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**MARKETING FARM PRODUCED TIMBER
IN PAKISTAN**

by

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APPENDIXES

TERMS OF REFERENCE	I
PERSONS CONTACTED IN PAKISTAN	II
REFERENCES	III
SMALL LOG PROCESSING IN MODERN SAW MILLS	IV
SMALL LOG PROCESSING IN MODERN PLYWOOD MILLS	V
THE ORIENTED STRAND BOARD PROCESS	VI
AVERAGE ANNUAL WHOLESALE PRICES OF TIMBER AT KARACHI: ACTUAL PRICES AND DEFLATED PRICE INDEXES 1975/76 1987/88.	VII
AVERAGE SALE RATES OF SHISHAM IR AND IIIR GRADE TIMBER AT CHANGA MANGA SALE DEPOT: ACTUAL PRICES AND DEFLATED PRICE INDEXES - 1975/76-1987/88	VIII
AVERAGE ANNUAL RETAIL PRICES OF KIKAR FIREWOOD IN KARACHI: ACTUAL PRICES AND DEFLATED PRICE INDEXES 1975/76 - 1987/88	IX
TERMS OF REFERENCE: EUCALYPTUS UTILIZATION EXPERT	X
TERMS OF REFERENCE: WOOD PANEL-BASED FURNITURE EXPERT	XI
TERMS OF REFERENCE: PUBLIC TIMBER SALE EXPERT	XII

MARKETS FOR FARM PRODUCED
WOOD PRODUCTS IN PAKISTAN

	<u>PAGE</u>
CONTENTS	
EXECUTIVE SUMMARY	
INTRODUCTION	1
OVERVIEW OF PAKISTAN FOREST INDUSTRIES	3
RAW MATERIALS	3
FOREST PRODUCTS INDUSTRIES	13
WOOD PRODUCTS MARKETS	46
INDUSTRY TRENDS	64
THE FARM WOOD PRODUCTS MARKETING SYSTEM	70
DISTRIBUTION SYSEM	70
MARKET REQUIREMENTS	75
TRADE DIFFICULTIES AND CONSTRAINTS	79
TRANSPORTATION SYSTEM	83
DEMAND WITHIN TRADE AREAS	84
IMPROVING MARKET INFRASTRUCTURE	87
MARKET NETWORK REVIEW METHODOLOGY	88
MARKET TRAINING FOR STATE FOREST DEPARTMENT PERSONNEL	89
CONCLUSIONS AND RECOMMENDATIONS	92

TABLES

The distribution of forest areas by type, ownership and productive area	1
Out turn of timber and fuelwood from forests under control of forest departments in Pakistan	2
Sources of logs and sawn wood imported into Pakistan 1975/76 - 1987/88	3
Imports of logs and sawn wood into Pakistan 1975/76 - 1987/88	4
Production of plywood and associated products in plywood plants surveyed	5
Current wood requirements of the Pakistan railways	6
The production and wood requirements of a typical wood-based sports equipment operation	7
Production of wood safety matches in Pakistan 1975/76 - 1987/88.	8
The supply and demand situation for poplar	9
Pakistan tree farm circles: area, sustainable annual harvest and chemical pulp yield estimates 1991	10
Average wood used in constructing a house in the Peshawar Division	11
Average annual wholesale prices of timber at Karachi: changes in actual prices and deflated price indexes between 1975/76 and 1987/88	12
Summary of the timber supply and demand situation from 1980/81 to 1988/89	13
Apparent consumption of pulp, paper and paper board in Pakistan 1975/76 - 1987/88	14
Estimated increase in consumption of paper products in Pakistan by 1999/2000	15
Present industrial wood requirements	16
Industrial wood requirements to 1993	17
Yield estimates of <i>Eucalyptus camaldulensis</i> available on private plantations for the years 1995, 2000 and 2005	18
Pit prop specifications and corresponding prices as of 13 May 1990	19

EXECUTIVE SUMMARY

The people of Pakistan have adapted to a life style that requires very little wood. The 5.4 percent of the land that is forested is mostly in the northern part of the Country. About 90 percent of the timber harvested is now coming from private lands. Although inflation constantly raises prices of timber in the market place, an analysis of deflated indexes indicates that the real price of timber has actually been declining for the last decade. Real firewood prices are rising gradually. These facts indicate that the market here has learned to live with limited supplies of wood.

Supplies of high quality shisham, one of the most desired species, are rapidly declining. Quality wood for veneer must be imported in significant quantities. The composition of these imports has shifted over the years from 82 percent logs and 18 percent sawn wood in 1975/76 to 24 percent logs and 76 percent sawn wood by 1987/88. Pulp and paper is by far the largest wood import, costing Rs.3 billion in foreign exchange in 1988/89. Other trends in timber resources are (1) a shift in available raw material from natural forests on government controlled land to plantations on private land; (2) less reliance on conifers and more on hardwoods for industrial wood; and (3) from long rotation timber crops to smaller diameter short rotation timber crops.

Wood use in Pakistan falls into two major categories: fuel and products. Residential use of fuelwood is the largest, but brick kilns and tobacco kilns are also important industrial fuelwood users. Wood products range from simple poles used in construction and a variety of rural applications; to primary products made directly from round wood, such as sawn wood, veneer, plywood and block board, wooden matches, and potentially, wood pulp; to reconstituted wood-based panels, including particle board, hard board and potentially oriented strand board; to

manufactured wood product like boxes, crates, pallets, furniture, rail way carriages, truck, bus and trolley bodies, boats and sports equipment. As part of this project, contractors were hired to profile these market segments and their findings are commented upon in this report.

The timber industry of Pakistan is highly integrated and very well adapted to the timber resources of the Country. The small scale of the production units is well suited to the extensive and fragmented nature of the forests. Utilization of the wood fiber is complete, nothing is wasted. However, the furniture segment is currently restraining the growth and development of the industry. It is based on making custom furniture from high grade shisham wood, now a declining resource. It is faced with modernizing into larger scale more automated operations using a much larger proportion of particle board. The particle board segment needs such a furniture industry to provide it with a market large enough to enable it to modernize, become more efficient, lower costs and improve product quality. A healthy particle board industry will provide an important market for the rapidly maturing plantation hardwoods, especially eucalyptus and poplar.

The pulp industry is interested in broadening their present raw material base of grass and bagasse to include wood. This will also provide another important market for plantation woods. Domestic pulping of hard woods would help reduce the huge cost of importing pulp and paper, now running Rs.3 billion (US\$140.1 million). Hard board is facing heavy competition from imported boards and the domestic plants may have a limited future.

There is a comprehensive wood distribution system in operation that is based on free enterprise and is generally serving the country well. It operates almost entirely within the private sector and although it's highly diversified small entrepreneur composition doesn't lend itself well to clear flow

charts, it efficiently and economically allocates the timber resources to the different market segments. Although they may not be elated over the price or quality, anyone with wood to sell can find a buyer and anyone needing wood can find a seller. The "middlemen" perform essential, but little appreciated, services at generally reasonable prices.

There is very little inventory information available on the timber growing in private plantations, but the estimated species composition is: Eucalyptus camaldulensis 65 percent; Acacia nilotica 15 percent; poplar spp. 10 percent; semal 5 percent; shisham less than 5 percent and all others less than one percent. The market demand for poplar and Acacia nilotica far exceed projected supplies. But available supply-demand estimates indicate there may be a problem. Eucalyptus supplies that will be ready to harvest in 1995 of 224,000 cm appear to exceed the present demand for that species of only 91,000 cm by 133,000 cm. The species is also encountering strong market resistance. Corrective action must be taken at once in three areas: (1) reducing the emphasis on planting Eucalyptus camaldulensis; (2) encouraging the use of more of this wood by the existing industry; and (3) developing new uses for it.

Recommendations for reducing the emphasis on Eucalyptus camaldulensis:

1. Evaluate more species for plantation timber.
2. Make more detailed studies of the economics of growing plantation timber.
3. Determine what must be done in order to grow conifers in private plantations in agricultural areas free from government control.

Recommendations to encourage the present industry to use more *Eucalyptus camaldulensis*:

4. Continue to work to establish contact and communication between growers and users of plantation timber.

5. Compile inventory data on plantation timber within farm forestry working circles.

6. Intensify efforts to promote the use of eucalyptus for particle board.

7. Assist industry establish a modern wood panel-based furniture industry.

Recommendation for developing new uses for eucalyptus:

8. Learn more about *Eucalyptus camaldulensis*.

Recommendation for reducing degrade in government coniferous timber sales:

9. Revise the timber sales policies and procedures in the provincial forest departments to reduce log degrade occurring between harvesting and auction.

Recommendation for training farm foresters:

10. Establish a program within existing farm forestry departments to provide practical, in the field training for young foresters.

INTRODUCTION

The Forestry Planning and Development Project is sponsored by USAID. It encourages private landowners to plant and grow trees to improve their land and for products for their own use or to sell for income. The project is now in its fifth year and has helped organize and increase significant private afforestation efforts previously underway. Today large quantities of farmer-produced wood are being sold and consumed in Pakistan. However, erratic pricing and other inconsistencies have lead both the Government of Pakistan and USAID to recognize the need to understand the opportunities and constraints influencing the farmer's ability and willingness to engage in forestry activities. A high priority has been placed on a qualitative analysis of the market structure at the farm level. Foresters and the farmers they advise need analytical information in order to determine what kinds of trees to plant and their relative values vis-a-vis other farm products.

This study of one of several wood product use studies carried out under Technical Directive No. 11/89.6-12 during 1990 to provide part of this information. It consists of two phases. Phase one was carried out by a group of Pakistani consultants, who studied the major forest products market segments within the country and estimated the type and amount of wood used in each segment.

The second phase involved the collaboration of the Pakistan wood use survey consultants with a forest products marketing specialist, Wendell P. Clark. Mr. Clark attended the Wood Producers-Wood User's Conference in Lahore during May 1990. Following the seminar he prepared draft questionnaires for use in the Phase One studies.

He then returned to Pakistan during the period 1 November to 13 December 1990 to review and evaluate relevant available data and reports, do sufficient field investigation to determine where shortfalls in information existed and make recommendations for pertinent follow-up actions, including expanded studies, research, training, and data bases which may be needed for the development of a forest products marketing information system. The terms of reference for the Forest Products Marketing Specialist are shown in Appendix I.

OVERVIEW OF PAKISTAN FOREST INDUSTRIES

Raw materials

The timber resources of Pakistan are a component of a world and regional timber resource system. While some aspects are unique to the Country and its culture, a brief look at what is happening elsewhere may be helpful in better understanding the pressures and trends affecting the timber resources and industries within Pakistan.

Closed forests cover 2.8 billion hectares (ha.) or 21 percent of the Earth's land surface. (27) Other wooded areas include tropical open woodlands and tropical forest fallow - the regrowth that occurs after forest land cleared for shifting cultivation has been abandoned. Including these raises the planet's total woody cover to 4.5 billion ha. or 34 percent. The total wooded area of Asia and Pacific averages 43 percent, while that of Pakistan is only 5.4 percent of the total land area. (3)

In 1975, forest plantations covered an estimated 13 million ha. in Western Europe; 17 million ha. in Eastern Europe and the USSR; and 11 million ha. in North America. Such plantations cover a relatively small area in the tropics. Out of a total of 11.5 million ha. of these, 4.4 million ha. (39 percent) are nonindustrial plantations for fuelwood production or environmental protection and 7.1 million ha. (61 percent) are industrial plantations for the production of commercial timber, pulpwood, or charcoal. The trend in world forest cover in recent decades has been a decline in tropical forests and woodlands and a slow net increase in temperate forest area because of plantation establishment.

Recent computer assisted studies dealing strictly with tropical timber, have projected a shift in supply from Asia to Latin America and Africa after 1990 as Asian forests are logged over and no longer able to meet demand.

Because forests are so widespread over the planet and wood is a low value commodity relative to its bulk, most wood is consumed locally and only a small proportion (3-18 percent) is traded internationally. However, wood is the third most valuable primary commodity in world trade after petroleum and natural gas. Developed nations dominate world trade in wood products, accounting for 81 percent of imports and 87 percent of exports by value in 1985.

Finally, most of the tree species in the natural tropical forests are not suited to being converted into pulp and paper because they are dark in color; are normally hardwoods with less desirable short fibers; contain a larger proportion of minor species in small volumes; frequently contain silica deposits within the cells that quickly dulls chipper blades; and often grow in countries lacking adequate transportation infrastructure to concentrate sufficient wood in one place to supply a pulp mill. The production of these products is thus concentrated in developed nations, and the earnings developing nations receive from timber exports are nearly offset by imports of pulp and paper.

Less developed societies consume a large proportion of wood as fuel and sawn wood, but with economic development they consume more wood panels (like plywood) and paper. Technological advances allow more efficient use of wood in the form of composite panels like particle board, medium density fiber board and oriented strand board. Paper consumption rises as literacy increases in developing countries.

Forests in Pakistan cover 4.74 million ha. or 5.4 percent of the total land area, and are concentrated in the northern parts of the country. (3) Of this forest area, 30 percent is in the Northwest Frontier Province; 20 percent in Northern Areas; 15 percent in Baluchistan; 14 percent in Sind; 13 percent in Punjab and 8 percent in Azad Kashmir. Per capita forest area in the country is a meager 0.05 compared with a world average of 1 ha. per capita.

Conifers here grow in dry or moist forests between 1,500 to 3,000 meters in elevation and consist mainly of species such as fir, spruce, deodar, blue pine and chir pine. They are the main construction timbers. Associated hardwoods include: maple, walnut, horse chestnut, bird cherry, oak, and poplar. State owned irrigated plantations contain shisham, mulberry, bakein (*Melina azedarach*) and poplar (*P. deltoides* & hybrids).

They are the main source of timber for furniture and sporting goods.

Riverain forests grow along streams and rivers mostly in Sindh and Punjab Provinces and are almost entirely state owned. The main species are Kikar (*Acacia nilotica*), Farash or Ghaz (*Tamarix aphylla*), *Populus euphratica*, and *Prosopis specigera*. They are important raw materials for fuelwood and mine props and timbers. Scrub forests consist of olive, Phulai (*Acacia modesta*), and other minor species and supply some local fuel to local people. Coastal mangrove forests are also almost wholly state owned and supply minor quantities of fuelwood and fodder. They are being heavily overcut and face imminent destruction.

Table 1 - The distribution of forest areas
by type, ownership and productive area.
(Area in 000 ha.)

<u>Forest type</u>	<u>State</u>	<u>Private</u>	<u>Total</u>	<u>Percent</u>
Coniferous	1,197	762	1,959	41
Irrigated plantations	233	159	142	10
Riverain	296	-	296	6
Scrub	900	802	1,702	36
Coastal mangrove	345	2	347	7
Other forest areas	<u>17</u>	<u>24</u>	<u>41</u>	<u>2</u>
Total	2,988	1,749	4,737	100
Percent	63	37	100	-

Source: Pakistan Forest Institute. The State of Forestry in Pakistan (1987). For. Econ. Br., Peshawar, Pakistan. Pg.7. 1988.

Although they occupy only 37 percent of the forest land, privately owned farmlands supplied an average of 1.04 million cubic meters (cm), or 50 percent of timber demand annually during the period 1975/76 to 1984/85.(13) Imports supplied 36 percent or 0.74 million cm and state forests, whilst comprising 63 percent of the forest land, contributed only 0.29 million cm or 14 percent.

The long term output trends from state controlled forest lands have been downward for both timber and fuelwood over the last ten years, as can be seen in Table 2.

Table 2 - Out turn of timber and fuelwood from forests under control of forest departments in Pakistan. (Annual average in thousand cubic meters)

<u>Ten year period</u>	<u>Timber</u>	<u>Fuelwood</u>
1949/50 - 1958/59	120.54	496.84
1959/60 - 1968/69	236.57	508.47
1969/70 - 1978/79	382.63	336.10
1979/80 - 1988/89	413.80	210.80

 Source: Pakistan Forest Institute. The State of Forestry in Pakistan (1989). For. Econ. Br., Peshawar, Pakistan. 1990. Pgs.24-25.

State timber production peaked in 1973/74 at 582,000 cubic meters and recorded fuelwood production in 1960/61 at 704,000 cubic meters. The timber out turn in 1988/89 was 482,000 cubic meters, down 17 percent from its peak; and for fuelwood 234,000 cubic meters, down a depressing 67 percent. NWFP lead in timber output in 1988/89 with 49 percent; followed by Azad Kashmir with 20 percent; Sindh 15 percent; Punjab 11 percent; and Northern Areas with 5 percent. Conifers comprised 73 percent and hardwoods 27 percent of the timber out turn that year.

Recorded fuelwood out turn of 234,000 cubic meters in 1986/87, came from Punjab 53 percent; Sindh 34 percent; NWFP 8 percent; Northern Areas 3 percent; Balochistan 2 percent and production from Azad Kashmir was negligible. In addition to this recorded production of fuelwood, a considerable quantity is also removed from the state forest lands in the form of fallen wood, lops and tops of trees, twigs and branches, and conversion waste. Fuelwood is also removed by right holders and the population of neighboring villages. It is certain that the quantity of this non-recorded removal is quite substantial.

There are no good estimates available on the area and volume of timber growing on private lands. These stands are highly fragmented and widely scattered throughout agricultural lands in block and row plantings. But their total output is obviously very significant, as they are estimated to produce 50 percent of the timber and 90 percent of the firewood used in the country. A lot of this timber is certainly used as fuelwood or poles by the grower and never enters any kind of statistical record.

Finally, imports are supplying an estimated 36 percent of the wood being used in Pakistan. Major suppliers of imported ~~logs and sawn wood in 1987/88 are Malaysia, Singapore and Burma,~~ as shown below:

Table 3 - Sources of Logs and Sawn Wood
 Imported into Pakistan in 1987/88.
 (Volumes in cubic meters)
 (Value in Rs.000)

<u>Country</u>	Product	<u>Volume</u>	<u>Value</u>
	<u>Class</u>		
Malaysia	Logs	13,249	19,713
	Sawn wood	48,151	58,974
Singapore	Logs	7,359	9,931
	Sawn wood	18,997	28,325
Burma	Logs	8,459	11,568
	Sawn wood	2,941	4,219
Other	Logs	797	937
	Sawn wood	21,277	20,952
Total	Logs	29,864	42,149
	Sawn wood	91,366	112,470

Source: Pakistan Commodity Trade Statistics.

Data for logs and sawn wood were not added in the above table because they are measured by different rules. "Logs" here includes S.I.C Code category group 247. "Sawn wood includes category group 248.

Please note how dominant Malaysia is as a supplier of wood. The Malaysian States of Sabah and Sarawak are major suppliers of hardwood logs to Pacific Rim countries. However, Sabah's timber supplies are now declining rapidly and they are taking action to

drastically reduce log exports within the next few years. They presently export 60 percent of their harvest and use the rest in their newly developing forest industries. Sarawak now exports about twice as much as Sabah and expects to continue cutting at the present level for another ten years. But they, too, have advanced plans for developing domestic industries to utilize their own logs. Both states are also the major suppliers of hardwood logs to Japan, Korea and Taiwan - all of whom are very short of logs for their own wood industries. Pakistan will have to compete for logs with these wealthy countries for the better logs, as well as with India and China for the lower quality and less desirable species of timber.

Singapore is the second largest wood supplier to Pakistan, but obtains it primarily from Malaysia and Burma for resale. Burma has huge reserves of dipterocarps or "gujran", which it has largely ignored in favor of harvesting and exporting teak. Now large volumes of wood are said to be going to Thailand, which is severely restricting harvesting in its own forests. Depending upon how this export activity is controlled, Burma could be a good long term source of gujran for Pakistan. It is already a very important supplier to India's log famished timber industry.

Malaysia and Burma are the last holdouts in the generally declining timber supply situation in Asia, mentioned earlier. The ready availability of high quality hardwood logs in export markets at reasonable prices is a temporary situation. Pakistan and other countries in Asia will have to increasingly rely on their own timber resources and import primarily lumber, plywood and finished wood and paper products. This shift has been underway for some time, as shown below in Pakistan's log and sawn wood imports.

Table 4 - Imports of Logs and Sawn Wood
into Pakistan 1975/76 to 1987/88

<u>Year</u>	<u>Logs</u>		<u>Sawn wood</u>		<u>Total</u>
	<u>Cubic Meters</u>	<u>Percent</u>	<u>Cubic meters</u>	<u>Percent</u>	
1975/75	244,358	82	52,313	18	296,671
1976/77	322,077	84	61,353	16	383,430
1977/78	347,381	60	231,660	40	579,041
1978/79	307,817	87	44,424	13	352,241
1979/80	514,571	83	107,289	17	621,860
1980/81	116,355	29	279,017	71	395,372
1981/82	8,712	9	93,376	91	102,088
1982/83	22,714	12	172,492	88	195,206
1983/84	105,121	47	119,663	53	224,784
1984/85	17,009	17	82,331	83	99,340
1985/86	44,668	32	94,877	68	139,545
1986/87	35,839	32	76,980	68	112,819
1987/88	29,699	24	93,638	76	123,337
1988/89	32,993	21	122,412	79	155,405

Source of basic data: Pakistan Forest Institute. State of Forestry in Pakistan (1989). For. Econ. Br., Pakistan Forest Institute, Peshawar, Pakistan. 1990. Pgs.56-68.

(Note: Logs and sawn wood were added in this table to provide a ratio for comparison. They are not true percentages.)

There was apparently a change in government policy in 1980/81 to discourage log imports. It is understood that the Jammu and Kashmir Logging and Sawmilling Corporation and the Forest Development Corporations were set up at that time to increase the output of domestic state timber and decrease reliance on imported logs. However, this is not supported by any noticeable increase in output of state controlled timber, which gradually

dwindled from 367,000 cubic meters in 1978/79; to 384,000 cm in 1979/80; 255,000 cm in 1980/81; 295,000 cm in 1981/82; and 309,000 cm in 1981/82. Another view is that the rapid increase in timber prices and wood imports between 1974/75 and 1980/81 may have been connected to the oil boom in the Middle East. Many people from Pakistan went to work in the oil countries and sent money home that fueled a building boom here. The decline of real timber prices and imports following 1980/81 was caused by the end of that building boom. There may also have been some influence from log exporting countries changing their policies to restrict log exports to support their developing domestic industries. The point remains that there has been a significant shift from importing logs to importing a greater proportion of sawn wood.

Pakistan, then, is following the trends of other countries within the Asian region. Timber availability is shifting (1) from declining natural forests on state controlled forest lands to plantations growing on private lands; (2) From coniferous timber to more use of hardwoods; (3) from large long rotation timber to smaller short rotation timber; and finally, (4) imports of wood have decreased in volume, prices have risen, and the ratio of sawn wood has risen from 18 percent in 1975/76 to 79 percent in 1988/89. Huge increases in imports of wood pulp and paper will be considered in the next section.

Forest Products Industries

The utilization of wood in Pakistan falls into two major categories: fuel and products. Fuelwood is further divided into residential, the largest use; and industrial, which includes fuel for brick kilns and tobacco curing sheds. Wood products range from simple poles for construction of rural buildings and associated structures to primary products made directly from round wood, such as sawn wood, veneer, plywood and block board, wooden matches, and potentially, wood pulp; to reconstituted wood-based panels such as particle board, medium density fiber board, hard board, and potentially, oriented strand board; and finally, to manufactured wood products such as boxes, crates, pallets, furniture, rail way carriages, truck, bus and tractor trolley bodies, boats and sports equipment.

Fuel wood is a very important source of residential heat, especially in rural households. A report in 1985/86 estimated per capita domestic fuel requirements in Pakistan at 0.4 cubic meter.(5) Approximately half of these requirements were being met by kerosine oil, natural gas, coal, cow dung, and agricultural residues, with wood providing the balance. Applying their factor of 0.2 cm to a 1990 estimated population of 110,407,376 indicates fuelwood usage at roughly 22 million cm. That is as good a figure as any until someone comes up with a better one.

The two main sources of fuel wood are private farm lands and the state controlled forests. It is estimated that the state controlled forests supply only about 10 percent of the fuelwood, which is in the form of recorded production, biomass obtained during the conversion processes and from illicit cutting by local inhabitants.(13) The remaining 90 percent is supplied by private farm lands. The latter supplies are estimated at no more than 12 million cm on a sustainable basis, which means that 8 million

cm is unaccounted. It is probably a combination of more illicit cutting on state controlled forests than estimated, cutting beyond the sustainable yield on both public and private forest lands, or the estimated consumption could be grossly in error.

Studies just completed in conjunction with this report estimate present wood fuel used by brick kilns at 82,370 cm (stacked) and that by tobacco curing sheds at 77,000 metric tonnes or about 103,180 cm (assuming 1 metric tonne = 1.34 cm of fuel wood at a sp. gr. of 0.75). (23,9) Adding this combined total of 285,550 cm to the residential fuelwood use of 22 million cm, would very roughly estimate country-wide fuel wood usage at around 22.3 million cm. per year. All species of wood are used as fuel, the most common and preferred are kikar (*Acacia nilotica*), phulai (*A. modesta*), shisham (*Dalbergia sissoo*), and ber (*Zizyphus mauritiana*).

As with raw material supplies, world trends in forest industries may be having an influence on the forest industries in this country. It may be useful to have a quick look at them. As a result of changes taking place in global timber supplies, there is (1) a shift from traditional large logs to smaller plantation logs; (2) many species of timber are now being utilized that were not formerly considered to be of commercial value; (3) increased world trade in logs, wood, pulp and paper products; (4) more mechanization and automation is being used to reduce processing costs; (5) each tree harvested is being more completely utilized; and (6) new reconstituted panel and engineered construction component products have been developed to replace large solid wood products from the natural forests with products made from small pieces of wood from the smaller plantation trees.

The timber industry of Pakistan is highly integrated and very well adapted to the timber resources of the country. The small scale of the production units is well suited to the extensive and fragmented nature of the forests. Utilization of the wood fiber is complete, nothing is wasted. No wood is being dumped in land fills or incinerated for disposal. It is all used.

Small scale production units are normally multi-functional, seldom specialized. A wood yard may buy and sell round wood, have a sawmill producing sawn wood, making furniture for local sale, crates and boxes from the off cuts, and selling the trim and residues as fuelwood. Decent Furnishings in Gujrat has a saw mill cutting their lumber from round wood; a slicer cutting their veneer for plywood and block board; all of which is used in their large high quality furniture factory. Kashmir Development Corporation near Jhelum peels and slices veneer from round wood for plywood and block board. Veneer log cores are sawn into core stock for the block board. All residues, limb wood and low grade round wood is chipped and made into particle board. Such highly integrated operations are very good for reducing operating costs and utilizing all of the wood fiber, but are very bad for people trying to collect data on round wood being used for specific products. Lamentably, there is a tendency here to think of product market segments, i.e., sawmilling/crate/box making; furniture making, truck and bus body/tractor trolley/boat building, etc. as separate industries. Trying to determine how much round wood each uses is like trying to determine how much food is needed for your feet, hands and ears.

There is very sparse information published about the timber industry of Pakistan. In an effort to enrich this meager data base, GOP/USAID/Winrock International sponsored a series of

surveys to profile the following market segments and estimate their round wood consumption:

- Brick kilns.(23)
- Flue-cured virginia tobacco.(9)
- Mining.(24)
- Wood yards.(25)
- Saw milling/Crate/Box making.(15)
- Chip board/particle board and hard board.(17)
- Furniture.(14)
- Truck & bus body/tractor trolley and boat building.(16)
- Railways.(6)
- Sports equipment.(7)
- Pulp.(26)

Material from these surveys will be presented and commented upon where appropriate in discussing the industrial product groups below.

Saw mills - are the most basic industrial unit, but even they are hard to define. In Pakistan, a "saw mill" is basically a motor or engine powered saw that can cut pieces longitudinally from round wood. They range in size and complexity from a small vertical band saw in the back of a tiny furniture shop supplying sawn wood to the shop and local market, up to much larger installations more familiar to North America and Europe. The vast majority are of the small village variety. The most common Pakistani saw mill is equipped with a horizontal band saw and a winch operated log carriage. There is also usually a vertical band re-saw in the mill.

It is impossible to locate or even list all of the "saw mills" in Pakistan, but it is a safe guess that they number in the thousands. A 1978 survey in India estimated there were 25,220 saw mills operating in that country. MSJ Research

Institute list 363 saw mills in Lahore; 334 in Multan; 128 in Sargodha; 58 in Karachi; 38 in Hyderabad; 20 in Peshawar; 14 in Haripur; and 9 in Mardan.(15) This totals 964 and there must be many more in those places that were not recorded, as well as scattered throughout the country in the other towns and villages.

The MSJ survey contacted 60 operations selected according to an experimental sampling design. These saw mills generally obtained their wood supplies from a middle man rather than directly from tree growers or the state Forest Departments. Favored species were shisham, chir, deodar and poplar. Their annual wood use averaged 683 cm (24,079 cft), and their annual sales averaged Rs.1,057,086 (US\$48,357), of which fuel wood sales comprised Rs.145,114 (US\$6,638), or 16 percent. An average of 6.53 people worked in each mill.

All of the mills in the sample were equipped with electric powered horizontal band saws and vertical band saws. They custom cut to order when possible, but also produce sawn wood to make a variety of items for retail sale. In addition to sawn wood, the sample mills produced an average of 22,433 fruit boxes, 14,007 crates, and 8 doors during 1989.

The saw mills are having to adapt to a log supply of declining quality. Pakistani mills are best equipped to cut large or medium straight logs, but are now forced to cut short, often defective, and crooked logs of declining diameter. The future holds a much greater proportion of small (7 - 8 inches or 9.54 - 20.32 centimeters) diameter, but straight logs from private timber plantations. Pakistani mills can process such small logs, but it's very slow. However, half of the units surveyed were operating at 50 percent or less of their capacity, their capital investment is low, and most of the equipment was

paid for years ago, so in many cases it's not critical, if it takes longer to process such logs.

Tightening timber supplies are forcing saw mills world-wide to shift from large native forest growth logs to small plantation grown logs. New technology has been developed to efficiently process these small logs, but lamentably, much of it is inappropriate for use in Pakistani conditions. A brief look at how small logs are being processed in modern saw mills elsewhere is given in Appendix IV.

Pakistan is presently being well served by its small scale, low capital, wood efficient saw mills. Little new technology has addressed itself to more efficiently processing small logs in small scale mills. Minor, inexpensive modifications to traditional Pakistani saw mill equipment to enable them to better handle the small plantation wood is an area of opportunity that should be of interest to domestic machinery manufacturers.

Veneer and plywood - is a product segment that seems to be getting less attention than it deserves. Like sawn wood and matches, veneer is a primary product sliced or peeled directly from the log. These operations range from very small based on a slicer or lathe, air dried veneer, glue spread by hand, and pressed in a single opening press up to much larger production units complete with steaming vats for the logs, lathes and chargers, slicers, clippers, veneer drying kilns, glue spreaders, multiple opening presses, dimensioning saws, and panel sanders.

Veneer can be dried and sold as such; made into plywood; block board or used as the surface laminate over particle board in "venboard". Logs to be peeled must be reasonably straight and cylindrical with solid centers. Logs for slicing can be most anything that contains any good wood and can be held in place for

cutting. Both types of logs contain their best wood in the outer portions. When this has been removed, the remaining center portion of the log is normally sawn into strips of lumber and used for block board core.

Plywood is a panel composed of several layers of veneer glued together. Block board is a panel with four outer layers of veneer and a lumber core. "Venboard" is a panel like block board, but with a particle board core. The two outer layers of veneer in a panel are oriented with their grain at right angles to balance moisture induced dimensional change and provide stability to the panel. The outer layer forms the face and back of the panel and must be good quality veneer, especially in decorative plywood. The inner layers, or "cross-bands" can be of lower quality, but must be free of holes and voids.

Veneer and plywood/block board/venboard operations are very often associated with a furniture plant. Logs are normally obtained through a middle man and often have been imported - especially the peeler logs. Shisham is by far the preferred wood for face veneer, mango has become standard for cross-bands, and poplar sawn wood, shisham or mango core material is used for core stock. This product segment is the most adversely affected by a declining timber supply, both in terms of quality and size. A large percentage of the logs being imported are used for veneer. In India, imported logs are evenly divided between saw logs and veneer logs. The ratio is likely to be similar in Pakistan.

As with sawn wood, much of the small log technology that has been developed for veneer and plywood is inappropriate for use in Pakistan. It has concentrated on rotary peeled coniferous veneer for structural plywood and large highly automated factories. Unfortunately, little has been done on processing

small logs in small scale operations. The processing of small logs in modern plywood mills is explained in Appendix V

There is little recent information available on this important product segment, which is certainly several times the size of the reconstituted panel segment. Khan and Sheikh published a paper on the plywood industry in 1986. (8) They traced the start of the industry in Pakistan to immediately after World War II, but it really did not become important until after efforts were made to develop the market in 1960. By 1986, they found ten plants operating in the country, of which only seven were willing to provide information about their output. These were averaging 61,143 square meters of plywood annually and running below capacity due to inability to get wood of suitable quality in adequate quantities. Their production cost averaged Rs.45 per square meter and their wholesale selling price was Rs.50, leaving a very narrow profit margin of only Rs.5 per square meter. The authors estimated the total annual volume of timber going into plywood at that time to be 70,000 cm.

Besides plywood, these mills also produce flush door, block board and veneer. The importance of these diversified products are shown in Table 5.

Table 5 - Production of plywood and associated products in plywood plants surveyed in 1983.
(Square meters)

	<u>Area</u>	<u>Percent</u>
Plywood	428,318	50
Flush doors	213,491	25
Block board	192,723	22
Veneer for sale	<u>22,103</u>	<u>3</u>
Total	856,635	100

The flush doors and block board, of course, have sawn wood cores and are much thicker than the plywood. All are covered with veneer. This sample indicates that they make up about half of the output of a plywood mill.

The domestic woods being used were: shisham, mango, semal, and deodar. Imported woods were teak and gurjan (*Dipterocarpus tarbinatus*).

It was recently (26 November 1990) estimated by a PFI staff member, that there are now 17 plywood mills operating within the Country. Statistics on domestic production of plywood were not available at the time of this report. It is understood that PFI is doing a survey of the plywood industry and the results should be published in due course.

Particle board/medium density fiber board/hard board - are among the new reconstituted panel products that can be made from small plantation timber and the residues from other processes. Raw materials can be wood, bagasse, straw, grass, cotton stalks, rice hulls, and other agricultural residues.

Particle board (also called "chip board") and medium density fiber board (MDF) are medium density panels in the 500 - 700 kgs per cubic meter range. They are used as sub-strait beneath veneer or plastic overlays in tables and desks; tops, fronts, sides and shelves of chests and cupboards, bookcases; and for radio television and sewing machine cabinets. Hard board is a thin heavy panel with a density of 700 kgs. per cm or above. It is used primarily for partitions and paneling.

The particle board industry in Pakistan came into existence in 1965 to relieve the acute shortage of timber in the Country and to produce a substitute for solid wood. (17) It was felt that

any industrial product which could serve as a suitable replacement for timber or wood would have a large and profitable market. This is happening only very slowly.

At present there are 16 plants engaged in the production of particle board with a combined production capacity of 131,500 metric tonnes per year. Their 1988/89 production totaled 33,336 metric tonnes, only 25 percent of capacity. The reasons for this low figure cited most frequently during the survey by National Management Consultants were: the particle board market is oversupplied; second hand equipment in most of the plants frequently breaks down; and a shortage of raw materials. (17) All plants are in the private sector, except Dir Forest Industries Ltd. Eleven of these plants use wood as a raw material and the other nine are based on bagasse.

The wood-based particle board plants used a total of 88,105 m tonnes of wood in 1989. The species used were: mango 57 percent; poplar 32 percent; jangli toot (*Broussonetia papyrifera*) 2 percent; and mixed wood residues 9 percent. Of the 11 wood using plants, nine purchase only from middlemen, whilst K.D.C. Board and Plywood (Pvt) Ltd. purchases both from middlemen and from Forest Department auctions. Dir Forest Industries Complex, being government owned, purchases deodar, kail, fir and spruce, only from Forest Department auctions and from the government owned Forest Development Corporation.

The middleman generally obtains the wood directly from farmers having orchards or plantations. Farmers remove over-mature or diseased mango trees which are no longer bearing economic quantities of fruit and replace them with new more productive trees. Some wood is also brought from marginal farm lands. The harvested wood is delivered to the factory most often by truck. Orchard wood is mostly mango and many of the trees are

large with diameters to 24 inches or more. The main stem is sold to veneer and plywood plants and the limbs go to particle board. These plants run on firewood, tops and limbs, and wood residues for raw material.

The availability of wood is seasonal, especially mango, as truckers prefer to haul agricultural crops and other products to firewood. This forces the particle board producers to incur substantial costs in building inventories when the wood is available to tide them over the periods when supplies are tight. Raw material supplies are presently adequate for this product, but producers are worried about future supplies.

Particle board is one of the industry segments with the greatest potential for using plantation grown wood. It is already being largely supplied from mango plantations in the Multan area. Pine makes an excellent particle board, as does poplar. Aspen (*Populus tremloides* and *P. grandentata*) is widely used for this purpose in North America. *P. deltoides* would be even better, but it is in strong demand for pallets and crates and it is priced out of the particle board raw material range there. *Eucalyptus camaldulensis* now being widely planted in private plantations should also make good particle board, but the finished panels may be a little heavier than desirable. It may be possible to blend eucalyptus with poplar or other less dense woods to produce a somewhat lighter weight panel, but still with desirable strength properties. Good quality industrial grade particle board can serve as the basis for an efficient modern residential and office furniture industry - as it does in many other countries - and provide good economical furniture for the people of Pakistan.

Wood-based particle board is made from chips. In the industrialized countries, dry planer chips are used. Twenty percent of these are refined into fine shreds of fiber, which

are then laid in the top and bottom layers of a three layer panel to provide smooth surfaces suitable for overlaying. The central layer, or core 80 percent, is composed of coarse chips to reduce costs. This construction leaves the panel with rough edges that must be concealed in the furniture design or banded with a wood trim. Most particle board made in Pakistan is a one layer panel composed entirely of coarse chips. Some individual mat lay up operations can sift the chips to some extent to get more fines into the surface layers and so produce somewhat smoother surfaces. Thicker layers of expensive decorative veneer are then required to overcome the roughness. They can never be made smooth enough to use with some of the modern plastic laminates and still get an acceptable finish.

MDF is a little better board than particle board at a little higher cost. It is a single layer board in which all of the fibers have been refined. This provides a panel with smooth surfaces and edges, that is a little more stable and machines a little more smoothly than particle board. It can also be machined into trim and moldings. However, considerably more electrical power is required to do 80 percent more refining. MDF is used in cabinets and furniture where edges must be smooth, such as door and drawer fronts, or where greater dimensional stability is needed, such as the tops of high quality desks and tables.

The only MDF plant in the Country is run by Al-noor Sugar Mills and operates on bagasse. It produces a board having a minimum density of 700 kg. per cm. Unfortunately, this product has so far not found much favor in the market. Although it is 40 percent cheaper than a good quality wood, like deodar, the market is skeptical about its virtues and is reluctant to put it in use where a good quality wood may be required. It is also not excepted in the particle board market because of its higher

price. The domestic furniture industry has not yet developed the size and sophistication to properly use MDF.

If these market problems can be overcome, MDF would use the same woods as particle board and could potentially be a good market for privately grown plantation wood.

A new structural particle board, oriented strand board or OSB, is playing an important and increasing role in the construction industries of the world. Its main advantages for Pakistan would be the ability to produce a structural wood panel from small diameter round wood of the species being grown in private plantations. It would be excellent here for concrete shuttering, roof sheathing and interior partitions. A cost competitive OSB mill would be comparable in size and capital requirements to a large particle board plant. OSB is described in more detail in Appendix VI.

There are five hard board plants in the Country, with a combined capacity of 84,000 m tonnes. However, total production in 1988/89 was only 19,614 m tonnes, a pathetic 23 percent of capacity. Even draconian import duty and sales taxes are failing to protect the industry from lower priced imported hard board and thin MDF.

Older plants, such as those in Pakistan made hard board using the now obsolete wet process. Essentially, they first made wood pulp and then squeezed out the water, dried the fiber, added resin and pressed it into thin, hard panels. Then a wave of new technology swept over them and all the new plants used a dry process that was much less capital intensive and could make good quality medium density panels, as well as the high density panels. The latest technology in this industry is using highly automated moving presses to extrude a continuous board four or

five feet wide and up to 6 mm or so in thickness, that can be cut to any length desired up to 24 feet. Thin 3 mm MDF is now flooding the world with a lower cost, superior product that is replacing thin plywood and old hard board as an underlay material for use with veneer or plastic laminates. Heavy government protection and subsidies may be able to prolong the Pakistan hard board industry a few more years, but the outlook for these four plants appears to be grim.

Four of the hard board plants use wood, but Crescent Boards Ltd. makes its boards out of bagasse. The other four used 35,061 m tonnes of wood in 1989, of which 96.7 percent was kikar (*Acacia nilotica*) and 3.3 percent was eucalyptus. A new mill run by M/s Oosman Brothers Hard board Industries has recently started using eucalyptus, which they buy as waste wood or fuelwood. All of the plants are supplied by middlemen, except for Oosman, who purchases both from middle men and directly from tree growers. The wood-using mills are all located in Sindh Province and all of their wood comes from there and is delivered by truck.

Furniture - is almost entirely made in custom wood working shops in Pakistan. These range in size from tiny one man carpenter shops making furniture for use in the local village, up to relatively large plants using all of the standard kinds of wood working machinery and producing large batches of furniture for office use, as well as high quality residential furniture. In their survey of 63 furniture operations in 12 cities, the MSJ Research Institute found each employing an average of ten workers, all skilled craftsmen. (14) The primary products are chairs, tables, almirahs, beds and a wide variety of other kinds of furniture.

As with saw mills, there are a huge number of furniture shops in the Country, and they are rather hard to separate from

other wood processing units. Most are operated in conjunction with a saw capable of cutting round wood. The larger ones are often in conjunction with operations producing veneer, plywood, block board, or even particle board and venboard. Carpenters making crates and boxes in wood yards, also can make window and door frames, rough furniture and handles for farm implements for local use. The survey found that 82 percent of the shops they contacted were selling furniture retail to the end user. This is to be expected, as most of the work is for custom orders.

The survey found those sampled to be performing these processing functions: transporting wood 10 percent; de-barking logs 22 percent; sawing or slicing 48 percent; fabricating 95 percent; finishing 100 percent; wholesaling 24 percent and retailing to the end customer 82 percent.

Fifty nine of the shops sampled were using an average of 184 cm of wood per year. The other four firms in the sample were doing finishing work only. Shisham was by far the most preferable furniture wood, comprising 84 percent; deodar was 4 percent; mulberry 4 percent; poplar 3 percent; kikar 3 percent; eucalyptus 2 percent; farash (*Tamarix articulata*, *T. aphylla*) 1 percent. Kail and partal (*Abies pindrow*) were used in faint quantities.

Forty-seven percent of this wood was purchased as logs, showing the extent to which they had their own "saw mills"; 36 percent was branch wood; only 16 percent was purchased as lumber and 1 percent as scants (logs with their sides squared, also known elsewhere as cants), indicating their preference for producing their own sawn wood. In addition to the 184 cm (6,475 cft) of sawn wood used by the average shop, they also used some panels. Particle board was used by 68 percent of the shops, who averaged 24 panels per year; 51 percent averaged 25.5 sheets of

hard board per year; and 56 percent used an average of 20 plywood and 22 venboard panels per annum. This is a very meager use of panel products. They could be using much more. In cubic feet, this would be roughly, particle board (0.75 inch) 47.28 cft; hardboard (0.125 inch) 8.50 cft; plywood (0.375 inch) 19.81 cft; and venboard (0.75 inch) 44.09 cft. A total of 119.68 cft of panels per shop that used them. In North America, the panel use could easily equal or exceed the sawn wood use. They could be using a lot more wood-based panels in furniture here.

Middle men are the chief source of wood for the furniture producers. Ninety-five percent of it is grown on private lands. Wood is delivered to shops away from the big cities by truck. In the cities, it comes by either truck or animal. In crowded and cramped industrial areas, animals are often more convenient.

The furniture shops surveyed were equipped as follows: vertical band saw 68 percent; horizontal band saw 21 percent; thickness planer 29 percent; veneer laminating press 29 percent; molder 25 percent; drill 27 percent; and a jointer 13 percent. In addition, there were a wide assortment of non-powered hand tools being used.

There are presently no estimates available of the total volume of wood being used for furniture in Pakistan. Such estimates would be very crude because of the highly fragmented, dispersed and non-organized nature of this product segment. MSJ Research Institute is currently attempting to provide such an estimate and their efforts should prove interesting.

The furniture industry of Pakistan consists almost entirely of custom wood working shops, with a few of the larger ones doing small batch-type production. None encountered yet are doing

assembly line production. As the industry continues to develop and mature, it will increasingly need more wood-based panels, which are best suited to more automated and mechanized modern production systems. Wood requirements will shift from shisham, deodar and the other traditional species to panels made from poplar, eucalyptus, possibly mango, and other short rotation plantation grown species. Arrangements will have to be made to establish domestic producers of high quality metal hinges, couplings, and other specialized hardware needed for use with wood panels. Good quality shisham will always be in demand for decorative veneer for use in overlaying the panels, but plastic laminates with such realistic shisham and teak wood grain finishes as to be very hard to distinguish from the real wood will gain increasing acceptance. The stronger, better financed companies within the industry can make this change to a modern panel-based furniture industry working with overseas equipment manufacturers, but it will take a lot of money and the Government will have to cooperate by reducing import duties on the essential new equipment, and by not taxing them into oblivion before their new factories get into full production.

Truck & bus body, tractor trolley and boat building - are operations not commonly thought of as part of the wood-using industry, but which use a considerable amount of wood. This product segment was also surveyed by MSJ Research Institute. (16) They contacted 55 companies in eleven cities, who used 1,207 cm (42,526 cft) of wood per year in producing a total of 309 truck, 276 bus, 55 mini bus, and 47 ambulance bodies, 18 trolleys and 15 boats. That is an average of 22 cm of wood per operation per year.

However, there are many much smaller firms doing this kind of work, but who keep a low profile and stay well out of reach of the regulating industries. Appearances can be misleading and

many of these humble looking small firms are well patronized and do a reasonably large volume of business.

The species used are: shisham 62 percent; partal (Abies pindrow) 25 percent; chir (Pinus roxburghii) 9 percent; kikar (Acacia nilotica) 3 percent; and deodar 1 percent. The firms interviewed were not interested in using any other species. "What is time tested and tried is best for them". The wood came as: lumber 65 percent; logs 26 percent; scants 5 percent; and branches 4 percent. Middlemen supplied 85 percent of the firms; 9 percent of the firms bought from both middlemen and directly from the tree grower; and tree growers directly sold to 6 percent of the users. Most of the wood used is relatively low in quality. Fifty-six percent of the firms had their wood delivered by animal carts; 29 percent by a combination of animal carts and trucks; 9 percent by other; and only 6 percent by trucks alone.

The firm of Hakimullah & Bros; Bus Body Builders of Karachi is the largest manufacturing unit in the industry segment. They have 100 employees. But of the 55 firms surveyed, the average unit had only seven employees. The smaller units are run by the proprietor, who is almost invariably a highly skilled technician managing and supervising the team he gathers around him. "He is the owner, manager, supervisor, guide and leader - all knowing, all powerful."

"Boat building is perhaps the oldest and amongst the most historically important wood-using industries in Pakistan.(16) River navigation used to be vital and by far the most important means of trade, as well as means of transport. A vast fleet of boats plied the five rivers and the Indus river played a pivotal role. The boat building industry in the country not only thrived, but occupied a position of pride. The craftsmanship enjoyed a fame far and wide. A great variety of river crafts were made to

suit various purposes. But, regretably, the advent of automobile and railways caused the decline of this industry. In its present state, boat building is mostly of interest to fishermen and people living near the rivers. So there are still boat builders around, "albeit scarcely noticed and little known."

There are now five boat builders in Karachi. All build boats to customer specifications. In 1987 three firms produced 10 boats; in 1988 five firms made 16 boats and in 1989 15 boats. The total wood required in 1989 was 10,500 cft (298 cm), of which 39 percent was deodar; 30 percent shisham; 26 percent teak; and 5 percent kikar. Four of the firms have their wood delivered by animal cart and one by truck.

Although the boat building industry segment is certainly one of atavistic and historical interest, at 298 cm per year, it is hardly a major wood user.

Railways - in Pakistan presently require nearly 18,000 cm of deodar and 2,000 cm of shisham timber in round form to maintain over 12,600 km of track and run carriage factories in Lahore and Islamabad.(6) The timber used in sleepers, bridges, points and crossings consists of deodar, kail (*Pinus wallichiana*), fir (*Abies pindrow*) and spruce (*Picea morinda*). It is understood that all of this material is pressure impregnated with creosote, including the deodar. Both shisham and deodar are used in construction, repair and maintenance of carriages and coaching vehicles. Very little other wood is used by the railways due to tradition and petrified specifications.

Owing to shortages of suitable wood, replacement work initially was restricted to the renewal of sleepers which were no longer fit for maximum speed and axle load. Prior to 1980/81, Pakistan Railways used to import sleepers in order to supplement

local purchases. In 1978/79, they imported 3,439 cm of wooden sleepers from abroad. But after 1980, when the concrete sleeper factories came into production, the import of wooden sleepers was discontinued.

Prestressed concrete sleepers cost more, but last longer than creosote treated wooden sleepers, as shown below:

<u>Type of sleeper</u>	<u>Cost per sleeper</u>	<u>Serviceable life</u>
- Wooden sleepers	Rs. 490 each (Deodar)	15-20 years (When creosoted)
- Pre-stressed Concrete	Rs.622 each (Mono block)	40 - 45 years
- Pre-stressed concrete	Rs,722 each (Twin block)	45 - 50 years

Wooden sleepers were once the mainstay of railway track, but are now being phased out in favor of pre-stressed concrete sleepers. Wooden sleepers comprised 62.3 percent of all sleepers in 1983/84, but have dropped to 53.5 percent by 1988/89. Meanwhile, concrete sleepers had increased from 7.9 percent in 1983/84 to 23.5 percent by 1988/89. Cast iron and steel iron sleepers declined slightly from 14.0 and 15.8 percents to 11.0 and 12.0 percent respectively.

The railways obtain their sleepers through contractors. The employment generated in the manufacture of wooden sleepers is, therefore, covered under saw milling.

Besides the track, passenger carriages and coaching vehicles constitute the basic infrastructure of the railway system. They have to bear the brunt of ever increasing traffic being moved on high density routes. With the introduction of powerful diesel and electric locomotives hauling trains at higher speeds, the

strain on the track as well as on the carriages has been increased greatly. The building of more reliable track and carriages has assumed greater importance in the running of railways in the country.

Pakistan Railways have been operating two carriage factories since 1970/71. One is known as the Carriage and Wagon Workshop at Moghulpura, near Lahore, for repairing the rolling stock; and the other, at Islamabad, is the Islamabad Carriage Factory for manufacturing new coaches. The current annual requirements of wood for the railways are given below in Table 6.

Table 6 - Current wood requirements of the Pakistan Railways (Cubic meters)

<u>Department</u>	<u>Deodar</u>		<u>Shisham</u>		<u>Round</u>
	<u>Sawn</u>	<u>Round</u>	<u>Sawn</u>	<u>Round</u>	<u>Total</u>
Route & Track	8,332	14,164	0	0	14,164
Moghulpura					
C&W Workshop	1,400	2,380	1,120	1,900	4,280
Islamabad					
Carriage	<u>350</u>	<u>600</u>	<u>55</u>	<u>100</u>	<u>700</u>
Total	10,082	17,144	1,175	2,000	19,144

Since wood is being continuously replaced by alternative metallic and synthetic materials, it is assumed that despite modest expansion of the railway system, the annual requirements of timber till year 2000 will remain around 20,000 cm in round form. (6)

It seems anachronistic to use a high quality versatile wood like deodar for creosoted sleepers. The limited available supplies of this timber would be much better used in furniture, veneer or even as trim and molding in construction. The railway

specifications calling for deodar sleepers was evidently written in colonial days when the best was cheap and readily available, and have become petrified with age, encrusted with tradition and are now seemingly impossible to change. In view of the declining supplies of deodar and competing demands for it, together with current economic problems that make imports of sleepers undesirable, Pakistan Railways had better start testing and evaluating alternative domestic woods. Eucalyptus species and kikar would appear to be among the leading candidates.

Wood-based sports equipment - is one of the most successful segments of the wood industry, and while relatively small, is strongly export oriented. It is localized in the city of Sialkot in the Punjab. Although craftsmen have been making sports equipment here since the 1880's, it is still very much a cottage industry. There are at present 306 concerns listed in the "Directory of Industrial Establishments in the Punjab, 1988" as engaged in the manufacture of all kinds of wood and non-wood sports equipment at Sialkot, of which, 110 are engaged in making goods based exclusively on wood. There are 30-40 hockey stick makers; 40-50 cricket bat makers; and 15-20 make tennis and other kinds of rackets. In addition, about 1,000 families living in the Sialkot area make cricket bats, wickets, and different kinds of rackets, which they sell to the larger firms. Except for cricket bats which have a good domestic market and only 10 to 30 percent of them are exported, approximately 80 to 85 percent of all other sporting goods are exported. This segment was surveyed by Envoforestry (Pvt) Ltd. in 1990.(7)

Mulberry (*Morus alba*), poplar (*Populus spp.*) and willow (*Salix alba* - imported cricket bat willow and *S. tetrasperma* - grown domestically) are the major woods used by this industry segment. The volumes presently used are: Mulberry 7,075 (17 percent); poplar 22,640 cm (55 percent), willow 5,660 cm (14

percent); and all others 5,660 cm (14 percent). No hockey stick maker thought that mulberry was in short supply, they only complained about its quality. But cricket bat and racket makers did think that hybrid poplar and willow wood was in short supply. The manufacturers who use mulberry worried that the introduction of poplar in irrigated forest plantations was at the expense of mulberry and that its supplies would decline.

Further investigation by Enviroforestry did not verify that there was a shortage of poplar wood.(7) What is short is wood of proper size and the reason seems to be that for the last few years huge quantities of polar wood of larger size has been used by Afghan refugees for making their huts, houses, furniture, etc. Supplies of larger size poplar are likely to remain tight until the refugee problem is resolved. To the contrary, middlemen in Sialkot were of the view that even now there is no shortage of poplar wood of any size for those who want to buy for cash. The small traders who transport wood by their own or hired trucks to Sialkot, want their payments in cash. But the buyers, suspecting that the wood may be of inferior quality, try to purchase it on credit so they can discount the price for quality deficiencies later. This gives the impression that there is a shortage of wood, where there are only shortages of credit and trust.

Despite a general impression that most of the mulberry is coming from private land, this survey found that 80 - 90 percent was actually coming from government forests. The wood in inventories of the operations visited came primarily from Changa Manga and Daphar irrigated plantations of the Punjab. Almost all good quality polar and willow wood is grown on private farms in the Peshawar, Mardan and Hazara Divisions of NWFP.

The production and wood requirements of a typical wood-based sports equipment operation are presented in Table 7.

Table 7 - The production and wood requirements of a typical wood-based sports equipment operation.

	Hockey	Cricket	
	<u>sticks</u>	<u>bats</u>	<u>Rackets</u>
Annual production (No.)	80,000	120,000	80,000
Annual consumption of main wood (cm)	707	1,415	283
	(mulberry)	(poplar)	(laminates)
Annual consumption of other woods	57	141	28

Source: Invo forestry survey.(7)

This small industry segment is still thriving, but is losing its position in international markets due to new competing materials; its low level of technology; a declining quality of its raw materials and finished products; and its narrow range of products. It would be to the Government's benefit to be more helpful to this small enterprise. It earns desperately needed foreign currency; it provides employment and supplemental income to many small proud entrepreneurs and artisans, who would have difficulty finding and adjusting to alternative employment; provides high value added content to otherwise relatively low value woods; and is based on species that grow well on irrigated plantations - private or public. Its market situation will be further discussed in the next section.

Wooden matches - are a very significant segment of the wood products industry in Pakistan. The first factory was established in 1927 at Shahdara near Lahore.(18) Now known as the Orient Match Company, this was the only wooden match producer in (West) Pakistan until 1971. Most of the match industry was located in East Pakistan (Now Bangladesh). Following dissection of the country that year, production of matches by Orient Match had to be heavily supplimented by imports from Europe.

Chir pine and semal were originally used for match stock, but required extra treatment to reduce undesirable characteristics, such as smell, lack of workability, etc. Lack of more suitable woods resulted in the introduction of wax matches in 1973. National Match Company started production that year, using poplar from NWFP. Since capacity has increased until now overseas markets are being sought to provide an outlet for excess production. Production of wooden safety (matches will ignite only if scraped on the treated side of the box) has increased 320 percent, or 26.7 percent per year, between 1975/76 and 1987/88, as shown in Table 8 below.

Table 8 - Production of wooden safety matches
in Pakistan 1975/76 - 1987/88.
(Million boxes)

<u>Year</u>	<u>Production</u>
1975/76	592.6
1976/77	780.8
1977/78	1139.4
1978/79	1275.1
1979/80	1444.3
1980/81	1672.6
1981/82	1337.2
1982/83	1402.6
1983/84	1690.0
1984/85	1765.1
1985/86	1899.2
1986/87	2129.6
1987/88	2490.8

Source: Pakistan Statistical Yearbooks 1972-82, 1985-89.

Almost all matches produced in Pakistan are of good quality and are competitive around the world, especially in the Middle East, where there are no match factories, and in Europe where match factories are closing down in large numbers.

Poplar is the essential wood for making matches because of its light color, lack of smell, workability, softness, light weight, relatively high strength in proportion to its weight, and its resistance to splintering. Private growers provide all of the poplar in NWFP and 15 percent of that in Punjab, where the Government grows the rest. The match industry is the largest user of poplar wood and had no trouble getting adequate supplies until 1986, when adverse weather conditions interfered. Since then, poplar supplies have been dependable, with only brief interruptions in the wood flow. The supply and demand situation poplar is shown in Table 9.

Table 9 - Supply and demand situation for poplar
(Cubic meters)

<u>Year</u>	<u>Demand</u>	<u>Supply</u>	<u>Gap</u>
1987	121,447	106,636	(14,811)
1988	116,560	101,866	(14,694)
1989	126,385	106,772	(19,613)
1990	138,968	94,750	(44,218)
1991	150,515	94,122	(56,393)

Source: Paper by Javed Niaz, Chief Executive, Orient Match Co. presented 13 May 1990 at the Wood Producers-Users Seminar, held 13-15 May 1990 in Lahore. (18)

The match industry uses approximately 40 percent of the poplar. Particle board is second. Plywood uses only 2 percent. Boxes and crates 10 percent and Afghan refugees - for house poles

- use 7 percent. Match companies want poplar round wood with an average diameter of 8 inches and a minimum of 5 inches; straight; knot free; non-twisted grain; natural color; and fresh logs. Particle board uses small diameter "firewood" poplar. Plywood wants a minimum log diameter of 14 inches.

Match companies are supplied with poplar by relatively few middlemen, who buy it from private growers and roadside pole markets in NWFP and Punjab and distribute it all over the country. The match companies in Peshawar are currently paying Rs.48-49 per 37.32 kg. md. for poplar match wood delivered to their plant. It is critical to peel it while fresh, within two to three days of arrival. Poplar wastes are sold to particle board and pulp mills, and in the Peshawar area, to Afghan refugees for fuel.

It is obvious that this ravenous user of poplar will continue to grow and become an even larger market for plantation grown poplar.

Pulp - is an industry with the potential to become a very major market for plantation timber - especially eucalyptus camaldulensis. There are presently 41 pulp and paper mills in Pakistan; 31 operating, eight planned and two idle.(26) They have a total capacity for producing about 292,000 tonnes of pulp per annum (TPA). Their primary fibrous raw materials are wheat straw and Kahi with some use of bagasse, cotton waste, and other materials. There is no domestic wood presently being made into pulp, with the exception of experiments being conducted by one of the mills. However, G. Wire, a pulp and paper consultant, found all mills he visited here in May and June 1990 interested in the possibilities of pulping wood.

Paper requires pulp with a combination of both long and short fibers. The long fibers give it strength and are usually made from coniferous woods. Short fibers increase the brightness of the paper, make it more opaque, and improve its printing ability. It is generally made from hardwoods and a wide variety of other fibrous materials, including straw, grass, bagasse, cotton, waste paper, etc. The proportion of long and short fibers required depends upon the type of paper. Heavy kraft paper may have 80 percent long fibers and 20 percent short fibers, whilst writing and printing paper may have 20 percent long fibers and 80 percent short fibers.

The raw materials now being pulped in Pakistan all yield short fibers, so a very substantial amount of long fiber pulp must be imported. In 1988/89, 52,706 tonnes of pulp were imported for Rs.259 million equivalent in hard currency. This was mostly long fiber pulp, but also included a substantial amount of short fiber pulp. Major pulp sources in 1987/88 were: Sweden 47 percent; USA 22 percent; United Kingdom 8 percent; Portugal 6 percent; Canada 5 percent; Norway 4 percent; Germany 3 percent; and all others 5 percent.

The straw, grass and waste paper now used in Pakistan makes poor quality pulp and paper. A lot of long and short fiber wood pulp must be imported to improve it. Wire estimated that up to 70 percent of the bleached Kraft pulp now imported could be replaced by pulp made from domestically grown *E. Camaldulensis*. (26) Satisfactory pulp can be produced from other chemical processes, including the soluble base sulphite and soda currently used by the Pakistan industry. Satisfactory TMP-BCTMP could also be produced, but power requirements of over 2,000 kw-hr/tonne are very high, and it would replace straw in the pulp, not imported pulp.

Assuming that the will, capital and technology can be developed for pulping domestic wood, let us now take a look at what might be involved in supplying wood to a pulp mill. There has been an exotic hardwood species tree farm planting program underway for several years - the primary purpose of the Forestry Planning and Development project. The species planted to date are: Eucalyptus camaldulensis 65 percent; Acacia 15 percent; poplar 10 percent, semal 5 percent; shisham and others less than 6 percent.

Young E. camaldulensis is highly desirable as a pulpwood, especially for chemical pulps. Poplar and probably acacia are also good. Less is known of the others. But generally, most hardwoods respond well to kraft, soda and neutral sulfite pulping. Potentially available pulpwood from tree farm circles is estimated in Table 7, along with the area planted and the tonnes per day of chemical pulp production that could be supported. (26)

Table 10 - Pakistan tree farm circles:
area, sustainable annual harvest and
chemical pulp yield estimates - 1991

<u>Circle</u>	<u>Area</u> <u>(Ha.)</u>	<u>Annual</u> <u>yield</u> <u>(000 cm)</u>	<u>Kraft</u> <u>TPD</u>	<u>Ha./TPD</u>
Kohat	1,264	13	10	126
R'pindi	3,298	37	28	118
Lahore	2,247	25	19	118
Multan	3,222	36	28	115
Jamal I	750	7	5	150
Khipro	<u>2,564</u>	<u>29</u>	<u>22</u>	<u>117</u>
Total	13,345	147	112	119

For example, if Adamjee Paper Co. at Nowshera (in the Kohat Circle) decided to use wood for ten percent of their pulp needs, 2,545 ha. of plantations would be needed.

The problem will have to be addressed of how to collect such a large volume of wood from hundreds of small farmers and land owners. There are several possibilities;

(1) they could simply announce that they were buying wood at the mill gate. This would reduce their logistics costs, but would leave their wood supply to the mercy of those who showed up with wood for sale each day. When to sell would be based on when the seller wanted to sell, not when the mill needed wood to keep operating.

(2) They could deal through a few reliable middle men, who would buy from the farmers; schedule harvests in cooperation with both farmers and the mill; extend short term credit to the farmers as necessary; arrange for transportation; and deal with the many taxes, duties, tariffs, and other payments that plague transportation. For these services, the middlemen would have to be paid. They can work for the mill, themselves, or for a group of timber growers.

(3) The pulp mill could buy timber from the private land owners one or more years before harvesting. They could make certain advance payments, assist with any necessary spraying for insects, disease, fertilizers, or help with irrigation costs. This would tie up more professional time and capital, but would also help insure the availability of wood when needed by the mill. The decision when to cut would be the mill's, in consultation with the land owner.

(4) The pulp mill could set up a comprehensive extension and collecting program. Company employed extension foresters could advise on the species to plant; make seedlings available; watch for and treat any insect or disease attack; fertilize as desirable; decide in consultation with the private owner when to harvest; arrange for harvest and transport; and make advance payments as necessary. Since the resource area will have to be large to supply so much wood to a central point from many small scattered woodlots, use of one or more collection points may be desirable. Wood from one area could be concentrated at a collection yard. There it could be cut to fit efficiently into a truck for transport, or de-barked and chipped by portable equipment and hauled to the mill as chips. This procurement possibility would eliminate the middlemen, but the pulp company would have to assume both his functions and those of an extension forester. Because of the more comprehensive involvement in the planting, management, harvesting and transport of the pulp company's forestry and procurement people, it would also assure better control over the wood supplies and when they would be available. Inventory records could be kept by the extension forester, so the pulp mill would know several years in advance exactly what wood would be available and where it was located.

(5) Finally, the pulp company could buy the land; plan, plant, manage, and harvest their own timber. This possibility would give complete control over timber supplies, but would also be the most expensive and might encounter difficulties with laws that could restrict the amount of land that a private company can own. The Government might also one day decide to "control" private forest lands in agricultural areas as they do now in the mountainous coniferous areas.

Along with particle board and poles, pulp wood has the potential for becoming a very major market for timber grown on

privately owned timber plantations. G. Wire (26) and C. McKetta (12) have both made excellent recommendations relevant to encouraging the pulp industry to use wood in Pakistan. Those pertinent to raw material supplies and pulp processing are re-emphasized below:

1. Conduct pulpwood supply inventories and projections to include: stand location, area and volumes; growth rates; optimum and probable harvest dates; determine and recommend optimum pulpwood rotation periods; and the associated economic costs and returns.

2. Investigate planting of conifers on private lands. If laws or policies discourage this, take steps to have them corrected.

3. Sponsor and fund "neutral" sulfite pilot research and development to find the best conditions for pulping wood in ways most compatible with those now used for existing fiber.

4. Sponsor and fund the introduction and evaluation of new pulp wood harvesting, transport and processing equipment from abroad. Fund or assist in funding the import and installation of such equipment.

5. Sponsor and assist education programs. There is a great need for pulp and paper technology education at all levels. Particularly the entry professional and vocational levels for operators, technical, supervisory and management personnel.

6. Increase the extent of joint crop interaction research in order to define relevant agroforestry options and tree/crop interactions across the broad range of tree/crop combinations that might be encountered in Pakistan.

7. Finally, since eucalyptus are likely to be the most desirable hardwood plantation species for pulping, and since concern has grown recently that this family of species may be very demanding in terms of ground water and soil nutrients, trials should be done to determine the effects of inter-planting eucalyptus with other species that might ameliorate their effects - such leguminous trees as acacia or leuceana.

WOOD PRODUCTS MARKETS

Although it is lightly forested by world standards and has one of the lowest per capita wood use rates, the people of Pakistan have adjusted accordingly and there appears to be no desperate unfulfilled demand for wood. The culture is influenced by the Mid-east and not much wood is needed. Reinforced concrete posts and beams support walls of brick and plaster in most urban buildings - commercial or residential. Floors are of stone or masonry and often carpeted. Roofs are also of reinforced concrete. Wood is used primarily for doors and windows, their frames, moldings, paneling and furniture. Rural buildings are of brick, or mud and wattle, perhaps with a wooden pole frame. Roofs are of mud or straw and supported by wooden pole joists. A recent survey of the use of wood in rural households in the Punjab, NWFP and Balochistan showed 97 percent of the houses using wood in the roof, 72 percent in the door, 49 percent in the window, 5 percent in the corral or stable, 3 percent in the cupboard and 3 percent in the wall.(4) Although sparse, the furniture in rural homes is usually of wood. The pieces of wooden furniture found in these homes were carpoi cot 97 percent; tables and chairs 33 percent; and a pitcher stand 14 percent.

Farmers also use wood for implement handles. Wood was used in 69 percent of the plows; 37 percent of the troughs; 34 percent of the yokes; 25 percent of the carts; 17 percent of the stakes; 10 percent of the harrows; and 8 percent of the handles. Major sources of timber for the rural people were; own trees 41 percent; bazaar 32 percent; landlord 20 percent; shamilat (community owned lands) 3 percent; fellow villagers 3 percent; and other 1 percent. From this it can be seen that farmers get their wood close to home. They also take what is growing there. The species most commonly used, whether for housing, furniture or farm implements is kikar (*Acacia nilotica*) by 38 percent of

the households surveyed; next was shisham 16 percent; followed by Z. jujuba 15 percent; deodar 8 percent; Acacia modesta 4 percent; O. oferruginea 4 percent; and others 15 percent.

A wood consumption survey of housing in the Peshawar Division by Sheikh, Hussain and Khan in 1986 found the wood used in an average rural house construction to be 6.11 cm vs 1.811 cm in an urban house.(22) This is detailed in Table 11.

Table 11 - Average wood used in constructing a house in the Peshawar Division

Use	Rural		Urban	
	Average Wood Used		Average Wood Used	
	Cubic Meters	Percent	Cubic Meters	Percent
Doors	0.60	7.57	0.80	44.86
Windows	0.19	2.37	0.31	17.02
Ventilators	0.06	0.67	0.09	4.97
Cupboards	0.32	0.04	0.20	11.22
Roofs	<u>4.94</u>	<u>85.35</u>	<u>0.40</u>	<u>21.93</u>
Total	6.11	100.00	1.81	100.00

Source: M.I. Sheikh, R.W. Hussain & S. Khan.(22)

Peshawar Division is in the most heavily forested Provinces, NWFP. The use of wood is probably somewhat less in the huge cities and in the more lightly forested Provinces further from the timber supplies. In Karachi and Lahore, a greater percentage of the people would be living in high rise masonry buildings, than would be the case in Peshawar. Such buildings commonly replace wood with prefabricated steel doors, windows and ventilators. The use of wood in such residential units is often limited to furniture, decorative paneling and parquet flooring.

The species of construction timber found in the Peshawar sample heavily favored the local conifers: *Pinus roxburgii*, *P. wallichiana*, *Cedrus deodara*, *Abies webbiana*, *Picea smithiana*, *Melia azedarach*, *Morus alba*, hybrid poplar, *Dalbergia sissoo*, and eucalyptus.

Fuelwood that appears in commercial trade is normally the residue of some wood product operation. It comes from logging residues, de-barking of logs, saw mill residues, used box, crate and pallet materials, etc. Very little is intentionally grown as firewood. Even the larger limbs of mango and other woods are used for particle board. An estimated 90 percent of all fuelwood comes from private timber lands or from private industrial operations. The ten percent or so coming legally from public lands is either sold at auction or cut on a firewood gathering permit. A far larger amount, no doubt, comes illegally and non-recorded from public lands.

Much of the firewood being generated as industrial process residue is sold to local people or given to plant workers directly from the plant. In rural areas, firewood is cut and sold in local villages, either by the owner or a firewood yard permit holder. Firewood is supplied to the larger metropolitan areas by contractors, who buy it from timber owners, smaller contractors and yard operators, or from large industrial generators of wood residues.

Logs and wood products from overseas are generally imported by the large companies who will use them. This is certainly true for the companies importing pulp. It would be normal for them to have the administrative work done for them by import agents.

Supply and demand - for timber and wood products have been in balance since 1979/80. Both wholesale prices and deflated

wholesale price indexes grew strongly from 1964/65 until 1979/80, when they leveled off or actually declined somewhat. (1) The increase in both timber and firewood wholesale prices was very strong between 1974/75 and 1979/80 - well above the long term regression line growth. This increase in price and apparent demand for timber is attributed to a construction boom in Pakistan during this period. The oil crises of 1974 caused an economic boom in the Mid-East. Large numbers of Pakistani workers were employed there and their repatriated earnings created the construction boom back home. By 1979/80, oil prices had dropped dramatically, the money faucet was turned down, and demand for timber and wood products in Pakistan returned more nearly to normal.

The run up in firewood prices from 1975/76 to 1979/80 may have been influenced by the skyrocketing cost of petroleum and alternative fuels during the same period. Since 1979/80, the average annual retail price of kikar firewood in Karachi has risen 187 percent, and the deflated price also rose 10.82 percent indicating some tightening in supplies relative to demand. The arrival of the Afghan refugees into Pakistan during this time may have been a contributing factor. However, firewood prices are also influenced by other factors, such as the prices of alternative fuels. After a rapid run up in price between 1974 and 1980, world petroleum prices declined considerably and remained relatively stable until the present difficulties started in the Mid-East this year. The moderating influence of petroleum prices in that period could be reversed now that petroleum prices are back up to historic peaks.

Prices of firewood (Kikar) in important markets for 1987/88 were: (Rupees per 40 kg. maund) Karachi 39.46; Lahore 39.96; Sialkot 39.33; Rawalpindi 44.72; Peshawar 40.20; Quetta 34.52; and Islamabad 45.00. Firewood prices are analyzed in Appendix IX.

An analysis of the average annual wholesale prices of timber at the Karachi market showed that although actual prices apparently rose strongly between 1975/76 and 1987/88, it was due to inflation. The deflated price index for all major species declined during this period. This is summarized in Table 12 and detailed in Appendix VII.

Table 12 - Average annual wholesale prices of timber at Karachi: changes in actual prices and deflated price indexes between 1975/6 and 1987/88 (2)

<u>Species</u>	<u>Actual prices</u>	<u>Deflated index</u>
Shisham	+ 66	- 35.88
Deodar	+ 144	- 5.80
Partal	+ 119	- 15.33
Chir pine *	+ 56	- 32.38
Kikar (Babul)*	+ 83	- 20.75

 * For the period 1976/77 to 1987/88.

This decline in real price since 1975/76 and 1976/77 would indicate no relative decline in the availability of average quality of wood of these species during the period. However, there may be a decline in the quality of wood of these species reaching the market. A look at the average sale rates of shisham timber at the Changa Manga Sale Depot reveals prices for high quality wood rising much faster than those of lower grade material, during this period. (2) Shisham IR grade logs increased 759 percent in actual price and 231.64 in deflated index; for lower grade IIIR shisham, the actual price rose 437 percent and the index 107.30. The average sale prices in 1987/88 at the

Depot were Rs.12,376 per cm for the IR Shisham and Rs.3001 per cm for the IIIR. The average shisham wholesale price in Karachi that year was Rs.3708 per cm. This could indicate that the quality of logs for sale at Karachi in 1987/88 averaged much closer to the IIIR grade than to the higher IR grade. The details are shown in Appendix VIII.

The timber supply - demand situation is summarized in Table 13. The consumption values are based on a World Bank estimate of 0.0239 cubic meters per capita for Pakistan and a population increase of three percent per year.(2) Recorded volumes for the ~~output from state controlled lands and import volumes are~~ subtracted from total consumption to estimate the volume of timber coming from private timber lands.

Table 13 - Summary of the timber supply
and demand situation in Pakistan from
1980/81 to 1988/89

(Thousand cubic meters)

State controlled							
Year	forests		Imports		Private lands		Consumption
	Volume	Percent	Volume	Percent	Volume	Percent	Total
1980/81	255	12.2	777	37.2	1,057	50.6	2,089
1981/82	295	13.7	534	24.8	1,323	61.5	2,152
1982/83	309	13.9	664	30.0	1,244	56.1	2,217
1983/84	420	18.4	819	35.9	1,044	45.7	2,283
1984/85	503	21.4	862	36.7	987	41.9	2,352
1985/86	424	17.5	818	33.8	1,180	48.7	2,422
1986/87	519	20.8	1,097	44.0	879	35.2	2,495
1987/88	547	21.3	1,094	42.6	929	36.1	2,570
1988/89	482	18.2	1,243	47.0	922	34.8	2,647
Percent change	89		60		(13)		27
Average per year	9.89		6.67		(1.44)		3.00

Source: The State of Forestry in Pakistan. Pakistan
Forest Institute. Peshawar. 1990. Pgs.84-86.

This analysis has covered the wood products markets in general, now the market segments covered by the market surveys will be commented upon, as appropriate.

Sawn wood - is probably the largest market for timber next to firewood. As mentioned in the survey, it is highly dispersed into small production units. One third of the production of the mills studied was contracted as a service to an end user who provided the round wood and specifications for the product.

Another very large amount of the sawn wood is used in further processing by the owner of the saw mill, such as boxes and crates, pallets, furniture, carpentry shops making door and window frames, stairways, etc. Other saw mills are operated by particle board and plywood mills to salvage good wood from the raw material stream and to convert peeler cores into core stock for block board. The rest is sold in small shops, stalls and wood yards.

There is little information available on current sawn wood prices; volumes produced; or markets being served. The survey conducted in conjunction with this report provided a very useful profile of the saw mill units, but because of the huge number of non-recorded saw mills existing, it was not possible to extrapolate the sample results to make nation-wide estimates.

Saw mills in Pakistan are serving their markets closely and well. Unlike the giant, well structured, and comprehensively documented sawn wood markets in the industrialized countries, saw mills here are very small and generally sell to specific well known customers. It makes it difficult to compile national timber consumption statistics, but there would seem little value in trying to structure this informal market more definitely at this stage of its development. If more structure is desired, sawmiller's associations would be the best approach - perhaps one in each major metropolitan area. They could lobby for favorable legislation, lower taxes and duties, compile production and sales statistics and, perhaps one day, set and enforce lumber grades and standards.

Veneer and plywood - markets share several traits with sawn wood: little is known about them; they usually work closely with their customers or are owned by the users of their output. Khan & Sheikh found the seven plywood mills they surveyed to average

61,190 square meters of plywood; 30,500 sm of flush doors; 27,530 sm of block board; and 3,160 sm of veneer.(8) There are now said to be 17 plywood mills operating in Pakistan, so a very crude idea of present production might be: plywood 1.04 million sm; flush doors 0.52 million sm; block board 0.47 million sm; and veneer 0.05 million sm. Veneer imports in 1988/89 were 641 metric tons, which would be around 1.068 million sm (1 mm basis). Plywood imports of 159 metric tons would come to about 0.088 million sm (3mm basis). This would very crudely put present veneer consumption at 1.12 million sm and plywood at 1.13 million sm of plywood.

This is an important industry. If there are only 17 plants operating, it would only take about a month for someone to make a 100 percent survey to provide full, up to date information about it. It would be very helpful if PFI would add a table showing the production of veneer/plywood/block board/flush doors in their annual publication, "The State of Forestry in Pakistan.

Particle board/medium density fiber board/hard board - are among the new reconstituted wood-based panel products that will have a bright future here. Particle board production has grown steadily from 11,355 tons in 1975/76 to 36,230 tons in 1987/88, a gain of 219 percent or an average gain of 18.25 percent annually.(2) Furniture is the major market in Pakistan for this product. The furniture segment profile study indicated that particle board is being used by 68 percent of the furniture shops, but of those using it, only two panels per month are being used. Advertising, product promotion, education and experience with the product will be needed to increase that amount to its full potential. The big market will be a modern panel-based residential and office furniture industry. This will be discussed in due course.

Veneer board or "venboard" is a product rapidly gaining acceptance in South Asia. It is wood veneer laminated over particle board to make a finished panel usually 0.75 inches thick (19mm). It is used in lieu of plywood in furniture and paneling. It has the look and feel of real wood, but is much less expensive and more stable in dimension. The board presently being made has a very coarse single layer core, which necessitates using thick decorative veneer to avoid the roughness showing through the final surface. Better quality particle board will result in better quality venboard, as well as substantial savings in the cost of decorative veneer.

Medium density fiber board is still a small, but among the fastest growing, segment of the reconstituted panel market. In the USA, it has about 10 -15 percent of the particle board market. Thin MDF is currently flooding world markets as an underlayment in decorative 3mm - 5mm panels for use in furniture and paneling. It replaces 3mm hardwood plywood and hard board. However, until Pakistan develops a much larger and more sophisticated furniture industry, there will probably not be room here for an MDF plant. Al-noor Sugar Mills has recently started operating an MDF plant based on bagasse, and appear to be learning that grim fact.

Hard board is an industry experiencing hard times and with a future even more grim. As mentioned previously, it is rapidly being replaced on world markets by thin MDF - a better and less expensive product. By 1987, the domestic hard board industry was in crisis due to overcapacity and competition from lower cost, better quality imported board.(17) There was extensive under-invoicing by importers extending up to half of the actual price. In 1986/87, the Government reduced the import from 120 percent to 80 percent and the sales tax on hard board from 20 percent to 12.5 percent. At this point the imported board was priced below

the domestic board. However, in 1988, the Government retreated and restored the duty and tax rates to their previous levels. This bought a few more years of life for the industry.

It may be to the Government's interest to heavily subsidize its hard board industry to save scarce foreign currency, but in the long run there are surely better ways to spend its money.

Furniture - is a very critical industry for Pakistan. Producers and users are accustomed to high quality, custom made products based largely on high quality shisham wood. Now high grade shisham supplies are declining rapidly and prices are soaring. Buyers will increasingly have to choose between very expensive solid shisham furniture; solid wood of less desirable species at prices nearly as high; turn to furniture combining solid wood with particle board laminated with shisham veneer, as other countries have done; or do without.

An efficient modern residential and office furniture (including schools, hospitals, laboratories, etc.) industry based on particle board and other reconstituted wood panels would provide several important benefits: (1) it would expand the market by making good quality products available to the people at reasonable prices; (2) provide the market volume necessary to modernize and upgrade the particle board industry; (3) which - in turn - would provide expanded markets for the timber on private plantations; (4) extend remaining supplies of high grade shisham by enabling them to be used as decorative veneer over reconstituted wood panels; and (5) make it possible to introduce more automation and computer-controlled processing to at least the leading companies in the wood products industry.

The government would have to cooperate by keeping taxes reasonable and, perhaps, encouraging the import of necessary production equipment and hardware with suitable tax incentives, low cost loans and credits. Beyond this assistance, a new furniture market can best be developed by the private sector. The most logical steps would be to: (1) establish panel laminating - both wood veneers and plastic laminates - facilities at the particle board plant (Both particle board plants visited were already doing this and had plans to expand these efforts); (2) establish a modern panel-based furniture plant in conjunction with the particle board plant and a saw mill; (3) form a wood panel industry association to coordinate with the Government; set industry quality standards; collect and distribute industry production and marketing statistics; help arrange for someone to domestically manufacture the high quality specialized hardware needed for panel-based furniture; and through the combined resources of the association: and (4) promote the market for wood by; aggressive advertising, trade shows, training seminars for custom furniture makers on techniques for working with wood-based panels.

Such an approach should help break out of the present "chicken and egg" syndrome - without good furniture at reasonable prices there is little market; without a market there is little good panel-based furniture. The government should watch industry efforts to improve this situation and encourage them wherever possible.

Truck & bus body, tractor trolley and boat building - is a small, stable industry segment that doesn't need a lot of discussion. It has 55 manufacturing units that turn out 309 truck, 276 bus, 55 mini bus, 47 ambulance and 18 trolley bodies a year. The industry has no wholesale or retail sale marketing. It caters to the needs of its clientele through work undertaken on a contract basis.

The boat segment consists of only five active firms making an average of 14 wooden boats per year. This work is also done on a contract basis to specifications provided by the client.

This small segment of the wood products industry should continue as at present with little change or scope for change in size, products or volume.

Railways - use wood for sleepers and in building carriages. It has been the railway's intention to replace wooden sleepers with reinforced concrete sleepers in about 20 years. However, actual sleeper replacement chronically lags behind these dramatic plans and replacement sleepers, in turn, have to be replaced with more wooden sleepers, as production of the reinforced concrete sleepers also lags behind schedule.

The production of carriages is also behind schedule. The slight growth in output is offset by decreasing use of wood, which is slowly being replaced by alternative metallic and plastic materials.

The Railway now uses an estimated 2,000 cm (round wood) of shisham and 17,140 cm (round wood) of deodar annually. (6) It is expected that this market segment will remain at around 20,000 cm (round wood) per year for the next decade.

Wood-based sports equipment - is a successful cottage industry strongly oriented to export markets. Its markets, opportunities and challenges are well covered in the industry profile by Envoforestry (Pvt.) Ltd. (7) The high points are that the pattern of export markets has changed since 1985/86. The export of quality rackets has almost ceased, and the cricket bats exported now are mostly toys. However, exports of hockey sticks have increased substantially.

Hockey sticks from this Country are considered the world's best and some 800,000 are exported annually. About 80 percent of the sticks produced are exported and the rest used here. The demand for this product is expected to grow steadily.

Pakistan, once famous for making good quality rackets, especially Sialkot hand made wood-catgut tennis rackets, has been virtually wiped out of this export market since 1984 by rackets made with frames of aluminum, fiberglass, graphite and other synthetic materials, and by lower manufacturing costs in South Korea, Taiwan and Japan.

Unlike other sports equipment, 70 - 90 percent of the cricket bats are used domestically and only 10 - 30 percent are exported. Substitution of poplar for willow has had little adverse effect on the bat market, which is now largely comprised of amateurs, not professionals.

South Korea, Taiwan and Japan, who have been competing with Pakistan for international sporting goods markets, are now being handicapped by increasing wage rates in their countries. The competition is shifting to Malaysia, Indonesia and the Philippines where labor rates are still low and wood and other raw materials are readily available. To keep abreast of the competition, the Pakistan industry should consider and the Government encourage joint ventures with foreign companies to gain access to markets, capital and technology.

Envoforestry (Pvt.) Ltd. makes several good recommendations for the industry; continue emphasizing quality products, instead of sliding into cheap goods; broaden its product base; modernize and introduce new machinery; develop a means of introducing new technology; a market research capability to forecast trends and new product needs; and keep the business in the private sector.

Mining - uses wood for pit props and mine planks. Coal mines are the major wood users. (24) Coal production by Province in 1989 was: Balochistan 2.115 million tons; Sindh 1.708 million tons; Punjab 1.085 million tons; and NWFP 0.167 million tons for a total of 5.075 million tons. This is expected to increase to 6.903 million tons by 1992, according to the Planning Commission's Seventh Five Year Plan.

The TurkPak Study determined that the use of wood per 1,000 tons of coal varied with province as follows: Sindh 22 cm; Punjab and NWFP 30 cm; and Balochistan 43 cm.

Brick kilns, cement factories, WAPDA (Water and Power Development Authority), and Pakistan Railways are major coal users. The demand for bricks is expected to increase by 2.9 percent per year. WAPDA's coal requirements will increase by 0.7 million tons by 1992. Demand for coal by Pakistan Railways is expected to decrease as locomotives are converted to diesel. It is estimated that coal production will increase at a rate of 3 percent per annum and that 11.8 million tons of coal will be produced by the year 2,000. Further, that the wood required to mine this coal will decrease from 30 cm per 1,000 tons in 1990 to 26 cm per 1,000 tons by the year 2010 due to more efficient use of wood and new technology. Thus 307,000 cm of wood will be required for production of 11.8 million tons of coal by 2010.

Babul (*Acacia nilotica*) is the species preferred, and made up 90 percent of the wood used by mines in 1987/88.

Current events may influence this projection of coal and its associated wood use. Present calls by the Government for greater economic self reliance may encourage greater use of domestic coal as fuel and decreased reliance on imported oil. The difficulties in the Persian Gulf and the resulting record

prices for oil and petrol should also make domestic fuels look more attractive. These influences may significantly increase the wood needed for this industry, at least in the near and mid-terms.

Matches - are a major user of poplar grown on private plantations. The market for wooden safety matches has been growing at the rate of 26 percent a year. Now the Pakistan industry has expanded sales overseas, especially to the Middle East and Europe. However, the production of tobacco in Pakistan has stabilized at an average of 24,000 m tons since 1980/81.(9) That might indicate that the growth rate of matches could also level off in the domestic market, at least. In that event, continued future expansion would depend on expanding overseas markets.

Pulp and paper - is one of the major and fastest growing markets in the Pakistan economy. Its technical aspects have recently been intensively reported upon by G. Wire (26) The apparent consumption of paper and paper board in the Country grew 222 percent between 1975/76 and 1987/88, an average of 27 percent annually. This growth is shown below in Table 14.

Table 14 - Apparent consumption of pulp, paper
and paper board in Pakistan
1975/76 - 1987/88
(Metric tons)

<u>Year</u>	<u>Domestic production</u>	<u>Imports</u>	<u>Apparent Consumption</u>
1975/76	30,916	78,527	109,443
1976/77	32,794	74,459	107,253
1977/78	34,463	76,918	111,376
1978/79	59,266	109,449	168,715
1979/80	59,175	109,329	168,504
1980/81	67,661	120,772	187,833
1981/82	73,586	129,976	203,562
1982/83	76,211	142,862	219,073
1983/84	73,491	177,461	250,952
1984/85	82,722	226,206	308,928
1985/86	75,894	209,335	285,229
1986/87	63,723	298,349	362,072
1987/88	65,457	286,876	352,333
1988/89	-	321,396	-

Source: State of Forestry in Pakistan. PFI. Peshawar 1990.

In 1987/88, domestic production was 19 percent of consumption, imports 81 percent. These imports of pulp, paper and paper board cost Pakistan Rs.3 billion (US\$140.1 million) in foreign exchange. The 65,457 tons produced here that year were comprised of: paper board 52 percent; packing paper 29 percent; writing paper 15 percent; and printing paper 4 percent.

Consumption of these products is estimated to increase as shown in Table 15.

Table 15 - Estimated increase in consumption
of paper products in Pakistan by 1999/2000
(Metric tons)

<u>Category</u>	<u>1988/89</u>	<u>1999/2000</u>	<u>Percent Increase</u>
Printing & writing	128,700	306,300	238
Packaging & other	74,900	181,300	242
Paper board & chip board	136,900	275,200	201
Newsprint	<u>51,800</u>	<u>131,300</u>	<u>253</u>
Total	392,300	894,100	228

Getting even a few of the major pulp mills in this industry to use domestic pulp wood for part of their requirements would provide a very significant market for plantation woods - especially eucalyptus.

Industry Trends

A look at trends should start with where we are at present and what we know up to now. Although the picture is far from complete, Table 16 summarizes what we have learned from the industry profiles and available information about the present requirements for wood by the industry.

Table 16 -- Present industrial wood requirements
(Cubic meters, percentages and rankings)

<u>Industry segment</u>	<u>Shisham</u>	<u>Deodar</u>	<u>Poplar</u>	<u>Kikar</u>	<u>Mulberry</u>
Poles	-	-	***	-	-
Saw mills	55%	27%	9%	4%	1%
Veneer & plywd.	***	-	*	-	-
Particle board	-	-	29,010cm	-	-
Hard board	-	-	-	18,308cm	-
Furniture	93%	5%	-	-	2%
Truck, bus & boat	651cm	10cm	-	32cm	-
Railways	18,000cm	2,000cm	-	-	-
Sports equip.	-	-	22,569	-	6,976cm
Mining	-	-	-	***	-
Matches	-	-	138,968cm	-	-
Wood yards	9%	4%	1%	80%	-
Tobacco	8,462cm	-	-	27,906cm	11,715cm
Brick kilns	**	-	-	***	-
Pulp	-	-	-	-	-

-----Continued-----

Note: *** denotes the relatively largest volume.

<u>Industry segment</u>	<u>Mango</u>	<u>Partal</u>	<u>Chir pine</u>	<u>Other</u>	<u>Total</u>
Poles	-	-	-	*	?
Saw mill	1%	2%	1%	-	?
Veneer & plywd.	**	-	-	-	?
Particle board	28,596cm	-	-	4,515cm	62,121cm
Hard board	-	-	-	659cm	18,967cm
Furniture	-	-	-	-	?
Truck, bus & boat	-	263cm	95cm	-	1,051cm
Railways	-	-	-	-	20,000cm
Sports equip.	-	-	-	11,490cm	41,035cm
Mining	-	-	**	*	162,929cm
Matches	-	-	-	-	138,968cm
Wood yards	-	2%	-	4%	?
Tobacco	-	-	-	47,185cm	77,000cm
Brick kilns	-	-	-	*	82,370
Pulp	-	-	-	-	?

Notes: Metric tonnes were converted to cubic meters assuming a 60 percent moisture content and densities for: poplar 390 kg./cm; mango and eucalyptus 705 kg./cm; and 745 kg./cm for kikar. Fuel wood for tobacco curing was converted only on the over dry weight density.

This table illustrates the importance of shisham, especially to the saw mills, furniture and railways, probably the three largest industrial users of wood. Poplar is extremely important to poles, particle board, sports equipment and matches. It will also be of great interest to the pulp industry, when they start domestic pulping of wood. Kikar is a species widely distributed throughout the farming areas, so is readily available for use by rural people. It is very useful for poles, hard board, comprises a very large percentage of wood yard inventories, and is an excellent fuel for domestic use, as well as for tobacco curing and brick kilns. Mulberry is mainly important to the sports

equipment segment and for fuel. Mango is presently the "life blood" to the particle board industry. Amongst the "other", 4,515 cm of eucalyptus is used for hard board, and 5,745 cm of willow by sports equipment.

The wood requirements for these industry segments were projected to 1993 on the basis of estimates from the industrial profiles. They are shown in Table 17.

Table 17 - Industrial wood requirements to 1993 (Cubic meters)

<u>Industry segment</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>
Poles	?	?	?	?
Saw mills	?	?	?	?
Veneer & plywd.	?	?	?	?
Particle board	69,327	77,369	86,344	96,360
Hard board	21,072	23,411	26,010	28,897
Furniture	?	?	?	?
Truck, bus & boat	1,050	1,050	1,050	1,050
Railways	20,000	20,000	20,000	20,000
Sports equip.	41,035	55,592	70,148	84,705
Mining	179,788	196,653	213,517	230,381
Matches	138,968	150,515	157,783	165,049
Tobacco curing	95,268	95,268	95,268	95,268
Brick kilns	82,370	84,759	87,214	89,744
Pulp	?	?	?	?

The unknown parts of this table fall into three groups: (1) poles are largely sold locally or used by the owner/cutter, so seldom get recorded: (2) the saw mills, veneer and plywood, and furniture are all part of an integrated lump and the wood use of each would be very difficult to sort out with any degree of

accuracy; and (3) wood pulping has tremendous potential as a market for plantation woods, but has yet to materialize.

Several trends are emerging from the foregoing analysis that are of tremendous importance to the timber industry of Pakistan.

1. A general decline is taking place in the quality of timber being harvested. This was demonstrated by decreases in the deflated average wholesale price index for shisham timber at Karachi of 35.88 percent since 1979/80, while the deflated average sale price index of grade IR shisham timber being sold at the Changa Manga Timber Depot increased 231.64 percent during the same period. This general decline in timber quality is obvious from a visit to any wood yard or saw mill, especially when a crooked rotten domestic log is compared with a large, straight, clear, sound imported log nearby.

A related quality problem is the appalling degrade taking place in coniferous timber being harvested from government and government "controlled" timber lands. It includes some of the nicest, most valuable high grade coniferous logs still available in the world. These are export quality logs that in Japan, Korea or North America would go into valuable clears, high grade shop and molding grades and be used in furniture, cabinets, trim, moldings, etc. Here, as a result of the government's ponderous and sluggish timber sale procedures, these valuable conifer logs lay around in the sun and weather for months - often years - before getting to a saw mill. By then, all of the high grade wood has been ruined by blue stain and deep seasoning checks and splits and the log has been de-graded to rough construction timber. In fact, the great bulk of coniferous wood in Pakistan is used in rough construction and for sleepers. A great waste of a unique and valuable natural resource!

The major effects of the general decline in log quality is already being felt by the veneer and plywood industry. Plywood formerly made entirely of shisham, now has shisham faces and core of mango or poplar. A large amount of the decorative veneer used in plywood, block board, flush doors, and veneer board is now imported or sliced from high quality imported logs. Defective logs are more difficult and expensive to process in saw mills as well. So costs are going up as the quality and value of the finished product goes down. It is also felt that more poles are being used in rural construction replacing sawn wood and that, along with great hulking "shade tree" logs, more smaller logs are also entering the market from private timber lands. This will certainly be the case as more short rotation timber from private plantations comes into the market. However, no statistical data was discovered that would substantiate or refute this concept.

2. Poplar is emerging as the premiere short rotation plantation timber for industrial use. Already an estimated 138,968 cm is being used for wooden safety matches; 29,010 cm for particle board, which would happily use it to replace another 28,596 cm of mango, if it were available; and 22,569 cm for sports equipment, a total market of 219,143 cm! In addition, it's the wood demanded for the large pole market, whose exact size has yet to be determined. It is also one of three species - along with conifers and eucalyptus - of most interest to the pulp industry.

3. Reconstituted wood-based panels are starting to replace solid wood and plywood in furniture. The furniture profile survey found particle board being used in 68 percent of the custom furniture shops sampled. True, the amount being used - only two panels per month - is meager, but it is being used. Markets for plantation timber, particle board, MDF, veneer and plywood, and sawn wood are all being suppressed by the lack of

a wood panel-based modern furniture industry in Pakistan. So this modest start is just the welcome harbinger of the furniture industry that must come.

4. The pending pulping of wood by the domestic pulp and paper industry. An additional market for 77,250 cm of eucalyptus or poplar plantation timber per year would be created by 1995, if the domestic industry used wood for only ten percent of its raw material needs. The Rs.2.2 billion per year now being spent to import pulp, could be reduced as much as 20 percent, a savings of Rs.440 million (US\$20 million).(26)

THE FARM WOOD PRODUCTS MARKETING SYSTEM

We have reviewed the forest industries of Pakistan in general, now let us focus specifically upon the marketing of wood products from private timber plantations.

THE DISTRIBUTION SYSTEM

There is a comprehensive wood distribution system in operation that is based on free enterprise and is generally serving the Country well. It operates almost entirely within the private sector and, although it's highly diversified small entrepreneur composition doesn't lend itself well to clear flow charts, it efficiently and economically allocates the timber resources to the different market segments. Although they may not be elated over the price or quality, anyone with wood to sell can find a buyer and anyone needing wood can find it.

In the basic channel of distribution, the timber grower - public or private - sells to a middleman or contractor who transports it to market and sells it to the end user. There are many variations of this model based on the scale of the transaction. At the small end, a farmer cuts down a tree and uses it for fuel or some product. Most timber harvested in Pakistan is utilized in this manner - for fuelwood or poles. Very little recorded data is available on this very major type of transaction, but estimates hover around 80 percent of the timber being used this way.

Next, wanting some money, the villager cuts a tree and sells it to his neighbor or piles it along the road for sale to passersby. This is still grower selling direct to user. This goes so well that the tree grower comes to the attention of a truck driver who would like a back haul so he won't have to

return to the city with his truck empty after hauling goods from the city to the country. The truck driver loads his truck with wood purchased from the villager and heads for the city. There he wants to sell the wood as soon as possible to return to what he does best, hauling things in his truck. So he sells it to a wood yard, who in turn, will find end users and sell the wood to them. This is the basic grower/middleman/user model. A group of growers may combine to hire a middleman just to find buyers for their timber. The middleman would be their agent. A large user - say a pulp mill - may contract with one or more middlemen to find wood for his mill. They would be buyer's agents. There are relatively few middlemen - four or five - that buy poplar from growers and small roadside pole yards and supply them to match factories all over the country. The many versions, modifications and combinations of these producer/distributor/user relationships are what makes the wood distribution system seem so confusing to an outsider. It's not. Everyone is getting paid to perform a needed function. Lamentably, there are also many others who involve themselves in the channels of distribution and get paid without performing any useful function. More on that in the section on trade difficulties and constraints.

Wood yards are the retailers in the distribution system. TurkPak does a good job of describing them in its profile study. "In the wholesale market, the commission agents start auction of the wood in suitable lots before dawn. Wood yard owners take part in the auction to purchase their requirement. However, wood can also be sold by negotiation after the auction in the wood markets. Credit sale is the usual practice, although concession is always available for cash payments. The yard owner usually settles the credit of the commission agents from the sale proceeds of his wood."

"A needy farmer may also bring the produce directly to the wood yard and this can be a good bargain for the yard owner because the farmer is unable to carry back his produce to his farm. However, such purchases are not a source of sustained supply, but are supplementary in nature. The yard owner prepares a comprehensive market plan for the entire volume of wood as well as individual logs. This market plan or "vand" assures him of the best use and best sale price for all items."

"Sales of wood and primary products to regular customers or retailers is not very lucrative. Better margin of profit is available from industrial users or consumers requiring wood for personal building construction. The later are generally accompanied by the "wood working expert". Even though the yard owner may never have seen or talked to the expert before, it is an unwritten law to pay him 5 percent of the total sale proceeds. This assures a good margin of profit for the yard owner by overcalculation of volume or mixing low quality wood with the better one. The casual customer may be losing up to 50 percent on his wood purchase."

Timber sold from public land goes through a cumbersome procedure before being sold to the middleman. Most public timber in most of the Provinces is grown and sold by the Provincial Forest Departments, except in NWFP, where it is so grown, but harvested and sold by the Forest Development Corporation (FDC). In the old days, the procedure was for the Forest Department to mark a stand of trees to be harvested. A public auction was then held, at which buyers would go to the forest, examine the trees and then make their bid. The winning bidder then cut down the trees and took them off to market. The logs could go directly to a end user or big city retail yard and arrive while still fresh. There was little time wasted between the cost of harvest and transport and getting paid upon delivery to the buyer.

Unfortunately there were abuses. The public forest officers were not adequately supervised and often let the buyers take more trees than they had purchased. In 1974, this practice was stopped in the NWFP. FDC was established in 1976 to harvest and sell Forest Department timber in that Province. It now harvests the timber - mostly old growth conifers - and skids it to landings in the forest. There it is stored until it can be loaded on a government truck and hauled to a sales depot, as much as 100 miles distance and well away from the forest. The point here is to keep the buyers entirely away from the forest, so they can't steal trees.

At the depot, the logs are sorted into piles (called "sub-lots") by species, size and grade. There they sit blue staining, drying and cracking in the sun until enough accumulate to hold an auction. These are held every six months or so. A time is selected and the sale widely advertised. It is attended mostly by middlemen or contractors, but also by some of the larger users. The bidders examine piles of logs of interest and prepare their bids. Meanwhile, the Forest Department establishes a "reserve" or minimum price. The Punjab Forest Department bases this reserve price on an average of the prices obtained at the last few sales. FDC has a pricing committee that considers several factors in setting the reserve price, including recent sale prices, but also taking into account other factors influencing the market. The bidders bid on each pile of interest to them. The logs are awarded to the winning bidder, who pays 10 percent down and the balance on pickup within two months. Included in the sale price is the cost for FDC to haul the logs to the address designated by the winning bidder. All payments are handled by a bank. FDC has no money at risk. FDC also sells sawn wood from Dir Forest Industries, which is owned by the NWFP government. It is believed that the Forest Departments in other Provinces sell timber in a similar fashion.

Private timber lands in the mountains of NWFP are managed or "controlled" by the Forest Department and their output harvested and sold by FDC. These private timber lands must have a management plan prepared or approved by the Forest Department. When ready for harvest, FDC foresters mark the trees to be cut; hire logger to cut the trees and skid the logs to roadside. A different contractor is hired by FDC to haul them to the FDC log depot, where they are sold along with the public logs.

After the sale, if the logs were sold, the money from the buyer goes to the FDC bank account, where it languishes until all of that lot of private logs are sold. This may take a couple of years, if the reserve price is too high. When the logs are all sold, FDC deducts all of their expenses connected with the sale. Then it is necessary to wait until the Price Committee meets - every three months to a year - for them to allocate the proceeds to the Forest Department, FDC, and the residual to the private owner. It commonly takes three to four years or more for the owner to finally get all of his money. However, the FDC makes advance payments, as necessary, to enable the owner to survive until this process runs its course. The last payment is withheld until all details are finalized. FDC has no control over private forest lands in the low lands, only in the hills.

The middleman or contractor provides essential, but little appreciated, services at generally reasonable charges. That tree on private land must be harvested, transported to market and sold to a user. Along the way are permits, taxes, fees, gratification payments and other assorted costs to be paid. Someone has to arrange for and schedule the transportation. Find buyers and locate wood suitable for them. Often credit must be extended both to growers and buyers of farm timber. These are the services that the middleman performs. In the case of public timber sales, the government provides these services and then

charges the seller (in the case of private timber they "control") or buyer (in the case of the winning auction bidder) whatever the costs. This "cost plus" basis is not famous as a way to minimize costs. Industrial buyers, such as pulp mills or particle board plants that decide to buy directly from the farmer will have to perform these services, or "buy at the gate" and let the farmer worry about the problems. A large middleman with a good volume of business is generally in much better position to make all of these formal and informal payments than a private land owner, who harvests his timber only at intervals of five or six years.

MARKET REQUIREMENTS

There is very little inventory data available on the timber growing in private plantations. However, it has been estimated that the species composition is: Eucalyptus camaldulensis 65 percent; Acacia nilotica 15 percent; Poplar spp. 10 percent; semal 5 percent; shisham less than 5 percent; and all others less than 1 percent. (26) The annual volume of E. camaldulensis available in the next 15 years is thought to be as follows:

Table 18 - Yield estimates of Eucalyptus camaldulensis available on private plantations for the years 1995, 2000 and 2005 (Thousands of cubic meters)

<u>Tree farm circle</u>	<u>1995</u>	<u>2000</u>	<u>2005</u>
Kohat	13	19	20
Pindi	99	144	150
Lahore-Faisalbad	60	87	91
Multan	<u>52</u>	<u>76</u>	<u>79</u>
Total	224	326	340

Since eucalyptus represents 65 percent of the trees planted, a rough estimate of the other species volumes in 1995 would be: acacia 52,000 cm; poplar 43,000 cm; semal 17,000 cm; shisham 7,000 cm; and others 2,000 cm.

Populus deltoides is enjoying enthusiastic market acceptance. It is the premiere' wood for safety matches, and is highly desirable for poles, particle board and sports equipment. The market would happily accept a great deal more poplar than is now available.

The match companies want short sections of poplar round wood with a minimum diameter of 5 inches and length of 5 feet. Pieces averaging 6 to 8 inches in diameter are ideal. The wood should be as fresh as possible, not more than a few days from being cut. A match plant in Peshawar is now paying Rs.48-49 per 37.32 kg. maund delivered to their plant for such material.

Particle board producers will take poplar down to a minimum diameter of 3 inches. It must be 2 feet or more in length and free from rot. Heavy blue stain will show up in the finished board and is not desirable. Mills in the Jhelum area are paying Rs.32 per 40 kg. maund for wood delivered to their plants. The sports equipment manufacturers want poplar in larger size logs for sawing. When the pulp mills start using poplar, they will probably also want a minimum 3 inch diameter, with a length of 5 feet or more. As their wood will have to be de-barked prior to processing, the pieces will have to be long and straight enough to readily go through their de-barkers. This will require pulp wood users to compete in the pole market, and not in the firewood market for their raw materials.

Eucalyptus camaldulensis, lamentably, is meeting strong market resistance. It is basically an industrial raw material

and excellent for pulp wood, which will become its major market. It will also be very good for particle board and hard board, especially when used with poplar. Eucalyptus should also have an important role to play in pole and pit prop markets, when users become more familiar with it. Now complaints are that it splits badly and warps and twists when dried. Proper handling during drying will minimize these problems. It grows with reasonably good straight form and is stronger than the poplar now popular for these purposes. Its use for poles and pit props could be further enhanced, if it proves possible to increase its durability with low cost and simple preservative treatment using borates. Eucalyptus is widely used around the world as fuel in the form of biomass, firewood and charcoal. The wood burns rapidly with a relatively smoke-free (if dry) flame, but forms few coals and doesn't last very long.

Acacia nilotica (kikar) is a native hardwood commonly found in farm lands in the frost-free zone of the Country. It is a dense, durable wood useful for many things that rural people need - posts, poles, tool handles, charpoy cots, firewood, etc. Plantations of this wood have been encouraged in Sindh Province. It is a relatively fast growing tree (7 to 10 year rotations), and is a legume that helps add nitrogen to the soil. Its leaves are good fodder. Its acceptance is assured in rural markets.

Kikar is very desirable for making hard board, and is the preferred fuel wood for brick making and tobacco curing. It provides a steady, hot, relatively smoke-free flame that is very long lasting. Kikar pit props support the coal mining industry and their supply is the main reason for acacia plantations in Sindh. Table 19 gives pit prop specifications and the prices recently (13 May 1990) paid for them.

Table 19 - Pit prop specifications and corresponding prices as of 13 May 1990.

<u>Length</u> (Cms)	<u>Mid-girth</u> (Cms)	<u>Volume</u> (Cubic meters)	<u>Price</u> Rs./each
180	22.5-32.5	0.011	6
180	34 - 45	0.024	15
210 - 240	35 - 45	0.030	22
270 - 300	35 - 45	0.038	31
330 - 360	35 - 50	0.053	51

Source: Sirhindi, B. Production of mining timber in Sindh. Proc. Wood Producers-Users Seminar. Lahore, Pakistan 13-15 May 1990.

Seral (*Salamalia malabarica*) is also a common native hardwood. It often grows as a very tall, straight, solitary tree in open pasture lands and along the borders of cultivated fields. Many consider these big trees objects of great beauty and feel they should not be cut, but preserved for their aesthetic benefits. The wood is somewhat like poplar, but less dense and not as strong.

Shisham (*Dalbergia sissoo*) is one of the most useful and desirable woods native to Pakistan. It is highly in demand for sawn wood, veneer and plywood, furniture, and railway sleepers. Its residues are valued by the brick and tobacco producers as industrial fuel. However, it is long cycle tree and may take 60 to 100 years to grow the clear, finely textured, richly colored wood so highly valued. There is every reason to continue managing natural stands - especially those in public forest lands - for this treasured timber. But how economically attractive it may be as an investment in private plantations remains to be seen.

The strategy for marketing timber from the private plantations should be to go for the big users, build a large dependable base, and then diversify selling efforts into smaller, but higher value, market segments! This will be critical for eucalyptus. It is essential to avoid a program disaster similar to that in north west India, where the planting of eucalyptus was strongly encouraged on a vast scale without adequate consideration of suitable markets.(20) When the plantations matured, the timber could only be sold as firewood at rates far below the owner's high expectations, and often at a considerable loss. This disillusioned many of the most progressive farmers in the region, who felt that they had been misled and swindled by the Government. Most paid Rs.5 per tree to dig out the stumps and put the land back into marginal agriculture. They had no interest in even waiting for the coppice crop.

Considerable progress has been made towards developing an industrial market for eucalyptus in Pakistan. Progressive leaders in the pulp, particle board and hard board industries are presently conducting trial runs to evaluate the wood for use in their products, or are considering such activities. Success in selling even a few of these companies on the use of eucalyptus would provide the critical base for the market. With an assured market for growers, and planting and wood flows increasing, alert farmers and small entrepreneurs could start pulling out some of the best trees to sell as poles or pit props at higher prices. Other uses will develop as the resource becomes widely available and better known.

TRADE DIFFICULTIES AND CONSTRAINTS

Anyone attempting to harvest, buy or move wood around Pakistan is subjected to an array of harassing permits, taxes, duties, and on occasion, some officials must be given

"gratification payments" to collect the tax or issue the permits. A person who must earn his living in such a corrosive environment has to learn to play the game in order to survive as an economic entity. This gives the professional trader - the middleman - a great advantage over a novice, such as a small farmer who wants to take his trees to market only once every few years. Some of these problems will be examined below.

Permits and licenses - regulate the movement of timber and firewood in NWFP, Rawalpindi, Civil Division of Punjab, and Sindh.(24) In NWFP, the Forest Department issues a permit for transport of firewood upon payment of Rs.50 per truck, and for timber of Rs.123 per cubic meter. This fee is imposed irrespective of the source of the wood, i.e. government forests, private land, tribal areas, or imports from Afghanistan. In Attock, Rawalpindi and Jhelum Districts (Punjab), the Divisional Forest Officer (DFO) issues a permit for movement of wood after satisfying himself of its source. No fee is charged for this transit pass. Deodar is a state tree in NWFP and it cannot be felled from private property without government permission. In practice, this rule is not seriously observed. Similarly, the Government's permission is necessary for felling of trees in Rawalpindi District or from within five miles of the international border. In Sindh, permission of the concerned DFO is necessary for movement of wood within the Province. The Sindh DFO issues the transit pass (TP) on the basis of a "no objection certificate" (NOC) issued by Mukhtiarkar and the agreement deed executed between the land owner and purchaser of the timber.(24) The harvest site is also visited by a representative of the Forest Department, who verifies the "bonafides of the wood." The permission of the Conservator of Forests is required for transport of wood out of the Province.

This system of obtaining permits and transit passes is very difficult.(24) A ban on tree cutting in certain parts of the country is a further constraint to the smooth flow of wood supplies. Similarly obtaining NOCs from revenue authorities for transit of wood is a big hurdle in the movement and supply of wood. The users and wood dealers have to spend substantial time, energy and money to procure such permits.

"In theory, transit passes on the movement of wood and timber in Sindh and Jhelum/Pindi Districts of Punjab are granted free of charge by the Forest Departments. In practice, significant expenditure is incurred by wood dealers on travel, verification from revenue authorities and obtaining TPs from the Forest Department. Similarly obtaining permission of the competent authority to cut trees from proprietary lands within 8 km of the (international) border or in Rawalpindi District (Punjab) is a time consuming exercise which involves hidden expenses. A number of check posts set up by the forest/police departments at Chowk Mari, Sukkar and Jacobabad (Sindh), Turnaul, Jhelum, Murree (Punjab), Khairabad, Peshawar, Abbotabad (NWFP) cause considerable botheration to wood transporters in addition to financial burden of varying extent. All of this avoidable expenditure adds to the high cost of wood."(24)

Taxes are also lousy. An advance income tax of 3 percent is payable on all purchases of wood from the Government. Small traders of firewood whose annual net income is much below the taxable minimum, have also to pay this tax.(25) In theory, the advance tax is refundable to those assesses who do not fall within the income taxable bracket. In practice, this is never done. The traders are too poor to pursue the refund case and the procedure for refund is too difficult to be of any practical use.

A 12.5 percent sales tax is also payable by purchasers of firewood from the Government.

"District council export tax is even more harsh. According to the schedule of rates fixed by the Government, it should be 2 percent of the value of produce. It is, however, fixed at 10 percent of the value. The district councils auction out the export check posts to contractors, who charge up to 100 percent of the value of the wood as export tax. These contractors are influential gangsters and they pay gratifications to police, district administration, district council administration and all concerned officers, including the ministers of local government departments. As such, they are immune from accountability."(25)

Other taxes include the municipal council octroi tax and the union council tax. Their extent varies in different areas.

Governments must tax their people to pay for necessary services, but here the Government seems to be feeding too low in the food chain. Consideration should be given to easing the tax burden on raw materials and, instead, seeking nutrients higher up among the finished products where the value base is much better able to bear taxes. There also needs to be some agreement between all of the taxing authorities on the definitions of different wood products and stages of processing. Poles should be taxed at a rate above firewood, but lower than saw logs. Wood for pulp mills and particle board plants should be tax free or taxed at a lower rate than residential firewood, because they also must pay taxes on the higher value of their finished products.

The amount of time wasted waiting to pay taxes on the road, as well as the myriad of small petty tax payments and their accompanying "gratification payments" could be greatly reduced

by selling tax coupon books or issuing long term comprehensive tax permits or passes. No citizens of any country should have to pay bribes to government officials!

The lack of standards within the timber industry needlessly wastes wood and creates unnecessary costs. This is a major constraint on the modernization of saw mills. Wood is wasted by cutting logs to random lengths in the woods and then having to re-trim to the correct length for plywood peeler blocks or for common size finish products as doors, windows, etc. A lack of standard construction sizes results in a lack of standard sizes for doors, windows, almirahs, plumbing fixtures, etc. This is another matter that will have to be sorted out before modern furniture and wood-based panel industries can be established in Pakistan.

THE TRANSPORTATION SYSTEM

Most trade and commerce in the Country moves on large diesel trucks. An excellent - if a bit overloaded - highway system connects most of the cities and towns. The major metropolitan areas are also connected by rail, but little wood uses this mode of transportation.

In the agricultural areas, local trade moves on the ubiquitous tractor trolley - a rugged truck body-like trailer pulled behind a farm tractor. Supplementing these vehicles are a creative assortment of animal carts and wagons pulled by a wide assortment of beasts, including donkeys, buffalos, oxen, horses and camels. There is no lack of good transportation in Pakistan.

There are, however, temporary interruptions of a seasonal nature and strikes and political turbulence frequently disrupt the smooth flow of traffic. During seasons when certain crops

are harvested, trucks get tied up hauling them and are unavailable for other purposes. This happens in any country. Particle board producers know when these seasonal shortages will occur and build up inventories of mango limbs to tide them through the lean periods.

Trucks are often operated by their owners, who are very competitive entrepreneurs. They hate to operate their trucks empty and are always on the lookout for back hauls. They are often willing to back haul just to cover their operating costs and sometimes without making a profit from a given haul. Much of the wood products flow seems to be going in the back haul direction and benefits from incredibly low freight costs as a result. Freight alone costs only around Rs.315 (US\$14.34) per metric ton to haul match wood from Peshawar to Karachi, a distance of 1728 km (1,036 miles).

Most of the timber in the Country is grown at the opposite end from Karachi, the sea port. This puts the industry at a disadvantage for exporting wood products and raises the cost of importing logs and sawn wood. This problem has had little effect on the highly successful export trade in sports equipment, which is low in volume and high in value. Top of the line items could probably even be air lifted overseas.

DEMAND WITHIN TRADE AREAS

There are really no geographic trade areas in Pakistan, except perhaps for some remote mountain valleys. The Forestry Planning and Development Project has concentrated on the Kohat, D.T. Khan, Pindi, Lahore-Faisalbad, Multan, D.M. Jamali and Khipro areas because that was where the land suitable for farm forestry is located. The market area supplied by each wood product production unit will depend upon the size of the unit

and the type of product. A small village saw mill and carpentry shop will serve its community and a few kilometers beyond. Pulp mills, particle board plants and hard board plants will draw their raw materials from a radius of 167 km.(100 miles) or more and sell to markets anywhere within the Country. The rest of the industry falls somewhere in between.

The geographic size of the market a manufacturer can economically reach will be different for each one. It will also not be round, but with long tentacles extending far out along main lines of transportation, such as main highways, rail lines, and navigable waterways. It will be squeezed smaller by mountains, areas lacking good road systems, lakes and ocean inlets, etc. A market area can also be influenced by the direction of trade. In the case of wood products, they benefit from low cost back hauls to the cities in trucks that have brought manufactured and processed goods from the cities out into the country-side. So the market area for most wood products is pretty much nation-wide.

Plantation wood supply/demand situation for the Country as a whole is shown in Table 20. However, the supplies and users are not uniformly distributed and local imbalances may exist.

Table 20 - The supply and demand situation
for three major plantation timber species.

(Cubic meters)

<u>Species</u>	<u>Supplies</u>	<u>Demand</u>	<u>Difference</u>	<u>Major user</u>
Eucalyptus	224,000	80,300		10% of pulp
		9,500		0.3 of PB
		<u>1,200</u>		Hard board
		91,000	133,000	
Poplar	43,000	9,500		0.3 of PB
		22,600		Sports Eqpt.
		<u>139,000</u>		Matches
		171,100	(128,100)	
Kikar	52,000	18,300		Hard board
		28,000		Tobacco
		13,800		Wood yards
		<u>40,000</u>		Brick kilns
		100,100	(48,100)	
Total	<u>319,000</u>	<u>362,200</u>	<u>(43,200)</u>	

Source: Supplies: Wire, G.G. "Study of Tree Farm Wood Utilization for Wood Pulp Production in Pakistan." For. Plan. and Dev. Proj., GOP-USAID. Islamabad, Pakistan 16 Aug. 1990. Demand: Table 16 - Present industrial wood requirements. Page .

This estimate is based on present industry wood requirements and estimated 1995 timber availability. Eucalyptus is clearly the over supplied part of the market. Its successful marketing will depend on getting pulp and particle board producers to use greater percentages of it in their products, and in finding other

new uses for it. Still, it's obvious that a lot of eucalyptus may end up as firewood.

IMPROVING THE MARKET STRUCTURE

The present free market system based on middlemen is working well and it's hard to see how any major changes in the structure would improve the system. One avenue to consider would be a timber growers association, such as the "Tree Farmer's Association" in the USA. Members could pool their resources and hire their own "middleman" to seek out better markets for their produce. However, such associations have had very limited and uneven success in South Asia.

Another option would be for one or more of the large industrial wood users, say a pulp or particle board company, to set up a purchasing system. They could combine the services of middleman, and perhaps farm forester, to better serve themselves and their supplying farmers. This sort of purchasing/collection system is being used to buy bagasse and possibly grass. Two of the pulp mills considering wood pulping have expressed interest in participating in such an effort.

At present, and probably for some time to come, tree farmers will continue to rely upon their farm forester for advice on marketing their timber. This service is working well at present, but it remains to be seen how effectively it will survive the present Forestry Planning and Development Project. The growers have more vested interest in the profitable marketing of their timber than does the Government, and it seems reasonable that responsibility for marketing it should remain in the private sector.

MARKET NETWORK REVIEW METHODOLOGY

There is a need to make current price, market trends and news, new technical developments, new species, economic returns analyses, etc. information available to the private tree growers. This is currently being done by this project through the services of their farm extension forester, a newsletter, grower-user seminars, short courses, field demonstrations, etc. The question is how to continue these services in the future?

The plan is to have these services carried on by a farm forestry department in the concerned provincial forest departments. Extensive preparations are being made to do this in Punjab. Hopefully this effort will continue and be successful. Another possibility would be for a tree growers association to take over this responsibility. Perhaps an association would be more successful with a comprehensive and useful program of services to perform, than have those formed solely as lobby groups to demand government benefits.

There are also similar extension programs in agriculture that work with many of the same private farmers. It may be possible for them to publish timber market and technical information along with their regular crop and agriculture reports. This possibility should be investigated further.

MARKET TRAINING FOR PROVINCIAL FOREST DEPARTMENT PERSONNEL

The first large obstacle to overcome is a very pervasive lack of consensus amongst government foresters that there should be a farm forestry program. Forestry is seen as the exclusive right of the public sector and there is little interest in helping create competition to it within the private sector.

When the farm forestry program does get firmly established, there will be two levels of training needed: (1) intensive training for those foresters charged with implementing the program, and (2) general awareness training for other public training for other public foresters who must be involved with forestry activities in the private sector.

The Pakistan Forest Institute would be the logical place to provide intensive training for farm foresters. Recognizing the, the Forestry Planning and Development Project has sponsored 26 students, who have gotten B.Sc. and M.Sc. degrees from the School.

The system for selling government timber is briefly mentioned during the B.Sc. syllabus in forestry, along with a few formulas for calculating internal rate of return and interest rates. Essentially nothing. The syllabus for an M.Sc. with specialization in farm and energy forestry lists the following subjects relevant to marketing of timber on page 3:

"...E. Commercial aspects: include arrangements for marketing the output produced and the arrangements for the supply of inputs needed.

IV. Commercial aspects of project analysis.

A. Market demand forecasts.

B. Marketing systems.

1. Inputs - supply of adequate factors of production.
 2. Outputs - sufficient demand per outputs of production.
 3. Financing.
- C. Pricing policies.
1. Government.
 2. Market.
- V. Financial aspects of project analysis.
- C. Pricing project costs and benefits.
1. Market price as a measure of value.
 2. Finding market prices.
 3. Predicting future values.

In discussing this syllabus with faculty members, it was learned that there was so much to cover in the curriculum that they barely had time to mention these subjects. None of the faculty had any experience in marketing, so what was mentioned was strictly academic. They could not see how more time could be spent on marketing.

The faculty members interviewed see the mission of PFI to train foresters to manage public timber lands. There seems to be some mental barrier that serves to isolate PFI staff from the private sector and they seem to have very little experience with it and little knowledge of it. This lack of awareness of market needs is reflected in their graduates and certainly must be a contributing factor in the amazing degrade allowed to take place in the present system of public timber sales.

Given the will and funding, PFI could provide their students with better training in marketing. In addition to putting their staff and faculty on wheels and sending them out to learn about markets for wood products, they could also consider establishing

a program to bring in guest lecturers from industry to teach marketing. The University of Washington (and maybe others) has an "Affiliate Professor" program that is proving quite successful. Recently retired managers and scientists are recruited from the public and private sectors. Most of these people do not have a Ph.D., but do have a lifetime of experience in forestry that the faculty lacks. The students are very enthusiastic about having teachers around with extensive real world experience. PFI should consider such a program.

Farmers are primarily engaged in agriculture and growing trees is usually a side line with them. They are practical and busy people who will not spend a lot of time talking with people who know less about their problems than they do. To be successful, a farm forester must have a basic understanding of farming, the farmer and his environment, and how tree growing fits into his scheme of things. Also a farm forester must be thoroughly familiar with the tools and techniques of forestry and be able to personally demonstrate the points being made.

The best training for a young forester is in the field experience with an experienced farm forester. There are such foresters - say at the Division Forest Officer level - in the farm forestry programs who could serve as excellent mentors to young foresters. They could be designated "Training Officers" or "Master Trainers" and their salaries increased for accepting the responsibility for training a series of young assistants. A few of the most effective could be selected for six month work/study courses in farm forestry overseas.

The agricultural people in Pakistan may have extension programs working with the farmers. Investigation should be made of what training facilities are available and what arrangements might be made to put on extension courses for farm foresters.

They could gain a basic understanding of farming, the farmer and his problems. If possible, the foresters should take these courses with the young agricultural officers. The personal relationships they form and the understanding of what the other is trying to accomplish with the farmers could be of benefit to them throughout their careers.

CONCLUSIONS AND RECOMMENDATIONS.

Wood distribution and transportation systems are working well and do not require priority attention at present. However, the impending glut of eucalyptus is a major problem that does require strong and immediate action. Available supply-demand estimates indicate that eucalyptus supplies ready to harvest in 1995 of 224,000 cm appear to exceed the present demand for that species of only 91,000 cm by 133,000 cm. The species is also encountering strong market resistance. Corrective action must be taken at once in three areas: (1) reducing the emphasis on planting *Eucalyptus camaldulensis*; (2) encouraging the use of more of this wood by the existing industry; and (3) developing new uses for the wood.

Recommendations for reducing the emphasis on planting eucalyptus include:

1. Evaluate more species for plantation timber. A wider selection of species is needed to allow growers more flexibility in supplying different market segments and allow them to move away from such heavy reliance on eucalyptus. The successes of existing species, such as poplar, should be exploited and similar species evaluated. In addition to other *Populus* spp. and *Acacia* spp, the growing of mango as strictly a timber crop, as well as conifers for low land areas to include *Pinus taeda*, *P. caribbea* and *P. ocarpa* (both of Honduran source) and other eucalyptus spp.

should be tested. Trials should be designed to be replicated and statistically valid. Native species and present plantation species should be used as controls in all plots. A short term consultant should be recruited to design and establish the trials based on studies of individual decorative and other trees growing in Pakistan, and upon close consultation with major potential users of the plantation woods to be evaluated.

2. Make more detailed studies of the economics of growing plantation timber. These would seek to find ways to economically grow some of the longer rotation species favored by the market, such as shisham and mango... by combining them with shorter rotation species, such as eucalyptus and poplar. The growth in value per hectare would be investigated as well as the volume per hectare. Look for combinations of species that could grow better together than in single species stands. For example, a species like eucalyptus, which is a heavy nutrient user might do better growing with acacia, which fixes nitrogen and helps build soil nutrients. Would it be practical to intersperse poplar with mango. The poplar could be harvested in five or six years, leaving the thus thinned mango trees to go to maturity at 10, 15 or 20 years for fruit crops before being harvested for particle board or veneer.

3. Determine what must be done in order to grow conifers in private plantations in agricultural areas free from government control. There seems to be legal or political barriers to growing conifers on private plantations not in the mountains. This seems to be theoretically possible, but is prevented from happening in actual practice. Conifers are much too valuable as industrial raw materials to permit this situation to continue, if there is any chance to resolve it. Conifers would be number one on the list of plantation species for pulp wood, particle board, structural plywood and for the construction industry. The

Country could save a lot of foreign exchange by substituting domestic pulping of conifers for the long fiber pulp now being imported.

4. Continue to work to establish contact and communication between growers and users of plantation timber. The grower-user seminar in May was excellent and should be held at least annually. Field days, demonstrations, and short seminars on special subjects are well attended and should continue to be emphasized. The newsletter should be continued and expanded to include such regular market statistics as prices currently being paid for plantation timber and the results of mill trials or news of any entry of a new user on the market. Intensify and expand these efforts to the extent possible.

5. Compile plantation timber inventory data within farm forestry working circles. Develop a buyer's guide for users and a seller's guide for growers. Keep it updated in a computer data base and publish updates annually. Show timber species, volumes, maturity dates, where located, the owner and how to contact him for users and buyers. Show users and buyers of plantation timber accessible to the working circle, a description of their needs, names and numbers of the persons to contact. Distribute these guides as widely as possible through the project newsletter mailing list, mailings to seminar participants, etc. Mass distribution should be annually. Give them out at seminars to those without copies, have them available at any time from the farm forester or through visits by short term consultants.

Recommendations to promote the use of more eucalyptus by the existing industry:

6. Intensify efforts to promote the use of eucalyptus for particle board. Project efforts to promote the use of wood

pulping need to be extended to particle board. A short term consultant should be recruited to contact all board plants interested in using eucalyptus and providing technical advice, samples of board made using eucalyptus with different laminates and finishes, encourage and assist with mill trials, assist in getting eucalyptus timber for the trials, if necessary. Also make available the sources and names of suppliers of any special equipment needed to use eucalyptus. This effort should be coordinated or combined with the Eucalyptus Expert, whose terms of reference are shown in Appendix X.

7. Assist in developing a modern wood panel-based furniture industry. Recruit a short term expert to encourage, coordinate current efforts, and provide technical assistance to those companies interested in establishing a wood panel-based furniture industry. This effort would be directed mainly at progressive furniture makers and particle board and hard board producers. The Expert's terms of reference are given in Appendix XI. The purpose of this effort is to enlarge the market for particle board and hard board, and thus provide enlarged market opportunities for plantation timber, especially eucalyptus.

Recommendation for finding new uses for *Eucalyptus camaldulensis*:

8. Learn more about *Eucalyptus camaldulensis*. Immediately contact the Commonwealth Scientific and Industrial Research Organization in Melbourne, Australia and get all of the information they can provide on this species. Especially how to cut it, dry it as poles, lumber and veneer? Can it be effectively treated with dip treatments of borate preservatives? What is the wood used for in Australia and elsewhere? What advice can they provide on how it can be most effectively marketed and used in Pakistan? Request CSIRO to provide a short term expert to

demonstrate the benefits of *E. camaldulensis* and to promote its use. This is urgent! There is a big gap out there between the huge supply of eucalyptus soon to mature and the meager flaccid interest in it in the market. Any advantages or benefits it has to offer need to be discovered and promoted now!

Recommendation for reducing the degrade occurring in coniferous timber between harvesting and sale:

9. Assist in revising the timber sales policies and procedures in the provincial forest departments and the Forest Development Corporation to reduce log degrade occurring between harvesting and sale. Appalling degrade is taking place in coniferous timber being harvested from government and government "controlled" timber lands. This timber includes some of the nicest, most potentially valuable high grade coniferous logs still available in the world. These are export quality logs that in Japan, South Korea, or North America would go into valuable clears, high grade shop and molding grades and be used in furniture, cabinets, trim, moldings, door and window frames, etc. Here, as a result of the government's ponderous and sluggish timber sale procedures, these valuable conifer logs lay in the sun and weather for months - even years - before getting to a saw mill. By then, all of the high grade wood has been ruined by blue stain and seasoning cracks and the log has been de-graded to rough construction timber. A great waste of a unique and valuable natural resource!

A Public Log Sales Expert should be recruited to assess the magnitude of the problem and propose corrective measures. The aim should be to cut the tree and get the wood to a mill within two weeks. Consideration should be given to returning to selling coniferous timber on the stump by auction, with harvesting and transport by the buyer. Collusion between forest officers and

buyers is a law enforcement and management problem - not a technical problem. It should be handled separately. The terms of reference for the Public Timber Sale Expert are presented in Appendix XII.

10. Establish a program within existing farm forestry departments to provide practical, in the field training for young farm foresters. Farm foresters need a basic understanding of farming, the farmer and his problems, and need a basic proficiency in personally using the tools and techniques of forestry in demonstrating important technical points. This program would be based on selecting experienced farm foresters - say at the District Forest Officer level - to be designated as "Training Officers" or "Master Trainers" and given increased salary to assume to the extra responsibility for serving as mentor and training a series of young assistant foresters. A few of the most successful could be sent overseas for short work/study courses in farm forestry.

APPENDIX I
TERMS OF REFERENCE

A. The Forest Products Marketing Specialist will attend the Wood Producers-Wood Users Conference in Lahore 13-15 May 1990. Following the conference, he will proceed to Project headquarters in Islamabad, where he will assist in preparing draft questionnaires for use in Phase One of this study.

B. Upon the specialist's return to Pakistan some months later, he will review draft reports and summary data prepared during Phase One.

C. Within seven working days after arriving in Pakistan, the specialist will have prepared a written work plan that includes at least a draft outline of the final report, a travel schedule, and a list of activities planned during the six to eight week consultancy.

D. Complete review of additional reports from the Forest Departments and other government agencies, USAID, World Bank, FAO, and other donor agencies which analyze costs, values and quantities of wood products produced from the public and private sectors, especially farms, industrial users and trade suppliers.

E. Interview wood product manufacturers, commercial fuelwood/timber buyers and users, and farmers/producers, to verify and clarify existing reports.

F. Participate in formal seminars which review and discuss findings of the Phase One wood use studies.

G. Develop a market network review methodology for farmer produced wood products, including such things as:

1. the wood flow from farm producer to industrial users within selected trade centers.

2. the wood flow linkages for material exported from the trade center.

3. the consumption/demand pattern from producer through wholesale/retail brokerage to industrial user, together with the local standards of market sensitivity related to species, size, grade, and conditions of products.

4. the degree of market constraints which may be restricting free trade - such as transportation restrictions, special duties, permits, licenses required for crossing domestic political boundaries (county, district, state), market failures, etc.

H. On the basis of the wood use survey studies of Phase One and supplemental information, the forest products marketing specialist will develop the following information:

1. generally describe the wood products marketing system with special attention to farm wood products.

2. characterize the transportation system from farm to industrial user, by product class where possible.

3. estimate the annual volume of production by product class, which can be economically marketed within the trade area.

4. suggest key elements of the market infrastructure which need priority attention in order to strengthen the nationwide forest industry.

I. Present a comprehensive written report on findings, including an action plan for additional marketing activities over the next three years of the project; a suggested training program to bring needed skills in marketing to the Forest Departments; identification of and a proposed methodology for continuing studies; and any other recommendations as appropriate. A draft report for review will be due one week before departing Pakistan. The final report will be due before the consultant leaves Pakistan.

J. Present a seminar on the findings of the consultancy to GOP and USAID personnel.

APPENDIX II
PERSONS CONTACTED IN PAKISTAN

ADAMJEE PAPER COMPANY
Nowshera

Mr. Rafiuddin
Managing Director

Mr. Rahat-ul lah-Khattak
Commercial Manager

AGRI-SWISS
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Dr. Robert Murtland
Senior Forestry and Watershed
Management Advisor
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1110 Morges 1
Switzerland

Mr. Willem E. Pleines
Phone: (201) 802 13 96
Fax: (201) 802 31 71

Near Attock town

Mr. Adamzai
Manager, wood yard/crate maker

Mr. Taru Jabba
Owner, Fuel wood yard

Near Charsadda town

An important match wood contractor

Proprietor, Pole yard

DECENT FURNISHERS (Pvt) LTD.
G.T. Road, Gujrat

Mr. Mirza Muhammad Fayyaz
Resident Director
Phone: (04331) 26351

FAO/SUKETAR WATERSHED MGT. PROJECT
House 336-37, Sector c-3
Mirpur, AJK

Dr. Niels L. Martin
Chief Technical Officer
Phone: (054) 3540

FOREST DEVELOPMENT CORPORATION

Mr. Magbool ur Rehman
Managing Director

Mr. Yousaf
Marketing Manager

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Chief of Party
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Fax: 824086

Mr. Gary G. Naughton
Dr. George Blake
Mr. Mahmood Iqbal Sheikh

FORESTRY SECTOR MASTER PLAN PROJECT
H. No. 17-A, Street No. 18, F-7/2,
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Mr. Gerold Grosenick
Resource Economist
Phone: 814075

GOVERNMENT OF PAKISTAN
Office of the Inspector General
of Forests
Islamabad

Mr. Abeedullah Jan
Inspector General of Forests

KASHMIR DEVELOPMENT CORPORATION
G.T. Road
Jhelum, Pakistan

Mr. Mian Bashir Ahmad
Owner (Father)
Mr. Mian Naeem Ahmad (Son)

MOHSIN MATCH COMPANY
Peshawar, Pakistan

Mr. Hassain Amad
Managing Director

PACKAGES LIMITED
Shahrah-e-Roomi
P.O. Amer Sidhu
Lahore-54770, Pakistan

Mr. Masood Abdullah
Senior Planning Officer
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Extension: 339

PAKISTAN CHIPBOARD (Private) LIMITED
P.O. Box No. 18, G.T. Road
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Mr. Mirza Tariq N Ahmad
Executive Director
Phone: (05941) 2795/2796
Fax: 2602

PAKISTAN FOREST INSTITUTE
Peshawar, Pakistan

Dr. Mohammad Khan
Silviculturist

Dr. Mahammad Amjad
Forest Economist

Dr. Mohammad Ayaz
Forest Engineer

Mr. Raja Zariff
Economist/Assistant Professor

Mr. Safdar
Assistant Professor/Training

Mr. Tanvir Ahmad
Assistant Professor

Mr. Mahummad Tanvir
Assistant Professor
Wood Technology

Afghan Refugee Camp
Near Peshawar

Proprietor
Poplar pole yard

PUNJAB FOREST DEPARTMENT
Lahore, Pakistan

Mr. Farid-ud-Din Ahmad
Secretary of Forests

Mr. Anwar Masrur
CCF - Central Zone

Mr. Inshaullah
DFO - Gujrat Farm Forestry

Mr. Khalid Hussain
DFO - Gujrat

Mr. Khabid
DFO - Farm Forestry Jhelum

Taxila Town

Proprietor of pole yard

USAID
Islamabad, Pakistan

Mr. K. Hameed Ullah
Project Officer

APPENDIX III - REFERENCES

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APPENDIX IV - SMALL LOG PROCESSING
IN MODERN SAWMILLS

Processes forced to handle more and smaller pieces must handle them faster or in bunches to maintain an economical level of output. At the mill log yard, large tractors with front-end loaders lift the whole load of full length logs (weighing 80,000 lbs. in North America) from the truck trailer and place them in storage decks. The same or similar machines then feed bundles of small logs into the mill, as needed.

Modern small log saw mills make extensive use of mechanization and computer controls to produce an optimum amount of usable sawn wood; in the correct sizes to best meet sales orders at the moment of conversion; and to convert the green wood residues directly into pulp chips.

Tree length small diameter logs (usually to a maximum length of 44 feet) enter the mill through the de-barker; are cross cut to desired lengths; and conveyed to one or more conveyor storage lines sorted by diameter groups. Logs are selected from these decks and dropped on a linear conveyor; passed through a scanning section, where lasers scan them and determine the size and geometry of each log, compare what can be cut from that log with products on order at that instant, optimize for value and set the saws automatically - all in seconds. Quad-saws usually cut the log into lumber in one pass and send it on to the edger. On larger logs, more than four saw lines may be needed, so multiple pieces are cut and sent to re-saws to be separated. Next the lumber is trimmed and automatically stacked and stickered for transport to the drying kilns.

Modern saw mill technology, then, includes:

- Computer control systems.
- Laser scanners.
- Quad-saws or "Chip-N-saws".

The minimum size saw mill of this type would cost at least Rs.765 million (US\$35 million) and require 60,000 cm of logs per year. Such mills are technically very sophisticated, capital intensive and become profitable only when operated continuously at or near full capacity. Their raw material requirements are awesome and they must be located near large concentrations of suitable timber. Their construction and maintenance requires high technology infrastructure. Very few employees are needed and they are almost all computer, automated machine or mobile equipment operators, technicians, clerical or administrative personnel.

APPENDIX V - SMALL LOG PROCESSING
IN MODERN PLYWOOD MILLS

In softwood plywood mills - where logs are rotary peeled - the problem in handling small logs is to position, chuck, peel and eject cores from the lathe very rapidly. With large size logs or "blocks", interruption in peeling for positioning and loading was relatively small compared with the large amount of veneer obtained from each block. But with small diameter blocks, more time would be spent in positioning, loading and unloading than in peeling using a large block-lathe.

In a modern small log (conifer) rotary peel operation, blocks are pre-positioned using laser guide lights; the block is gripped and the computer remembers the positioning and centering instructions for each block. When the core being peeled is ejected, the next block is instantly loaded in the lathe in the pre-determined position, the chucks grip the block and peeling continues - all in seconds.

Valuable production time can be lost during "roundup", while the new block is being shaped into a cylinder. A pre-rounding lathe does this while the preceding block is being peeled. When the new block is loaded, it is ready to immediately start sending its veneer to the clipper. Finally, when peeling small diameter blocks, knife pressure can bend or bow the block away from the lathe knife and result in unacceptable thickness variation in the veneer. To avoid this and to prevent "spinout" of the chucks on soft block ends, nose bars are usually powered. These three developments have been the main factors enabling softwood plywood mills to remain profitable and still shift from large natural to smaller second growth logs and are now found in most softwood mills in North America.

Appendix VI - The oriented strand board process

Oriented strand board (OSB) is made from the same woods as particle board - populus spp. and pines - and is in the same density range. The process consists of positioning short lengths of small diameter round wood cutting off long flakes. These are refined into long bundles of fibers up to an inch or so in length. These bundles, or strands, of wood are dried, coated with resin and formed into mats for pressing. During this lay up, the strands - either electrically or mechanically - are oriented in such a way that most in the top and bottom layers are oriented parallel to the panel, while those in the core layer are at right angles. This orientation of the strands produces a panel with strength and dimensional stability properties remarkably similar to structural plywood. Because it is composed of small strands, it has no knots holes, areas of cross grain, no gaps, laps or wet spots or other defects that afflict plywood and consequently is five percent stronger, especially in bending. It is rapidly taking over a major share of the markets for roof sheathing and sub-flooring in North America, Europe and Scandinavia.

Another concept, the "Spindleless lathe", sounded like a fourth good idea a few years ago, but was never accepted. It was found that by using the other three improvements, 95 percent of the benefits of the spindleless lathe could be had using existing mill lathes.

New small log technology in modern softwood plywood mills:

- "XY chargers."
- Pre-roundup lathes.
- Powered nose bars.

These new small log technologies are all very expensive and require large scale production to economically use the large investment. A minimum size Chip N Saw mill in the USA would cost on the order of US\$25 million and produce around 710,000 cubic meters of sawn wood per year. A minimum scale rotary veneer/plywood plant would be of a similar magnitude. As will be appreciated, these would be very large scale operations in Pakistan. Unhappily, very little technology has been developed to enable small mills to more efficiently saw, peel or slice small logs.

APPENDIX VII

AVERAGE ANNUAL WHOLESALE PRICES OF SHISHAM
 TIMBER AT KARACHI: ACTUAL PRICES (Rs. per cubic meter)
 AND DEFLATED PRICE INDEXES

<u>Year</u>	<u>Price index</u>	<u>Actual price</u>	<u>Shisham index</u>	<u>Deflated index</u>
1975/76	100.00	2232.96	100.00	100.00
1976/77	111.92	2383.76	106.75	95.38
1977/78	120.81	2678.05	119.93	99.27
1978/79	128.85	3119.49	139.70	108.42
1979/80	144.73	4708.67	210.87	145.70
1980/81	163.69	5002.96	224.05	136.87
1981/82	176.16	4473.24	200.33	113.72
1982/83	182.27	4514.38	202.17	110.92
1983/84	201.38	3296.07	147.61	73.30
1984/85	208.92	3266.64	146.29	70.02
1985/86	217.38	3678.64	164.74	75.78
1986/87	228.53	3590.36	160.79	70.36
1987/88	258.97	3708.07	166.06	64.12

 Source: "The State of Forestry in Pakistan." For. Econ. Br., Pakistan Forest Institute, Peshawar, Pakistan. Actual prices: Table 29, page 88. Price indexes: Table 28, Page 87.

APPENDIX VIII
 AVERAGE SALE RATES OF SHISHAM IR AND IIIR GRADES
 OF TIMBER AT CHANGA MANGA SALE DEPOT: ACTUAL PRICES
 (Rs. per cubic meter) AND DEFLATED PRICE INDEXES
 1975/76 - 1987/88

SHISHAM GRADE IR LOGS

<u>Year</u>	<u>Price index</u>	<u>Actual price</u>	<u>Shisham index</u>	<u>Defalted index</u>
1975/76	100.00	1441	100.00	100.00
1976/77	111.92	1443	100.14	89.47
1977/78	120.81	1594	110.62	91.57
1978/79	128.85	2295	159.26	123.60
1979/80	144.73	3037	210.76	145.62
1980/81	163.69	3460	240.11	146.69
1981/82	176.16	4167	239.17	164.15
1982/83	182.27	5579	307.16	168.52
1983/84	201.38	6603	458.22	227.54
1984/85	208.92	8087	561.21	268.12
1985/86	217.35	10171	705.83	324.70
1986/87	228.53	11754	815.68	356.92
1987/88	258.97	12376	858.85	331.64
1988/89	-	14504	1006.52	-

SHISHAM GRADE IIIR LOGS

<u>Year</u>	<u>Price index</u>	<u>Actual price</u>	<u>Shisham index</u>	<u>Deflated index</u>
1975/76	100.00	559	100.00	100.00
1976/77	111.92	677	121.11	108.21
1977/78	120.81	862	154.20	127.64
1978/79	128.85	1057	189.09	146.75
1979/80	144.73	1130	202.15	139.67
1980/81	163.69	1412	252.59	154.31
1981/82	176.16	1766	315.92	179.34
1982/83	182.27	1977	353.67	194.04
1983/84	201.38	2119	361.18	179.33
1984/85	208.92	2401	429.52	205.59
1985/86	217.38	2613	467.44	215.03
1986/87	228.53	2576	464.40	203.21
1987/88	258.97	3001	536.85	207.30
1988/89	-	3687	659.57	-

Source: "The State of Forestry in Pakistan." For. Econ. Br., Pakistan Forest Institute, Peshawar, Pakistan. Actual prices: Table 33, page 94. Price indexes: Table 28, page 87.

APPENDIX IX
 AVERAGE ANNUAL RETAIL PRICES OF KIKAR
 FIREWOOD IN KARACHI: ACTUAL PRICES
 (Rs. per 40 kgs) AND DEFLATED INDEX PRICES
 1975/76 - 1987/88

<u>Year</u>	<u>Price index</u>	<u>Actual price</u>	<u>Kikar index</u>	<u>Deflated index</u>
1975/76	100.00	13.75	100.00	100.00
1976/77	111.92	16.05	116.73	104.30
1977/78	120.81	15.97	116.15	96.14
1978/79	128.85	16.16	117.53	91.21
1979/80	144.73	19.04	138.47	95.67
1980/81	163.69	25.58	186.04	113.65
1981/82	176.16	28.91	210.25	119.35
1982/83	182.27	29.07	211.42	115.99
1983/84	210.38	30.79	223.93	111.20
1984/85	208.92	33.04	240.29	115.02
1985/86	217.38	33.81	245.89	113.12
1986/87	228.53	35.09	255.20	111.67
1987/88	258.97	39.46	286.98	110.82

 Source: "The State of Forestry in Pakistan." For. Econ. Br., Pakistan Forest Institute. Peshawar, Pakistan. Actual retail prices: Table 31, page 90. Deflated index prices: Table 28, page 87.

APPENDIX X - TERMS OF REFERENCE
EUCALYPTUS UTILIZATION EXPERT

TITLE OF POSITION: Eucalyptus Utilization Expert

DURATION: Three months.

POST: Islamabad, with travel within Pakistan as required.

CONTACT: The Expert will work under the supervision of the Project Manager, FORESTRY PLANNING AND DEVELOPMENT PROJECT.

A. The Expert will demonstrate the benefits of Eucalyptus camaldulensis and draw up a program to promote its use. Specifically:

1. Become familiar with present uses for E. camaldulensis now in Pakistan.

2. Through participation in seminars and published articles, describe how this wood is processed and used in Australia.

3. Describe its technical properties to include:

- a. mechanical, physical and machining properties.
- b. Its suitability for use in particle board, hard board and pulp.
- c. Its durability and ability to be treated effectively with borate preservatives using the dip method.
- d. Its suitability for use as poles and lumber.
- e. Techniques for processing eucalyptus to include: drying, sawing, peeling and slicing, gluing, nailing, etc.

4. Establish contact with the major potential users of E. camaldulensis, to include: particle board, hard board and pulp producers.

a. Become familiar with their interest and progress in using eucalyptus in their products.

b. Provide samples, technical advice and information as needed.

c. Encourage them to have mill trials of eucalyptus and participate to the extent possible

d. Assist them in obtaining suitable wood for their trials, chemicals, or other materials or inputs to make the mill trials successful.

e. Advise manufacturers on sanding, finishing and laminating boards made from eucalyptus.

f. Make information available on the source, type and cost of any equipment needed to process eucalyptus.

g. Provide any information available about mixing eucalyptus with other species to control panel density or to broaden raw material resources.

B. Prepare a comprehensive program proposal for educating people to the benefits and promoting the use of *E. camaldulensis* in Pakistan.

ESSENTIAL QUALIFICATIONS: At least ten years of experience in forest industries processing eucalyptus, including saw mills, plywood mills, particle board and hard board plants and pulp mills.

DESIRABLE QUALIFICATIONS: Processing experience specifically with *E. camaldulensis*; research and development; product promotion; and any experience in South Asia.

APPENDIX XI - TERMS OF REFERENCE
WOOD PANEL-BASED FURNITURE EXPERT

TITLE: Wood panel-based Furniture Expert.

DURATION: Three months

POST: Islamabad, with travel within Pakistan as required.

CONTACT: Project Manager, FORESTRY PLANNING AND DEVELOPMENT PROJECT.

A. The purpose of this mission is to help industry to develop a modern furniture industry based on the use of wood panels. Expanding this market will enlarge the demand for particle board and enable producers to upgrade and expand their production, thus creating greater demand for plantation timber, especially *Eucalyptus camaldulensis*. Specifically:

1. Become acquainted with progressive furniture makers interested in large scale production of panel-based furniture; and key people in the particle board and hard board industries interested in using eucalyptus. Some particle board manufacturers have or are interested in producing furniture using their own board.

2. Become familiar with any existing furniture or wood panel manufacturing or marketing associations and establish contact with them.

3. Become familiar with the status of plans, projects, ideas for establishing mass production of furniture and cabinets using wood panels. Assist as desirable by providing encouragement, technical information, sources of needed equipment, possible joint venture partners, suppliers of specialized hardware for particle board, making automated furniture plant layouts, etc.

4. Seek out, identify obstacles to such a modern industry, and help organize efforts to overcome them.

5. In cooperation with key people from industry and government, draw up a program for building a modern wood panel-based furniture industry in Pakistan. Include necessary assistance from the Government, where applicable.

6. With permission of the Project Manager, pursue any other avenues that may arise to further the objectives of the mission.

ESSENTIAL QUALIFICATIONS: Senior technical and managerial experience with a modern automated furniture or kitchen cabinet manufacturing plant. A recently retired executive would be ideal.

DESIRABLE QUALIFICATIONS: Experience with furniture manufacturing associations, computer control systems, linear programming, quality control procedures, etc.

APPENDIX XII - TERMS OF REFERENCE
PUBLIC TIMBER SALE EXPERT

TITLE: Public Timber Sale Expert

DURATION: Three months.

POST: Islamabad, with travel within Pakistan as required.

CONTACT: Project manager, FORESTRY PLANNING AND DEVELOPMENT
PROJECT.

A. The purpose of this mission is to evaluate the degrade occurring in coniferous timber from government timber lands between harvest and sale and propose corrective measures. Specifically:

1. Grade logs at public auctions and in government log depots to determine the degrade occurring. Use standard log grading rules for Ponderosa pine or southern yellow pine in the USA.

2. Conduct field interviews in major market areas and with major bidders at government timber auctions to determine the price differential that might be expected between high grade pine and deodar logs and degraded ones.

3. Conduct field interviews with major bidders and key government officials to solicit their ideas of how the present government timber sale policies could be improved to reduce the degrade of the logs whilst still effectively controlling collusion and other evil schemes.

B. Draft proposed changes in government timber sale policies and procedures that will effectively reduce log degrade and still effectively reduce collusion, while not creating new opportunities for corruption.

ESSENTIAL QUALIFICATIONS: Long experience with public timber sales; proficiency in grading pine logs using log grades standard in the USA.

DESIRABLE QUALIFICATIONS: Industrial experience with timber sales; experience with the U.S. Forest Service or one of the State Departments of natural resources in the Western USA. (Get names from the U.S. Forest Service, Forestry Support Group in Washington, DC.)