a sustainable long-term strategy.
- **Real wood remains popular:** In many markets there remains a strong cultural attachment to wood of all types. Wood's qualities of warmth, naturalness, and beauty are widely appreciated. The importance of this factor is shown by the huge resources devoted by other sectors attempting to mimic these qualities in non-wood products. There are always likely to be consumers and designers that want authenticity rather than an artificial construct. The obvious popularity and visibility of santos palisander at the Milan furniture show in 2009, and the apparent determination to use only the real-wood product, suggests that there is a continuing willingness in the most influential section of the European furniture industry to show off the aesthetic qualities of tropical hardwoods.
- **Design trends favoring tropical hardwoods:** Moves towards 'natural', 'timeless', 'authentic' and 'minimalist' products in the interiors sector should, with appropriate marketing, benefit suppliers of a traditional material such as wood. The narrative surrounding tropical woods can be very enticing if presented in the right way, given the material's 'exoticism' and diversity and the role that it can play in financing rural communities in developing countries. Tropical countries may also be able to enhance their competitiveness by creating products that incorporate elements of their cultural identity and contribute to a feeling of authenticity and individuality.
- **Lesser-known species in the finishing and interiors sectors:** Significant opportunities for the development of markets for lesser-known tropical wood species are likely to lie less in the structural sector (which is renowned for being relatively risk-averse and conservative) and more in the finishing sectors (where there tends to be more willingness to experiment and a greater focus on aesthetics, versatility and naturalness).
- **Exploiting the value in diversity:** Tropical hardwoods offer a wide pallet of looks and textures with the potential to increase appeal to high-end designers. This suggests continuing opportunities to add value to tropical woods through marketing campaigns celebrating their huge diversity and promoting individual species rather than grouping them into a single grade (such as 'mixed redwoods').
- **Programs to promote sustainable construction in LDCs:** Programs to encourage the development of higher-quality and sustainable construction techniques fin LDCs offer opportunities for tropical hardwood producers to both add value to their products and exploit the very low carbon footprint associated with the sourcing of wood products from sustainably managed local forests.
- **Energy-efficiency measures create opportunities in the doors and windows sector:** An increasing policy focus on energy efficiency in major markets is improving wood's overall competitiveness against non-wood products in the door and window sectors. Wood is a good natural insulator. Unlike metals it does not suffer from thermal bridging, and if the correct species is used it is sufficiently strong to be combined with triple glazing without modification. As a result, wood-framed windows – including tropical-hardwood-framed windows – are capable of achieving relatively high U-values without adding significant cost.

- **Increasing focus on quality standards:** In the key markets of Europe, Japan and the United States, the emphasis on quality performance standards is rising rapidly. In the EU, the enforcement of mandatory CE-marking standards is becoming more effective. In Japan there has been a dramatic increase in the focus on quality through recent amendments to the Building Standard Law. In the United States, importers and distributors are becoming more sensitive to accusations of inferior quality and are now going to greater lengths to ensure conformance to tougher quality standards among their international suppliers. The largest importers are actively lobbying for the strict enforcement of tough quality and environmental standards, notably with respect to formaldehyde emissions. This presents opportunities for tropical suppliers, many of whom have already demonstrated their ability to conform to tough quality standards, while competing manufacturers, particularly smaller companies in China, have struggled.
- **LCA:** An industry as misunderstood as the tropical hardwood industry has more to gain than most from the further development and wider application of LCA. Commissioning independent objective studies of the full life cycle environmental impact of tropical wood products could, in a short period of time, yield real dividends in the form of strong positive marketing messages.
- **GBIs:** By introducing greater objectivity into the assessment of the relative environmental merits of different materials, the expansion of GBIs that build on LCA principles has the potential to improve the overall competitiveness of tropical hardwood products. GBIs are still in the early stages of development in many countries, and international processes are now under way to consider how best to coordinate their development. There is a window of opportunity now to influence these development processes.
- **Carbon footprinting:** Rising interest in the carbon footprint of products has potential as a strong marketing opportunity for tropical hardwood products, depending on research to acquire appropriate data. The opportunity is likely to be particularly strong for products based on local wood raw that which are finished or semi-finished in tropical countries prior to export.
- **Emerging interest in whole-life costing:** A partial answer to the problem of rising raw-material cost in the tropical wood sector lies in emerging interest in whole-life costing. This strategy relies on the simple observation that while up-front prices of a product may be higher than the prices of alternatives, very significant savings may be made in the longer term if that product is low-maintenance and offers energy savings. Interest in whole-life costing is rising in the public sector in some countries as government authorities seek to comply with value-for-money procurement guidelines. It is also the subject of an international standard: ISO 15686 on Service Life Planning of Buildings and Constructed Assets.
- **Waste disposal and recycling:** Greater policy focus on waste disposal and recycling in certain consuming markets has potential as a significant competitive advantage for tropical hardwood products, which, unlike many other materials, tend not to require the application of chemicals and other treatments to enhance performance. Exploiting this opportunity requires the development of systems and procedures in wood-consuming regions to facilitate recycling.
- **Legislation and procurement policies targeting illegal wood imports:** Moves to introduce legislation in the United States and EU requiring due diligence with respect to the legality of wood supplies, and of public-sector procurement policies that formally recognize legal and sustainable wood, is an opportunity to create new markets for tropical hardwoods from well-managed forests. Wood-product manufacturers in countries that are heavily dependent on wood imports of indeterminate origin and complex supply lines are more likely to struggle to comply with the requirements of these laws than are manufacturers close to the resource base in tropical countries. There is a window of opportunity now for tropical countries to help shape the discussion on the forms of evidence that are most appropriate for demonstrating that wood is low-risk with respect to illegal logging.

- **Certification can overcome barriers to tropical wood market access:** Survey evidence suggests that forest certification can overcome negative public perceptions of tropical hardwood. It also suggests that there tends to be a greater willingness to pay premiums for high-quality and specialist assortments of certified wood, particularly tropical hardwood. The certification process has encouraged large, high-profile campaigning NGOs to engage in rational public discourse on the need to generate an income from the sustainable management of tropical forests for a wide range of values, both wood and non-wood, in order to discourage conversion to other land uses. This discourse is a demonstration that some environmental groups are willing to publicly endorse the continued use of tropical hardwoods under certain conditions.
- **The marketing potential of the FLEGT VPA initiative:** Particular opportunities are offered in the European market by the FLEGT VPA process, which aims to combine forest-governance measures with trade-related measures to tackle illegal logging. The process offers an opportunity to coordinate the marketing efforts of a range of major tropical wood-supplying countries that are engaged in the VPA process and to unite those countries behind a single set of marketing messages. It also offers an opportunity to supply tropical hardwood products to tropical wood-consuming markets with a level of endorsement by leading environmental groups, helping to turn the tables on long-term green campaigns that have encouraged boycotts of tropical hardwoods.
- **CSR policies of large wood-consuming corporations offer opportunities if practiced well:** Good CSR implies the corporate adoption of a comprehensive life-cycle philosophy and requires that companies spend the time to improve their knowledge of underlying issues and to develop realistic programs of action. Tropical hardwoods have suffered considerably more than most other commodity sectors from simplistic single-issue campaigns. Moves to a more rational and informed approach that balances the impacts of different materials and takes account of broader issues such as rural development could be beneficial.

Threats

Threats associated with wood supply

- **Declining availability and quality:** The declining availability and quality of the best-known primary species such as teak, mahogany, meranti/lauan, sapele, sipo/utile, iroko, ipe, merbau and ramin, some of which have achieved an aura of high quality and consistency in wood markets across the world (a reputation that is hard to substitute for), is a major threat to the long-term competitiveness of the tropical hardwood sector.
- **Continuing conversion:** Without successful moves to significantly increase the economic returns from tropical forests, the rapidly expanding populations and consumption in LDCs implies increasing pressure to convert these resources to other uses.
- **Inability to meet certification requirements:** The costs of conformance to certification are particularly high in the tropics, while the direct financial incentives to achieve certification remain limited. However, the lack of certified material greatly restricts opportunities for tropical hardwood suppliers to overcome existing negative sentiment about the environmental credentials of tropical hardwoods. There is also a mounting threat of exclusion from particular markets because public-sector bodies and corporations are increasingly demanding that tropical hardwoods are certified. Over-zealous demands for certified products not backed by a willingness to pay premium prices may provide another incentive to convert natural tropical forest to alternative land uses.
- **Growing focus on the carbon role of tropical forests may reduce focus on SFM:** REDD initiatives may focus attention on the carbon-sequestration role of tropical forests at the expense of their broader role in the delivery of social, environmental and economic services. Some environmental groups are already vigorously arguing that REDD initiatives should reward only forest preservation and that any form of wood extraction, including reduced impact logging, is incompatible with the goal of climate mitigation.

- **Heavy-handed responses to illegal logging:** Poorly conceived and disproportionate policy measures to tackle illegal logging that add costs to legitimate forestry operations may have a detrimental effect on the international competitiveness of tropical hardwoods.
- **Need for rapid delivery and turnaround times favors alternative products:** The need for product to be readily available for fast shipment has become increasingly important in the last decade. The global financial crisis has further reinforced the need for finished products to be available for fast-turnaround and in small flexible container loads to offset uncertainty in consumption and prices. Retailers, wholesalers and importers are all increasingly working on a just-in-time basis and maintaining low inventories. These factors are working against tropical hardwoods, which tend to be more difficult to obtain at short notice at reasonably stable prices.

Threats associated with industrial structure

- **Globalization of the wood industry and role of wood-processing hubs:** The emergence of China, Viet Nam and potentially India as major processing hubs may derail the efforts of tropical wood-producing nations to develop their own downstream-processing industries and move towards the domestic production of high-value products.
- **Large corporations and leading designers in industrialized countries shift market away from tropical hardwoods:** Global design trends tend to be led by large corporations and high-profile designers in industrialized nations who are more familiar with temperate wood products and may be prejudiced against the continued use of tropical hardwoods. In the absence of a strong cadre of influential designers in tropical countries there is a threat of a progressive loss of market share. This threat is becoming more pronounced as competitive pressures increase the need for product suppliers to regularly introduce new and innovative products, backed with appropriate technical information and design recommendations. This in turn implies higher barriers to market entry, requiring considerable investment in products, the acquisition of market knowledge and proximity to the consumer. In this way, larger corporations in industrialized nations are continuously reinforcing their market domination and their influence over global design trends.

Threats associated with product marketing

- **Negative perceptions of specifiers and designers:** Specifier and designer prejudices about the environmental credentials of tropical hardwood, combined with preconceptions about wood's behavior in fire, its durability and strength, and its image as an old-fashioned material, are significantly undermining the competitive position of tropical hardwoods. Moreover, even where the design community appreciates the aesthetic and other qualities of wood there is a risk that their views will be overruled by other actors in the specification process (such as building contractors and clients) who may be more risk-averse.
- **Consumers' lack of knowledge and negative perceptions of tropical hardwoods:** Many consumers have very clear and negative opinions about tropical hardwoods formed largely on the basis of limited knowledge. Long-term market access continues to be significantly threatened by limited awareness and understanding among consumers of the concept of SFM in tropical countries, and of the positive role that the tropical hardwood industry can play in contributing to rural development and acting as a disincentive to forest conversion.
- **Modified temperate-forest wood products:** A significant threat to the tropical hardwood sector is the ongoing work to modify the characteristics of temperate hardwoods and softwoods to improve their performance, often with the specific intent of mimicking the aesthetics, durability and strength of tropical hardwoods. Examples of wood-modification processes and products are proliferating, and the performance of treated products can be high compared to tropical hardwoods. Nowadays, alternative temperate species are being used as a substrate for the production of a host of looks.
- **Engineered and composite wood products:** Other competitive threats have emerged from the development of entirely new engineered and composite products comprising small-diameter wood, chips and even sawdust. Many of these

alternative products are sold with FSC or PEFC certification as standard to increase their marketability, particularly in the public sector in northwestern Europe and North America. A lack of production capacity for similar EWPs will be a major source of competitive disadvantage for many tropical countries.

- **Pressure from non-wood products:** There are indications that while tropical hardwood's share of wood markets is coming under increased pressure from alternative wood products, wood's overall share of construction and furniture markets is also being constrained by non-wood materials. Compared to alternative materials such as concrete, aluminium, plastics and steel, wood's performance is at best moderate on several key criteria – notably comparative production cost, strength, toughness, durability and flexibility. This greatly constrains the wider application of wood. Prices for plastics, aluminium and steel, which were rising until mid 2008, have since fallen dramatically – and more rapidly than wood – suggesting a renewed onslaught on wood's market share in the downturn.
- **Modern surface technologies:** Modern surfacing technologies have strongly affected the market for real-wood veneers. Production levels are already very high in key markets and the prices offered for finished goods (such as laminated flooring) are extremely low. Production has expanded very rapidly in Europe, North America and East Asia.
- **Loss of share to low-maintenance or no-maintenance products:** The need for regular maintenance is undermining the position of some tropical hardwood products, such as okoumé plywood, used for cladding. Specifiers looking for low-maintenance or no-maintenance products are being encouraged to turn to composites or modified softwoods.
- **Plastics recycling:** Many of the products arising from new and expanding efforts to recycle plastics are specifically targeting market sectors that have been large users of tropical hardwoods, such as garden furniture, concrete-formwork plywood, hoardings and decking.
- **Loss of share to abundant, more familiar species:** A requirement in large sections of the hardwood market for large-volume and consistent supply has increasingly focused attention on a limited range of temperate species, particularly oak. Ready availability, versatility and familiarity have meant that designers have continued to favor oak, even as fashions have shifted over the last decade from lighter to darker colors – a trend that otherwise would be expected to favor many tropical species. Stained oak is increasingly replacing tropical species, even for products in the darkest shades.
- **Products manufactured from other woody fibers:** Products derived from short-rotation crops, such as bamboo and rattan, that can be produced far more quickly and in larger volumes than wood are substituting increasingly for tropical hardwoods in the furniture and flooring sectors.
- **Chinese combi-plywood:** This product has emerged as a major competitive threat to tropical-throughout plywood in Europe and North America. Prices are considerably lower than the tropical-throughout product and, while the product lacks the same quality and versatility, it provides satisfactory performance in a wide range of utility applications previously occupied by tropical hardwood plywood.
- **Relative lack of access to certification and testing facilities:** While the emergence of tough quality standards in certain markets has the potential to boost the competitive position of tropical hardwood products, this opportunity may be undermined by a lack of access to testing and certification facilities at a level equivalent to that obtained by domestic manufacturers in these markets.
- **Diversity of standards:** Tropical hardwood producers selling into a range of markets face the challenge of conforming to a wide variety of quality and environmental standards and testing procedures, such as those related to formaldehyde emissions, structural characteristics and forest certification. A lack of harmonization adds to the costs of international suppliers and undermines market access.
- **Moves to prefabrication favoring tightly specified products:** Moves to prefabrication are increasing the focus on consistent compliance

with very tight size and quality specifications to avoid wastage and ensure consistent technical performance. This is becoming progressively more important than factors such as versatility and ease of on-site working, which have often favored tropical hardwoods in the past.

- **Impact of the global financial crisis:** Price has become an overriding concern for many buyers during the financial crisis, which is a threat to a higher-value commodity like tropical hardwood. The crisis has also had a disproportionately heavy effect on certain markets that have traditionally been important outlets for tropical wood, such as veneers in the southern European door sector.
- **Quality concerns undermine tropical wood's reputation:** Various factors have meant that quality issues have arisen frequently with respect to tropical hardwood products, threatening their long-term reputation. These factors include: underlying problems with log availability and quality; falling price expectations in markets for tropical hardwood product, leading to quality compromises as margins have been squeezed; and the increased role of smaller, less-experienced Chinese manufacturers in the market. Examples are: cheap combi-plywood from China using inferior glues and thinner face veneers; and the use of kapur rather than teak or bangkarai in garden furniture.
- **Some design trends encouraging a move away from tropical wood:** Concern for sustainability combined with a lack of knowledge among designers of tropical forest issues often results in strong prejudices against the use of tropical wood. Moves to mix materials have tended to undermine the competitiveness of tropical hardwoods in sectors where it has been dominant in the past, such as garden furniture.
- **Marketing and lobbying by temperate-wood-product suppliers:** Other wood suppliers that have invested heavily in certification and the development of modified temperate wood products, or which are based on domestic resources in consumer countries, often find it convenient to differentiate themselves from tropical hardwoods and to denigrate tropical forest management in their marketing activities. They are also actively engaged in political lobbying and standards-development processes to ensure that these play to their strengths. Tropical wood suppliers generally cannot rely on importer trade associations and importing companies to fight in their corner. Many importers simply respond to market signals and customer requirements and do not see themselves in the role of campaigning for one international supplier over another. In many large consumer markets, tropical wood suppliers simply lack a voice and are overwhelmed by the marketing and political muscle of domestic and temperate wood suppliers.
- **Marketing activities of other materials sectors:** Other materials sectors are becoming adept at 'stealing wood's clothes', not only through the development of new products but also through massive marketing campaigns and political lobbying activities. Other materials sectors are actively engaged in green building and similar initiatives to shift the environmental agenda towards issues where they score highly and wood is relatively weak, such as waste collection and recycling or local materials sourcing.
- **Public-sector procurement policies discriminate against wood, particularly imported tropical hardwood:** A common failing of many public-sector requirements for wood procurement (e.g. that wood is 'legal and sustainable') is that they are rarely matched by the imposition of equivalent controls on the procurement of alternative materials. As the requirements for wood may be complicated and convoluted, the policies have the potential to act as a strong incentive to avoid wood and to use other materials. Participation in stakeholder consultations surrounding public-sector wood-procurement criteria also tends inevitably to be driven by local national interests. The need to accommodate the views of national stakeholders often overrides the real needs of sustainable forestry in supplier countries. Generally national wood-importers associations are expected to represent and articulate the interests of suppliers and forest managers in all supplier countries. However these associations are often influenced more by the views of dominant softwood and composite panel interests and pay little heed to smaller, more fragmented tropical hardwood interests.

- **Legislation targeting illegal wood imports:** The Lacey Act amendment in the United States and proposed due-diligence legislation in the EU is expected to encourage importers to seek further assurances – typically backed by independent third parties – that, in areas or regions where the risk of illegal logging is judged to be high, wood has been obtained from legal sources, while imposing few extra demands on wood suppliers in regions where the risk of illegal logging is judged to be low. Since illegal logging is widely perceived to be a more serious issue in tropical countries, the new requirements are likely to fall most heavily on suppliers of tropical wood products. In the absence of clear guidance on appropriate forms of evidence, there is a risk that tropical wood products that are not either third-party-certified or legally licensed in accordance with the FLEGT VPA framework will be excluded from these markets.
- **CSR policies of large consuming corporations may threaten the market position of tropical hardwoods:** At one level, the rapid emergence of CSR activities among larger companies in the developed world may be seen as detrimental to the international competitiveness of the tropical hardwood industry. Requirements for higher labor and environmental standards and moves to avoid areas perceived to suffer from high levels of corruption may simply lead to further discrimination in favor of products from developed countries at the expense of developing countries. There is potential for CSR activities to be hijacked by protectionist interests in developed countries to deny developing countries their comparative advantage in low labor costs.
- **Carbon footprinting threatens some tropical wood product manufacturers:** The carbon footprint issue is unlikely to favor tropical hardwood products such as garden furniture if these are manufactured at a considerable distance both from the raw-material source and the customer – as is often the case in Southeast Asia.

11 IMPROVING THE COMPETITIVE POSITION OF TROPICAL WOOD PRODUCTS

Recommendations for ITTO

ITTO could undertake the following actions to improve the competitive position of tropical wood products:

- Facilitate efforts at the international level to bring ITTO producer governments, large corporations dealing in tropical hardwoods, trade associations and other bodies representing smaller enterprises in producer countries together with a view to developing an industry-wide, design-led generic marketing campaign for tropical hardwoods.
- Promote further research and development into tropical forest management regimes that combine sustainable wood production with income from a wide range of environmental services, including but not limited to carbon sequestration.
- Assist in the establishment of and actively promote models of economically viable natural forest management that generate income from a wide range of environmental services.
- Promote the increased use of more readily available but lesser-known tropical hardwoods by: facilitating the development and distribution of more comprehensive guides to their structural and design properties; and encouraging efforts to promote tropical hardwoods by product application rather than by species.
- Promote further research and development into high yielding plantations including:
  - high-yielding crops with enhanced resistance to pests, fire and other risks
  - processing technologies for the efficient harvesting and conversion of small-dimension plantation material
  - techniques to enhance the value of small-dimension plantation material, such as lamination, thermal treatment, acetylization and the manufacture of composites
- Continue to facilitate efforts by tropical hardwood producers to achieve internationally recognized forest certification standards, for both large concession holders and smaller enterprises through the development of group certification. This might involve both direct funding for certification initiatives in ITTO Producer countries and direct engagement with the governing bodies of international certification systems to encourage the further development of appropriate procedures for certification in the tropics, particularly for smaller enterprises.
- Facilitate cooperation between ITTO producer and consumer member countries to: avoid possible adverse impacts of unilaterally imposed market requirements, such as regulations designed to remove illegal wood from trade, public-sector wood-procurement policies, and building standards and codes; and develop common approaches and standards at international level to facilitate implementation while also providing flexibility to allow adaptation to widely varying local conditions in producer countries.
- Facilitate research into the carbon implications of sustainable tropical forest management for wood production that might bolster the case for the recognition of harvested tropical wood products as carbon stores and of sustainable tropical wood production in carbon trading schemes.
- Facilitate further research into the environmental impact of tropical hardwood products across their full life cycle and of the carbon footprints of tropical hardwood products in accordance with ISO and other international standards.
- Facilitate more detailed wood-market research in emerging markets with potential to provide major new outlets for tropical hardwood products in the future.

Recommendations for ITTO producer countries

Building on research in this document, ITTO producer countries are encouraged to undertake more detailed reviews of the global positioning and competitiveness of their national tropical wood-product industries with a view to developing realistic long-term strategies. In the development of these strategies, it is recommended particular attention is paid to the following:

- The most appropriate competitiveness strategy given a country's prevailing socioeconomic conditions. Countries that are relatively low in competitiveness rankings are likely to benefit from efforts to develop robust institutions, improve transport and other infrastructure, promote a more stable macroeconomic framework, and improve the health and literacy of the workforce. Countries that rank relatively highly for competitiveness are likely to benefit from measures to increase labor productivity, improve the quality of further processing, encourage innovation, and develop own-brand furniture and other wood products.
- The appropriate positioning of the national wood-products industry in relation to major emerging markets and wood-processing hubs, notably China. These countries offer both threats – as competing consumers of raw materials and suppliers of semi-finished and finished products – and opportunities – as major new markets and a source of new investment in forest industries.
- The appropriate positioning of the national wood-products industry in relation to larger corporations in industrialized nations with access to market knowledge, technical and design skills, and product innovations of potential value to tropical wood producers. While the scale and market dominance of these companies threatens the competitiveness of tropical wood industries there may be opportunities to use the leverage of access to wood raw materials and abundant labor to encourage technology transfer and training.
- The need for forest law reform, a process that might involve appropriate deregulation and efforts to simplify forest legislation combined with a more structured approach to enforcement, the clearer definition of rights and responsibilities, and the strengthening of social contracts.
- Measures to foster development of organizational structures at national level that enable small enterprises to work together, including forestry cooperatives and trade associations. It may also be necessary to simplify and stabilize laws and institutions related to SMEs if these are under the jurisdiction of multiple governmental agencies unfamiliar with their needs.
- The further development of domestic markets for wood products, particularly as an outlet for wood products from smaller enterprises and community forests. Consideration should be given to the opportunities for links to programs promoting higher-quality and sustainable construction in the domestic market.
- The provision of tax and other incentives for the development of high-yielding plantation forests on degraded land.
- Engagement with large private corporations and investment organizations in industrialized countries, which are becoming more important in the provision of financing for plantation development.
- Improving the efficiency of wood-processing operations and the level of knowledge on wood-handling. Particular consideration should be given to the implications of the harvesting and processing of larger volumes of small-dimension material from plantations.
- Encouraging a more positive environment for innovation and research and development, such as through public support for research activities, the encouragement of banks and other private financiers to invest in companies undertaking research and development, and the development of appropriate laws and regimes that protect intellectual property rights.
- Facilitating the development of and providing finance for national wood-marketing initiatives guided by the private sector. There may also be opportunities to coordinate these initiatives with other tropical wood-supplying countries. Consideration should be given to the potential to unite various national tropical wood-marketing initiatives around a core set of marketing messages and principles.

- The development of national infrastructure for legality verification and forest certification, and the provision of tax and other incentives for forest certification.

Recommendations for ITTO consumer countries

ITTO consumer countries are encouraged to:

- Ensure that the carbon role of tropical forests does not overshadow their role in the provision of wider economic, social and environmental goals. REDD initiatives should reward not only forests set aside as carbon stores but also forests maintained for a wider range of economic, social and environmental needs, including sustainable wood industries, particularly given their potential to substitute for other less energy-efficient products.
- Work towards the increased harmonization of quality and environmental standards and of certification and testing procedures, such as for formaldehyde emissions, structural characteristics, and forest certification, to help ensure a level playing field for all suppliers.
- Take steps to ensure that requirements for conformance with quality and environmental standards provide equivalent levels of access to testing and certification facilities for both domestic and international manufacturers.
- Work towards ensuring that green building and CSR initiatives and public-sector procurement policies are based on an objective and full LCA approach, so that tropical hardwood products can be compared with other wood products and alternative materials on a level playing field. Fair and equitable access to the development of these initiatives should be encouraged for both domestic and international materials suppliers.
- Match demands for third-party legality-verified and certified tropical wood products in public-sector procurement policies and GBIs with a willingness to pay the extra costs associated with supplying these products.
- Promote and develop the idea of whole-life costing. While up-front prices of a product like tropical hardwood may be higher, significant savings may be made longer term if that product is low maintenance and offers energy-savings.
- Actively engage tropical producer countries and suppliers in ongoing discussions on appropriate forms of evidence that wood is low-risk with respect to illegal logging.

Recommendations for tropical hardwood industries

Tropical hardwood industries are encouraged to focus on:

- Developing the opportunities that exist for tropical hardwoods in higher-value niche markets. Seeking to compete in large-volume, low-value commodity markets, where softwoods and other cheaper commodities dominate, is unlikely to be a sustainable long-term strategy.
- A commitment to full conformance with emerging quality, environmental and forest-certification standards. Long-term competitiveness, particularly in higher-value niche markets, is likely to lie in ensuring tight conformance with these standards. Rising consumer demands for quality in all its forms and moves towards prefabrication are constantly increasing the need to supply 'knowledge-based' products. Wood products now need to be bundled with product information in the form of third-party labels and other forms of declaration covering technical performance, legality and the sustainability of sources, corporate responsibility practices, contributions to the carbon balance, LCA, and energy consumption.
- Improving the regularity and consistency of wood supply through improved logistics, an increased dependence on resources managed for long-term sustained yield, including both plantations and managed natural forests, training in wood-handling, and other efforts to improve the efficiency of wood-processing operations.
- The development of tropical forest management regimes that combine sustainable wood production with income from a wide range of environmental services.
- For better capitalized companies in more connected tropical countries, improved productivity, product diversification and innovation, and the development of a range of more specialist product lines for specific market niches.

Key elements of a generic design-led promotion campaign for tropical wood

Given that as the competitiveness of the tropical hardwood sector is declining relative to alternative wood and non-wood products in traditional market sectors, a key recommendation of this study is the desperate need for a unified generic design-led promotional campaign to protect the sector's current market position. Such a campaign is also needed to identify and develop demand in new niche markets. While challenging questions of how to acquire funding for and to organize such a campaign are not addressed here, the study provides insights into its potential role and scope. Specifically, it would:

- Need to acquire comprehensive information on market perceptions of tropical hardwoods through designer, manufacturer and consumer surveys, particularly outside Europe and North America where this information is very limited. This would allow more accurate targeting of communication messages and provide a baseline on which to assess progress.
- Mainly target designers and architects. A core objective would be to both influence architectural and design trends in industrialized countries and build a strong cadre of designers in tropical countries to act as ambassadors promoting new regional styles based on locally derived tropical hardwoods.
- Focus on providing information on the structural and design characteristics of tropical hardwoods, particularly through the development and distribution of design manuals and actual case studies of tropical hardwoods in use. It would need to engage in regular seminars for architects and product designers, a comprehensive public relations program targeting the design press, and regular participation in trade shows, and it would need to involve sponsorship of individual designers and of building and furniture design competitions in leading markets.
- Aim to both inform designers of the technical characteristics of tropical hardwoods and excite them with respect to the aesthetics and wider cultural narratives of tropical hardwoods. Key communication messages would be:
  - The natural design qualities of tropical hardwoods: warmth, health, beauty and exoticism and the huge diversity of colors, looks and textures.
  - The natural technical qualities of tropical hardwoods: stability, strength and low maintenance requirements, and their durability in high-exposure applications.
  - The value of choosing an authentic product over artificial alternatives.
  - Industry commitment and progress towards achieving forest certification.
  - The contribution of sustainable tropical forest management to rural development and poverty alleviation and its role as a disincentive for forest conversion.
  - The low carbon footprint and the emissions avoided by using tropical hardwoods in place of more energy-intensive products such as plastics, aluminium and steel.
- Participate in key standards-setting processes with potential for boosting market prospects for tropical hardwoods, such as processes governing forest certification, GBIs, carbon footprinting, CSR and LCAs.
- Engage in targeted political lobbying in wood-consuming countries in order to influence building laws and codes, the contents of public-sector procurement policies, and processes to develop legislation designed to remove illegal wood from trade.

ANNEX 1: INDIVIDUALS AND ORGANIZATIONS CONTACTED DURING RESEARCH

The following individuals were consulted during research for this project:

First Name	Family Name	Organization	Country
Michele	Alfano	Alfano Legnami	Italy
Jane	Anderson	Building Research Establishment	UK
Khairul	Anwar	Malaysian Timber Council	UAE
Kevin	Ashby	UCM Croyden	UK
B.M.	Ashraf	Mohiudeen Wood LLC	United Arab Emirates
Alhassan	Attah	Ghana Forestry Commission	Ghana
Dominique	Aubry	DLH Group	Malaysia
Van	Avermaet	Leary C&C	Belgium
Pier Luigi	Bagarotto	Bagarotto	Italy
Alain	Bardet	Rougier Sylvaco	France
Mark	Barford	National Hardwood Lumber Association	United States
Greta	Beel	Firma Cras	Belgium
Rob	Berns	Kwantum Furniture	Netherlands
Jean-Marc	Billange	Synteko	France
Gerry	Bloohn	Consultant	UK
Eric	Boiley	Le Commerce du Bois	France
Duncan	Brack	Chatham House	UK
Alison	Brookes	Architect	UK
Roger	Brownill	PETAL Agency	UK
Steve	Bryan	International Plywood	UK
Rachel	Butler	Timber Trade Federation	UK
Alessandro	Calcaterra	Legnonord	Italy
Guillaume	Callon	Soboplac	France
Andrea	Carriero	Ala Legnami	Italy
Jermain	Cheetham	Wolseley	UK
Steven	Chew	Sitra Holdings International Ltd	Singapore
Keith	Clarke	Premdor	UK
Pierre	Consigliere	MEDIT	Italy
Domenico	Cora	Cora	Italy
Paul	Cornellison	Far East Furniture	China
Adam	Couch	John Robertson Architects	United Arab Emirates
Gino	Couckuyt	Decospan	
Jez	Cutler	Travis Perkins	UK
Sander	Daatselaar	Stiho B.V.	Netherlands
Guy	Daelmans	Belgian Federation of Wood Importers	Belgium
Andre	de Boer	European Timber Trade Federation	Netherlands
Vincenzo	de Carlo	De Carlo	Italy
Filip	de Jaeger	CEI-Bois	Belgium
Ms. Janneke	de Jong	Ministry of Housing Spatial Planning and the Environment (VROM)	Netherlands
Bruno	de la Chesnais	Castorama	France
Achille	de Waghner	Bomaco	Belgium
Koen	de Witte	Altripan	Belgium
Pierre	Declos	Consultant	Italy
Steven	dePypere	Martens C.N.V.	Belgium
Filip	D'Haeseler	Denderwood	Belgium
Kurt	Ditz	Samartex	Ghana
Mr. Jan	Douma	NBVT (The Netherlands Association of Timber Manufacturers)	Netherlands
Marc	Durant	ADO/Leroy Merlin	France
Allard	Eckhardt	Pontmeyer NV	Netherlands
Hakan	Ekstrom	Wood Resources International	United States
Martin	Ellis	Jeld-wen	UK

First Name	Family Name	Organization	Country
Julia	Falconer	European Commission	Belgium
Anthony	Feigl	Mott MacDonald	United Arab Emirates
Martin	Fenn	Oakwood Builders and Joinery	UK
Franco	Fragiacomo	Adriatica Agenzia Legnami	Italy
Sander	Franse	Ministry of Housing Spatial Planning and Environment (VROM)	Netherlands
Allan	French	Blairs Group	UK
Kenichirou	Fukasawa	Tokyo Lumber	Japan
Carl	Gminder	Danzer AG	Switzerland
Al	Goertzl	Seneca Creek Associates and International Trade Commission	United States
Per	Gogstad	AEC Online	United Arab Emirates
Emmanuel	Guillemette	Guillemette	France
Peter	Habraken	Houthandel Habraken	Netherlands
Steve	Hancock	Leeuwenburgh Veneers	UK
Jens	Hansen	DLH Nederland	Netherlands
Patrick	Hardcastle	Consultant and UK delegate to the International Tropical Timber Council	UK
Gijs	Helsloot	Cadillon Furniture	Netherlands
Malte	Herman	Danzer Group	Germany
Dr Alexander	Hinrichs	GTZ	Germany
Takeo	Homma	Sumitomo Forestry Co	Japan
Ward	Hubbel	GBI	United States
Peter	James	Arnold Laver	UK
Noel	James	Greenwood Floors	UK
Wilfrid	Jansen	Coplac (Groupe Danzer)	Belgium
Thierry	Joubert	Guy Joubert SA and Union des Fabricants de Contreplaqués	France
Adrian	Joyce	Architects Council of Europe	Belgium
David	Kelly	Woodbois International	UK
Amira Ben	Kemis	Point P/Saint Gobain	France
Miyoko	Kitagawa	Japan Lumber Journal	Japan
Peter	Koene	Maxeda (Praxis)	Netherlands
Peter	Kristensen	DLH Group	Denmark
Koichi	Kuniyoshi	Architect	Japan
Francis	Lammens	Fratim	France
Peter	Latham	James Latham	UK
Bruno	Layerre	Bois du Monde	France
Richard	Lazenby	Montague L Meyer	UK
Tom	Liebregts	Heuvelman Hout	Netherlands
Jarrod	Lim	Designer	Singapore
Steve	Lloyd	Allied Timber Companies	Italy
Maurizio	Magni	Federlegno	Italy
Christelle	Mallegni	Meplac	Belgium
Lara	Malucelli	Fedecomlegno	Italy
Pierrick	Mangeais	Bois des Trois Ports	France
A.H.	Mansabdar	Modern Woodwork	United Arab Emirates
Phillip	Meyer	Lyprodan	Viet Nam
Giacomo	Michielan	Michielan	Italy
David	Mintz	KnD-design Co Ltd	Viet Nam
Dominik	Mohr	C.I.D.	France
Anders	Moller	Carl Ronnow	Malaysia

First Name	Family Name	Organization	Country
Neil	Morris	Premdor	UK
Ashwin	Mugdal	Sudima Group Ltd	Singapore
Dr Richard	Murphy	Imperial College	UK
Harrie	Nieuwenhuis	CBM	Netherlands
Sanjay	Nihalani	United Agencies	United Arab Emirates
Marigold	Norman	DEFRA	UK
Yasuhiro	Ohashi	JLIA	Japan
Mike	Packer	Timbmet	UK
Marco	Paganoni	Paganoni Legnami	Italy
Tim	Pal	Doorwin Trading	Netherlands
Stuart	Palmer	Tradelink	UK
Angelo	Pe	Pe Pietro	Italy
Catherine	Peguillan	Inter-African Forest Industries Association	Inter-African Forest Industries Association
Laurent	Peyraud	DLH Indubois	France
Peter	Pieper	DLH-Indufor	Belgium
Karen	Plichta	KnD-design Co Ltd	Viet Nam
Harald	Ploss	Harald Ploss and Co GMBH	Germany
Chris	Powell	CP Lumber	UK
Scott	Poynton	The Forest Trust	Switzerland
Luis	Ramos	Lami Wood	Bolivia
Marku	Ranin	Fintec Asia Pacific Sdn Bhd	Malaysia
Sig	Recalcati	Pino Legnami	Italy
Francois	Remiche	CIBWood	Belgium
Luke	Richardson	White Design	UK
Dr Ralph	Ridder	European Forest Institute	Finland
Sebastien	Risso	Greenpeace	Brussels
Francois	Robichaud	Forintek	Canada
Cecile	Rochette	Rochette Stéphane	France
Marco	Russo	Imola Legno	Italy
Henri	Saelens	Saelens Trading BVBA	Belgium
Sheam	Satkuru-Granzella	Malaysian Timber Council	London
Jade	Saunders	European Forest Institute	Finland
Lynne	Schey	Wood Trend	UK
Michael	Snow	American Hardwood Export Council	United States
Michael	Stansfield	ITP Business Publishing	United Arab Emirates
Guy Van	Steertegem	Fedustria (Wood Industries Federation)	Belgium
Armand	Stockmans	Somex	Belgium
Budi	Sulistyo	Delta Furniture PT	Indonesia
Jirawat	Tangkijnga-mwong	Thai Timber Merchants Association and Furniture Industries Association	Thailand
Siokching	Tee	Maxwell Wood Sdn Bhd	Malaysia
Ngo Thi Hong	Thu	Truong Trang Furniture Corporation	Viet Nam
Marc	Trap	Trap	Belgium
Olaf	van Biezen	Dekker Hout	Netherlands
Paul	van den Heuvel	VVNH (The Netherlands Timber Trade Association)	Netherlands
Jan	van den Horst	Garden Retail Services	Netherlands
Andries	van Eckeveld	Precious Woods	Netherlands
Franz	van Hoorebeke	Van Hoorebeke Timber	Belgium
Stéfane	Vande-casteele	Vandecasteele Houtimport	Belgium
David	Venables	American Hardwood Export Council	UK
Andrew	Venman	Jewson	UK
Gianni	Vercellino	Ignisterra	Chile
Charles	Vernon	Gloster Furniture	UK
Tim	Vreman	Propex Timber	Netherlands
Jeremy	Wall	European Commission	Belgium
Ken	Walsh	Danzer Group	UK
Jan	Wijnberger	Timmerselect Doornenbal	Netherlands
Shengfu	Wu	China National Forest Products Industry Association	China

Additional discussions were held with unnamed sales representatives of the following companies at trade exhibitions:

Organization name	Country
Allin	France/Netherlands
Amabassador Windows	UK
Annibale Colombo Srl	Italy
Bacara	Spain
Bothwell	Indonesia
Boyland Joinery	UK
Brema	Germany/Indonesia
Brooks Brothers	UK
Carpanelli Spa	Italy
CBI	Indonesia
Cizeta	Italy
Classic Chair Co	Australia/UK/Thailand
Consorzio Vero Legno	Italy
Domus	Indonesia
Elite srl	Italy
Emmemobili	Italy
FEG	Italy
Fornosarig	Italy
Fronterra Furniture	Denmark/Viet Nam
GC Colombo	Italy
Glynpetermachin	Denmark
Green Home	China
Hove DK	Thailand
Il Giardino Di Legno	Italy
Index	Thailand
Indoexim	Indonesia
ITF Design srl	Italy
Jerry Anderson	Singapore
Kayu Lima PT	Indonesia
Koda Style	China
Kywakit	Thailand
Leva Mobilificio d'arte	Italy
Mama Green.	Belgium/Indonesia
Manotti	Belgium
Maxwell Wood	Malaysia
Moban	Thailand
Mobilidea	Italy
Mobimex	Switzerland
Morelato	Italy
Nueva Linea	Italy
O'Bredi	Singapore/Indonesia
OK Wood Product	Thailand
Pala Mobili in Stile	Italy
Paradini	Thailand
Pedrali Spa	Italy
Philos	Thailand
Pircher	Italy
Plysorol	France/China
Qingdao Minfeng Wood Co Ltd	China
Rattan Wood Design	Italy
Rho Mobili d'Epoch	Italy
Riva Design Eco	Italy
Roda Jati	Indonesia
Rothlisberger Kollection	Switzerland
Royal Botanic NV	Belgium
Scacco Matto	Italy
Schonhuber Franchi spa	Italy
Simply Solid	Belgium
Sitra Design	Canada
Sunwood Group	Thailand
Swedese Mobler AB	Sweden
Tagliabue	Italy
Thebault	France
Thonet Gmbh	Germany
Tribu	Belgium
Weltzholtz (plywood)	Germany
YDF	Italy

ANNEX 2: PREVIOUS ITTO COMPETITIVENESS RESEARCH

Executive Summary of ITTO Pre-Project Report on "The competitiveness of tropical timber and timber products vis-à-vis timber and non-timber substitutes." Extracted without editing from PPD 26/99 (M)) prepared for ITTO by Dr. James Bolton and Mr. Roger Cooper, October 2001

This report on tropical timber products markets is based on personal and telephone interviews carried out in Importing Countries (France, Germany, Italy, Japan, the Netherlands, the UK, and the USA) and Exporting Countries (Brazil, Ghana, Indonesia, Malaysia, Thailand). The study sought consensus views of the Industry on six questions shown in italics below. The answers obtained are summarised as follows:

Which macro-economic factors have the strongest influence on tropical timber products consumption?

Construction Activity and Housing Starts were, together, seen as the most important driver of consumption, scoring 45-60% of all votes cast for most tropical timber products. The exception was veneer, for which the most important driver was logically seen as Spending on Furniture. (Gross Domestic Product and Consumer Spending were generally seen as minor factors). Unsolicited, some interviewees mentioned other factors which are not macro-economic in the ordinary sense, but clearly of great importance to them. In Exporting Countries, actions of Government (issue of concessions, changes in law, tariffs etc, and the enforcement of these) were mentioned. In Importing Countries, issues relating to certification and taste were more frequently mentioned.

What key factors determining the selection of a tropical timber product by a buyer?

Natural Durability was generally rated most important of the Technical Factors considered. If the data from the exterior joinery, garden furniture, and boat building end use sectors were ignored, Appearance and Color Consistency became the most important Technical Factors. In Exporting Countries, Machineability was also rated important, presumably because of difficult-to-machine species which are used more domestically than for exports.

Amongst the Specification Factors, Quality and Grade Consistency were generally rated the most important. This picture is slightly confused by the importance attached to the Availability of Timber in the Right Sizes, particularly in smaller companies in Exporting Countries. Amongst the Supply Factors, Regularity of Supply was generally rated the most important factor, generally followed by Reliability of Supply. Availability on Short Delivery was also rated important, particularly in Exporting Countries. Minimum Order Size or the Availability of Packaged Timber were not seen as limiting factors.

Amongst the Cost and Price Factors, Price Competitiveness was uniformly regarded as the most important issue. Lesser issues, in decreasing order of importance, were Price Stability, Cost of Freight, Terms of Business, Currency of Transaction, and the Availability of Discounts.

How competitive is tropical timber in these key factor areas?

From a technical standpoint, most interviewees showed great confidence in tropical timber products. (However, later on in the Survey, many cited the exterior joinery sector as one where market share had been lost because of concerns about natural durability).

Interviewees were more critical of the competitiveness of tropical timber products with regard to Specification Issues, and more critical again about Supply Issues and Cost/Price Issues. The positive aspect of the deficiencies identified is that they all lie in areas under human control. Improvement is possible. Indeed there is evidence that some suppliers have made considerable improvements in these areas.

What are the main materials competing with tropical timber?

In Exporting Countries, it was common for tropical timber products from a different country or region to be identified as a major competitor. Softwoods were also identified as a major competitor, mainly in the field of panel products. In the Exterior Joinery sector, Metals were seen as the main

competing material, whereas Plastics were seen as serious competitors in Interior Joinery and Furniture production. Temperate hardwoods were hardly ever seen as the serious competitor they clearly are.

In Importing Countries, especially in Japan, softwood panel products, particularly structural plywood, OSB and MDF were seen as offering major competition; interviewees voiced considerable concern about this. Softwoods were also seen as offering major competition in Internal Joinery and in structural applications. Temperate hardwoods were seen as offering the most significant competition in furniture and flooring production. In the Exterior Joinery sector, the most important competition was offered by Plastics, while the role of Metals as competing materials was seen as most important in structural applications. The roles of Plastics and Metals, then, are seen very differently in Exporting and Importing Countries.

What are the main areas where tropical timbers are winning or losing markets, and what are the reasons for this?

In Importing Countries (especially Japan, and to a lesser extent the UK and Germany), interviewees questioned about expanding markets were frequently gloomy. Against this, other interviewees, particularly in the United States, had seen little or no evidence of a general downturn in tropical timber markets, and could more easily identify market areas which had shown growth. The more positive interviewees often gave the impression of having gone out to create new markets to offset other markets in decline.

The most commonly cited areas of growth were parquet flooring, garden furniture and decking, higher quality furniture and joinery, and smaller, more specialised, markets for plywood. The factors which have apparently helped growth include: the ability to undercut competitors on price, changes in fashion, the unique features of tropical wood (including durability achieved without preservatives), sustainability.

The most commonly cited areas of shrinkage were: standard plywood (especially in Japan), exterior joinery, interior joinery, furniture, and (solid wood) mouldings. Many declining markets were in commodity areas. Thus exporters of run-of-the-mill plywoods to Japan and P.R.China had often suffered; in contrast, some companies supplying more specialised plywood products to Japan claimed that their markets had never suffered that greatly and were now growing. Factors which have apparently contributed to this shrinkage include: cost (and the cost-in-service of exterior joinery, in particular), fashion, poor machinability compared to MDF in the production of mouldings, irregular or diminishing supplies, and certification issues.

In complete contrast to interviewees in Importing Countries, those in Exporting Countries were never specific about the reasons for the growth or shrinkage of a market. Thus growth was attributed to "strong demand from importers", for example. This inevitably raises doubt as to whether many companies are that well informed as why their end users in Importing Countries decide to buy, or not to buy, their products.

Interviewees in Exporting Countries mentioned the following difficulties they faced in exporting: supply limitations (including inadequate supplies of eco-labeled products), exchange rate fluctuations, unnecessarily tight specifications imposed by Importing Countries, and uncertainties and bureaucracy in shipping. Many interviewees in Exporting Countries were thinking of cutting out some or all of the middlemen in their traditional distribution chain.

What Strengths, Weaknesses, Opportunities and Threats are perceived by the industry?

Exporting Countries: Strengths. Interviewees frequently viewed the quality and consistency of their product as their main Strength. Some also listed the skill of their labor force as a Strength.

Exporting Countries: Weaknesses. Not surprisingly, most of the factors regarded as Strengths are equally regarded as Weaknesses by other interviewees less able or fortunate. Thus many interviewees regarded the lack of a sufficiently trained workforce as a constraint. Problems in the quantity or quality of raw materials available were seen by many as limiting growth now, and likely to constitute a Threat in the future. Another group of weaknesses centered on limited capital resources. Exporters also complained about limited market information. In Ghana, Indonesia and Brazil, the inability to supply eco-labeled products was seen as a major weakness. As one Brazilian interviewee put it "In the Amazon State, only two companies are

qualified as certified by the FSC. In the Amazon region the certification of companies working with tropical woods has become a survival issue." The length of delivery times, and the unreliability of shipments were generally seen as weaknesses.

Exporting Countries: Opportunities. Most interviewees see the future to lie in added value secondary products. Exploiting the potential of unused species and growing domestic markets for products were also cited as Opportunities in Ghana.

Exporting Countries: Threats. In Brazil, environmental constraints are already seen as a Weakness. In Indonesia they are seen more of a threat on the horizon. Many interviewees also feared changes in the Trade: will there be greater quantities of timber on the world market originating from "newer" sources, such as New Zealand and Eastern Europe? Will there be more added value product emerging from China? Institutional changes were frequently seen as a threat which could have a major and unpredictable impact on business. In Brazil, concern was voiced about potential changes in taxation, law, and the exchange rate. In Indonesia, the devolution of responsibility for concessions to State level, and their reallocation, was referred to. All countries feared a worsening raw material availability situation. All feared greater competition in future from panel products such as particleboard, hardboard and MDF, even if this might be produced domestically, or at least in the tropics.

Importing Countries: Strengths. Nearly half the interviewees in the UK were gloomy, and could name no Strength which would help tropical timber products over the next three years. The remaining interviewees, and especially those in Italy, the Netherlands and the USA, were very positive. The answers they gave echoed those given earlier: unique features of tropical timber, large lengths/widths available, acceptable prices, more value being added in producer countries, and so on.

Importing Countries: Weaknesses. Here again there were no surprises, with many issues raised before re-emerging. However, the environmental issues started to be raised here. These are discussed further below.

Importing Countries: Opportunities and Threats. With the exception of those in Japan, nearly 100 % of interviewees in Importing Countries mentioned environmental issues in some way as a Weakness, Opportunity or Threat. Overall, the effect of the environmental issues is hard to predict, because the issues are based on public opinion, at least partially ill-founded. In interview responses from Japan, environmental issues were partially replaced by concern over continued supplies. So the need for sustainable forest management and more tropical plantations were raised. Not one interviewee mentioned a negative influence on the market, caused by environmental concerns.

ANNEX 3: SUMMARY OF WOOD-PERCEPTION SURVEYS OF DESIGNERS AND ARCHITECTS

- O'Connor *et al.* (2003, 2004) suggested that wood use in the context of non-residential construction in North America is perceived by architects and other specifiers to have many shortcomings with respect to the structural, fire and durability performance of larger-scale buildings. Moreover, North American builders and developers are less wood-friendly than architects. Their primary concerns are related to costs, risks, labor, speed of construction, and product quality.
- Gaston *et al.* (2001) suggested that the use of wood in North American construction applications is limited by a number of factors, including: fire-related codes that are perceived to be too restrictive; steel and concrete seemingly offering easier and more cost-effective design solutions; an inadequate skilled labor force for large-scale wood construction; and designers needing to have more training, familiarity, and support in the wood-design process.
- In an examination of the barriers to timber use in non-residential buildings in Australia, Bayne and Taylor (2006) noted that common obstacles include performance, costs and building erection time. On the other hand, aesthetical properties, fire and energy-related properties are perceived as advantages of using timber.
- A survey by Denizou *et al.* (2007) of Norwegian architects found that using timber is perceived as difficult and expensive and fire-related properties also have a negative influence on the use of timber. It is noted that while architects play an important part in the design process, their choice of material is frequently overruled by the constructor and building owner.
- A survey of German architects and engineers in 1999 (Compagnon Marktforschung 2000) assessed perceptions of wood as a construction material. The results suggest that wood has more perceived weaknesses than strengths, even though many respondents had spontaneous positive associations with the term 'wood'. Key weaknesses included perceptions of poor dimensional stability, lack of durability on exposure, lack of fire resistance, unsuitability for long-span structures, and high maintenance. These concerns were only partly offset by certain positive attributes, particularly perceptions of ease of working, lightweight material, short construction period and aesthetic appearance.
- On the other hand, a survey by Adlwarth (2003), which assessed the attitudes of German architects to the specification of window frames, was generally positive, finding that a significant majority preferred wood windows over plastic windows. The perceived strong environmental attributes, appearance and contribution to personal wellbeing of wood windows significantly outweighed continuing concerns about high maintenance costs and durability.
- A similar survey conducted among homebuilders and public building associations in Austria was less positive. It showed that wood window frames were regarded as inferior when it came to the most important decision criteria, such as initial cost, maintenance and durability. On the other hand, they were rated as satisfying with respect to attributes such as disposal costs, renewable material, natural appearance and design. Those attributes, however, were also considered least important in the decision process (quoted in Rametsteiner *et al.* 2007).
- A survey of the attitudes of Austrian architects and builders to materials used for exterior facades showed visual appearance to be the key product attribute followed by service life, price and maintenance interval (Bruderhofer 2000). Environment-friendly production and recycling of the material were considered least important. Wood was the best siding material with respect to its visual appearance, natural character and environment-friendly production. Exceptionally low rankings were obtained for service life and maintenance interval. The study suggested that around one-third (36%) of respondents felt that the natural look of wood was more important than improved technical attributes, while 22% held the opposite opinion. Another 21% would accept some modification as long as the material still showed some resemblance to wood.

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