JAPANESE SAWMILLING INDUSTRY: CURRENT SITUATION, HISTORIC TRENDS, AND A COMPARISON WITH THE NEW ZEALAND INDUSTRY

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(Received for publication 10 June 1993; revision 29 October 1993)

ABSTRACT

New Zealand material in Japan continues to be sawn predominantly for packaging, in contrast to other supplies which are sawn overwhelmingly for construction uses. Overall recovery percentages for New Zealand material sawn (for packaging) in Japan are of the order of 64–68% which is much higher than the national average in New Zealand of approximately 50%. The higher recovery in Japan can be explained by: the JAS under-estimate of log volume; the volume of large squares in the raw material input; the high raw-material cost which has instigated slow, accurate, finer kerf sawing; the combination of products and dimensions produced.

The Japanese sawmilling industry is adaptable, adjusting to rising raw material costs and reduced supplies by adopting strategies such as diversification into value-added processing, the establishment of industrial complexes, downstream integration such as housing construction, and real estate.

Keywords: sawmilling; Japan; New Zealand.

INTRODUCTION

The New Zealand sawmilling sector is currently aware that conversion efficiencies in Japanese sawmills are considerably higher than those achieved in the New Zealand sector. These differences have been demonstrated by the Rotorua sawmill owned by the Japanese company Tachikawa Forest Products (NZ) Ltd which is a joint venture involving Tachikawa Forest Products Ltd and Nichimen Corporation. This mill, using Japanese equipment and producing mainly packaging grades for the Japanese market, manages to achieve conversions to sawn timber which are in excess of the New Zealand industry average, despite using logs of small sizes. Tachikawa's high conversion rate has been attributed to the comparatively high sawing accuracy, low throughput, the small dimension pieces being recovered (reducing loss around the edge of the log), a product which allows most defects, and buying and utilising logs of specified length (J.L.van Wyk & U.Sjögren unpubl.data)

Apart from that from the Tachikawa mill, there has been little information available in New Zealand, however, on which to make valid comparisons between the Japanese and New Zealand sawmilling industries. In 1984, a report on New Zealand sawn timber's prospects in Japan (Fenton 1984) examined the Japanese sawmilling sector using statistical data and first-hand observations. Although the author does not have first-hand experience in Japanese sawmills, it is the objective of this paper to update the available information and attempt to explain the differences in conversion efficiencies, particularly for mills in Japan and New Zealand sawing New Zealand radiata pine*.

Specifically, the purpose of this paper is to:

- Review the Japanese sawmilling sector, using Japanese statistics and the first hand experience of other NZ FRI staff in Japanese sawmills;
- Compare and explain differences between the Japanese and New Zealand sawmilling sectors.

TYPE, SCALE, AND LOCATION OF SAWMILLS

The statistics which are published by various organisations (e.g., Japan Forestry Agency, All Japan Federation of Lumber Associations) on Japanese sawmilling are very detailed. This is in contrast to the comparatively limited statistics available on New Zealand sawmilling. Overall trends in the main indicators of the Japanese sawmilling industry are given in Tables 1 and 2.

The number of sawmills has been declining steadily since the 1970s, with the largest decreases being for mills in the smallest size class (Fig. 1). The average size of sawmills, as measured by motive power consumption, has increased (Japanese sawmills are classified according to power class, rather than the usual sawn output or capacity classes) (Table 1).

In terms of installed power capacity, the largest percentage of mills (37%) are medium-sized, in the 37.5–75.0 kW class. In the last 5 years the only increase in number of mills has

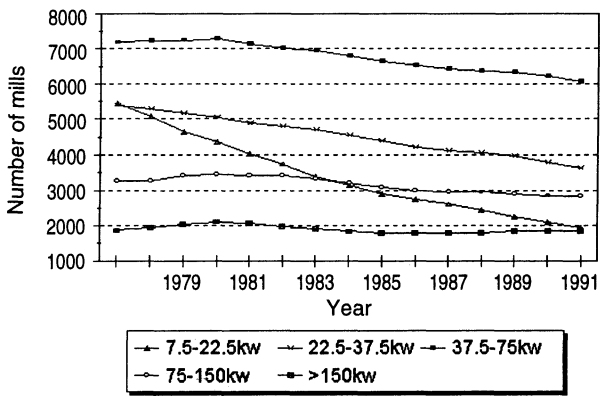

FIG. 1–Sawmills in Japan by size class, 1977–91
Source: JFA (1992a), and various issues

* For botanical names of all tree species mentioned in this paper, *see* Appendix 1.

TABLE 1–Sawmilling statistics for Japan, 1965–91*†

Calendar year	No. plants	Mill power (000 kW)	Labour (000 persons)	Log consumption volume (000 m^3)	Sawn timber output volume (000 m^3)	Average per mill				
						Power (kW)	Employment (persons)	Volume (m^3 RWE)	Volume (m^3 sawn)	Sawn recovery (%)
1965	24 803	818.6	269.2	44 845	33 291	33.0	10.9	1 808	1 342	74
1970	24 546	1 125.5	254.3	56 929	42 127	45.9	10.4	2 319	1 716	74
1975	23 630	1 417.8	221.4	51 434	37 362	60.0	9.4	2 177	1 581	73
1980	22 241	1 538.6	194.3	51 421	36 920	69.2	8.7	2 312	1 660	72
1981	21 535	1 486.3	177.7	45 344	32 497	69.0	8.3	2 106	1 509	72
1982	20 937	1 454.4	165.7	43 369	30 944	69.5	7.9	2 071	1 478	71
1983	20 256	1 403.9	155.9	41 730	29 601	69.3	7.7	2 060	1 461	71
1984	19 512	1 363.0	147.3	40 505	28 598	69.9	7.5	2 076	1 466	71
1985	18 834	1 335 4	139.5	40 160	28 403	70.9	7.4	2 132	1 508	71
1986	18 260	1 309.6	134.9	40 317	28 693	71.7	7.4	2 208	1 571	71
1987	17 886	1 304.3	133.2	42 376	29 763	72.9	7.4	2 369	1 664	70
1988	17 603	1 310.3	131.1	43 200	30 079	74.4	7.4	2 454	1 709	70
1989	17 275	1 314.5	128.6	43 667	30 481	76.1	7.5	2 528	1 764	70
1990	16 811	1 309.8	124.2	42 780	29 781	77.9	7.4	2 545	1 772	70
1991	16 300	1 305.0	120.0	41 415	28 670	80.1	7.4	2 541	1 759	70

Source: All Japan Federation of Lumber Associations (1992)

* There is some variation between these figures and those from other sources (JFA 1992a, b; MAFF 1992). Compared to JFA, these figures are higher for plant numbers and about 1.5% to 2.2% lower for log volume consumption. Employment figures are comparable.

† For mills over 7.5 kW

been in the largest mills (>150 kW). Since 1988, these mills have been classified as large (150–300 kW) and super-large (>300 kW) (*see* Table 2). Recent (1991) figures indicate that the number of mills in the >300 kW class has decreased to 526, with growth in the 150–300 kW class to 1333 mills (JLJ 1992).

Most of the small mills are using roundwood from predominantly domestic sources, with the larger mills using mainly imported roundwood (Fig. 2).

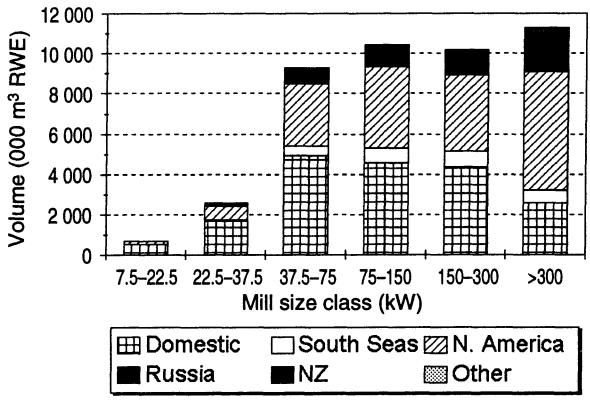

FIG. 2–Log input by source and Japanese mill power size class, 1990
Source: JFA (1992b)

TABLE 2–Number of mills in Japan, motive power, employment, and consumption by power class of mill, 1991

Mill power class* (kW)	Mills		Installed power capacity		Employment			Log consumption		Labour productivity (m^3/person)
	(No.)	(%)	Motive power (kW)	Power per mill (kW)	(No.)	(%)	(No./mill)	Log consumption (000 m^3)	Average consumption per mill (m^3)	
7.5–22.5	1 935	11.9	31 297	16.2	5 463	4.5	2.8	609	315	111
22.5–37.5	3 623	22.2	107 698	29.7	13 395	11.1	3.7	2 243	619	167
37.5–75.0	6 050	37.1	310 472	51.3	35 512	29.5	5.9	8 299	1 372	234
75–150	2 823	17.3	284 978	100.9	28 688	24.0	10.1	9 808	3 474	342
150–300	1 333	8.1	266 049	199.6	21 530	17.9	16.2	9 611	7 210	446
>300	526	3.2	289 285	550.0	15 951	13.2	30.3	10 945	20 807	686
Total	16 290	100.0	2 290 461		120 539	100.0		41 515		344

Source: MAFF (1992)

* Includes power required for the timber sawing machinery and the equipment attached to it, such as saw adjusters, cable winches, belt conveyors, etc.

Employment and Labour Productivity

The number of employees* in the sawmilling sector has been decreasing progressively in mills of all power classes although least rapidly in the >150 kW class. The number of employees per mill has remained relatively constant at approximately 7.4 people since 1985 (Fig. 3 and Table 1). Labour productivity has increased correspondingly, particularly in the larger mills (Fig. 4). This is largely a reflection of the increasing mechanisation of the industry and the trend towards dependence on energy rather than labour (or diminishing marginal returns to energy). These trends are indicated by the increase in installed power per worker and the decrease in volume of sawn output produced per unit of energy input (Fig. 5).

The level of employment in the New Zealand sawmilling sector is much lower than in Japan, but here too employment in the sawmilling sector has been decreasing, and labour productivity has been correspondingly increasing. In 1988, 6030 persons were employed in sawmills in New Zealand, compared with 4892 in 1992 (year ended mid-February)† (MOF 1992).

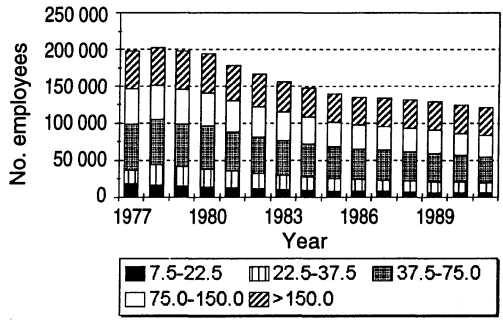

FIG. 3–Sawmill employees in Japan by mill power size class (kW), 1977–91
Source: JLJ (1992)

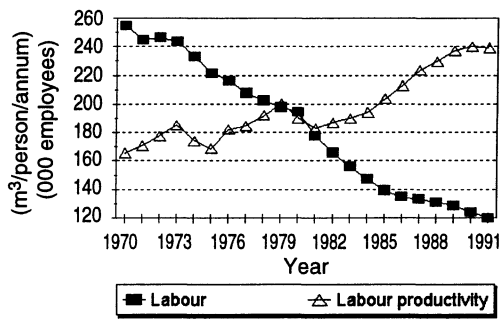

FIG. 4–Labour and productivity in Japanese sawmills, 1970–91
Source: All Japan Federation of Lumber Associations (1992)

* Employee numbers refer to workers and staff who work in the timber factory, whether they are permanent or temporary employees. Workers who double as office staff and carry out fixed duties and who receive pay under the same pay rules as general staff are included, even if they are company executives. If employees are engaged in more than one operation, they are taken as belonging to the factory where their main duties are carried out (MAFF 1992).

† Employee numbers refer to the total number of fulltime employees and working proprietors (i.e., persons working 30 hours or more per week) plus half the part-time employees and working proprietors (MOF 1992).

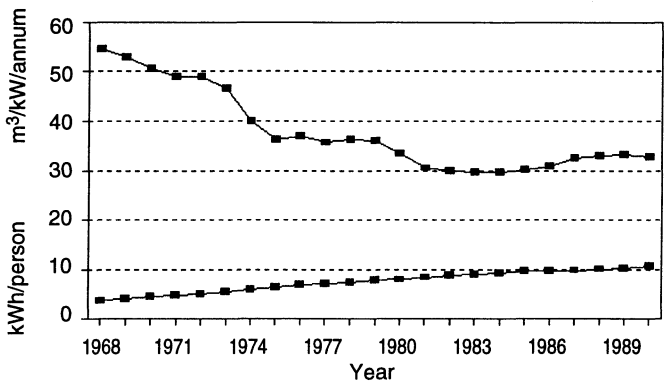

FIG. 5–Mill power/worker and sawn output/unit energy input in Japan
Source: All Japan Federation of Lumber Associations (1992)

Japanese wage rates have been increasing, and are high compared with New Zealand rates, but in comparison to other Japanese manufacturing industries the average monthly earnings of workers in the "lumber and wood products industry" (of which sawmilling employees constitute about half) are low. This would support the view that, even in Japan, the wood products industry is a relatively low-paid industry. The latest available published statistics show that wage rates in this sector were approximately 249,000 yen/month (NZ$4150/month) for male workers and 143,000 yen/month (NZ$2383/month) for female workers in the year ended June 1990 (Japan Statistics Bureau 1992). These figures are for regular workers, excluding part-timers, and cover private establishments only. Females represented 27% of the industry in 1990 although Fenton (1984) observed that the proportion of female workers in the small country mills was very high (80–90%).

The average age of sawmill workers is comparatively high at 44.5 years for male workers and 45.8 years for female workers, indicating a high level of experience in the workforce (the averages for all workers in Japan are 39.5 and 35.7 years respectively). The workforce is ageing but the average age of workers employed decreases with the size of establishment, suggesting that the new larger mills are being run and operated by a younger workforce. Also of significance is the fact that older workers employed in the lumber and wood products sector are less educated in terms of academic achievements than younger workers (Japan Statistics Bureau 1992).

There are indications that Japanese sawmilling companies are concerned about the comparatively high Japanese wage rates. It has been claimed that it is now the policy of several Japanese companies to establish sawmills in foreign countries in order to secure log supplies and "avail of the cheap employment and young labour force". The Japanese source (Kawata 1992) cites the Tachikawa sawmill in Rotorua, New Zealand, as an example of this strategy.

RAW MATERIAL INPUT TO SAWMILLS

The raw material input to Japanese sawmills, by source, is given in Fig. 6. It indicates the declining overall demand for roundwood in sawmilling, and the rapidly diminishing supplies of lauan.

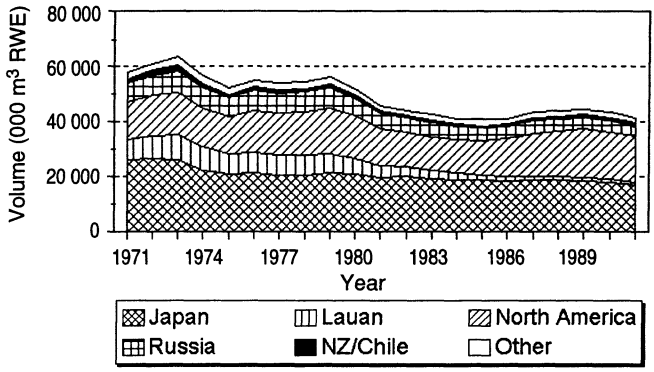

FIG. 6–Raw material input to Japanese sawmills, by source, 1971–91
Source: JFA (1992b); JLJ (1992)

The volume of squares (flitches, cants, "half-finished" timber) imported is important, as this will affect sawn recoveries. Recoveries from squares are high—of the order of 90% (Fenton 1984). The volume of squares (or half-finished material) imported from North America has remained at around 500 000 m^3 annually since 1981, although squares have decreased as a proportion of the total sawn timber imports (Table 3). Some of the items under "finished goods" in Table 3 are reported to be sometimes sent for further remanufacturing and ripping (JLR 1989). This would imply that the volume of sawnwood used in remanufacturing is higher than the import figures for half-finished timber. Squares are predominantly hemlock, spruce, and Douglas fir (Table 4). As a proportion of total log and square imports from North America, the proportion of squares is minimal (in contrast to New Zealand, for example—*see* Table 5). A reason for the import of large (>160 mm) squares in preference to logs at places such as Hitachi, was that there was no DANCHI development, and the mills had less easy means of disposing of bark, sawdust, and chips.

TABLE 3–Change in volumes of imports to Japan of North American sawnwood

	Finished* goods (%)	Half finished† goods (%)	Total volume (000 m^3)
1975	55.9	44.1	2232
1980	77.7	22.3	3840
1981	79.7	20.3	2685
1982	83.9	16.1	3412
1983	83.6	16.4	2966
1984	84.3	15.7	2749
1985	83.5	16.5	3116
1986	84.7	15.3	3331
1987	87.9	12.1	4441
1988	89.9	10.1	4949
1989	91.5	8.5	5874
1990	91.6	8.4	5722
1991	91.1	8.9	6025

Source: All Japan Federation of Lumber Associations (1992)

* Baby squares $3^9/_{16}$", $4^1/_8$"; Dimension lumber; Others

† Half finished goods: Big-medium squares 6" × 6"; "Weenies"; Others

TABLE 4–Sawnwood imports to Japan from North America, 1991

Article	Volume (000 m^3)	Size and species
Softwood		
Baby squares	854	$3^9/_{16}$", $4^1/_8$" squares: Hemlock (74%), D. fir (28%), Spruce (3%). Kiln dried (15%), green (85%)
Big-medium squares	274	12–30" square: hemlock (40%), spruce (19%), D. fir (22%)
"Weenies"	140	Hemlock (46%), spruce (43%), Noble fir (6%)
Dimension lumber	751	2 × 4, 6, 8, 10, 12": S/P/F (55%), hemlock (40%), D. fir (4%). Kiln dried (95%), green (5%)
Planks for rafters	680	$1^3/_{16}$", $1^{13}/_{16}$", $1^7/_8$" thickness hemlock (70%), S/P/F (18%), D. fir (8%). Kiln dried (30%), green (80%)
Japanese custom ordered and others	3923	Lumber for Japanese conventional houses 10.5 cm, 12.0 cm square, rafter, interior, etc. stud and other components for prefabricated houses, lamina. Hemlock (56%), D. fir (19%), S/P/F (18%). Kiln dried (20%), green (80%).
Softwood total	**6622**	
Hardwood		
Oak	61	$^3/_4$", $^5/_4$" thickness: Red oak, white oak, alder, yellow poplar white ash, birch, maple, aspen, basswood, cottonwood,etc. Kiln dried, higher processed lumber.
Alder	10	
Birch and others	219	
Hardwood total	**290**	

Source: All Japan Federation of Lumber Associations (1992)

The input of domestic roundwood to sawmills has decreased progressively from around 45 million m^3 in 1971 to 29 million m^3 in 1990 (Fig. 7), with softwoods (sugi, hinoki) being the dominant species. Sugi and hinoki provide the main supply for Japanese conventional housing, based on 10.5-cm^2 and 12.5-cm^2 columns. The availability of domestic supplies of softwoods which will be able to produce these columns will increase, although the cost of harvesting these stands may be limiting.

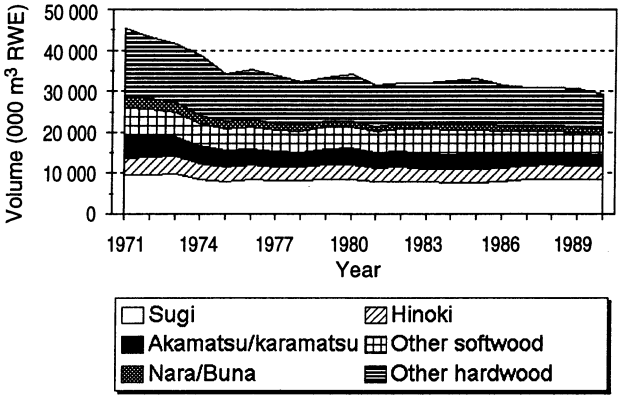

FIG. 7–Japanese domestic roundwood input to sawmills, 1971–90
Source: All Japan Federation of Lumber Associations (1992)

TABLE 5–Imports of radiata pine logs and squares to Japan from New Zealand and Chile, 1973–92

Year (ended December)	New Zealand			Chile	
	Logs (000 m^3)	Squares (>160 mm) (000 m^3)	Large squares as a percentage of total logs and squares	Logs (000 m^3)	Squares (>160 mm) (000 m^3)
1973	1605	88	5	0	0
1974	1094	95	8	0	0
1975	447	71	14	0	0
1976	800	100	11	0	–
1977	838	176	17	84	18
1978	775	208	21	93	31
1979	963	264	22	211	34
1980	777	286	27	307	28
1981	497	240	33	62	2
1982	421	251	37	79	0.7
1983	312	255	45	220	26
1984	306	172	36	353	62
1985	294	152	34	379	92
1986	260	115	31	270	100
1987	389	130	25	244	121
1988	569	NA	NA	216	NA
1989	756	NA	NA	241	NA
1990	1136	NA	NA	311	NA
1991	1334*	180†	12	278	NA
1992	1259*	NA	NA	162	NA

Source: Japan Tariff Association (1973–91) except—

* There is a large discrepancy between the figures given by the Japan Tariff Association (1973–91) and the New Zealand Ministry of Forestry, with log export volumes for 1991 being 1 785 000 m^3 for 1992 and 1 715 000 m^3 provisionally for the year ended December 1993 (MOF 1994).

† JLR (1992).

After 1987, import classifications do not differentiate sawn squares from logs and sawn timber

Domestic logs down to a 5-cm diameter can be sawn, provided they are straight. There is evidence that Russian pulplogs are also largely sawn—*see* Fenton & Maplesden (1986). Although there were no recent data available on size classes of domestic roundwood sawn, Nishimura (1984) estimated that approximately 60% of roundwood was in the 14–28 cm s.e.d. class, while the small (<14 cm) and large (>30 cm) classes were about 15% each.

Log sizes are variable, with standard Japanese and Russian logs being characteristically small—between 22 and 30 cm in diameter. Specified lengths for Russian logs are 4 m and 8 m for larch and 3.65, 3.75, 3.80, 7.30, 7.50, and 7.60 m for whitewood. For U.S. logs, a key grade determinant is width of growth rings, the slower-grown old-growth material being generally considered of higher grade than second-growth material.

Mills Cutting New Zealand Raw Material

In the period 1980 to 1987, the proportion of sawn squares in the New Zealand log/squares mix was significant, varying from 25% to 45% of the total (Table 5). Large squares were also reported to be sawn in Japan from imported New Zealand logs, and sent for further processing

to inland mills (Fenton 1984). In 1991 the proportion of squares dropped to 12%, although the volume has remained at similar levels. Japanese statistics on raw material input to sawmills classify New Zealand and Chilean inputs as "New Zealand" only. Imports of logs and squares from New Zealand are significantly higher than from Chile, although from 1984 to 1986 Chilean imports were at comparable levels.

These figures do not classify logs by grade, although exports from New Zealand are principally Japan A-grade and J-grade. A-sort logs, which have a larger minimum small-end diameter requirement, commanded a 4% price premium (CIF) over J-sort logs in April 1993 (*see* section on Log Costs). The volume of J-sort logs in the log mix is likely to increase, given that the average harvest age in the next 5 years is likely to be lower than current levels if the projected harvest levels are to be sustained.

The location and size of sawmills cutting New Zealand and Chilean logs and squares are indicated in Table 6 by number of sawmills and volume of input. Logs and squares from New Zealand and Chile are utilised predominantly in two prefectures—Kochi and Hiroshima. In 1991 they used 21% and 18% respectively of the total radiata pine input to Japanese sawmills. Aichi and Ehime Prefectures used 11% and 7% respectively, and the rest was distributed amongst the other 43 prefectures. Radiata pine logs and squares represented a large component (71%) of the imported volume sawn in Kochi Prefecture and 38% of the total (domestic and imported) volume sawn (MAFF 1992). In Hiroshima Prefecture the corresponding figures were 12% and 11% respectively. The major discharge ports for New Zealand logs are Matsunaga in Hiroshima Prefecture and Susaki in Kochi Prefecture. The volumes of radiata pine imported in 1990 (including small volumes from Chile) totalled 270 000 m^3 in Susaki and 213 000 m^3 in Matsunaga (Kawata 1992).

EQUIPMENT

Japan has an advanced sawmilling equipment industry, exporting sawmilling machinery to many countries, including New Zealand. There is, however, little evidence that there is a "standard" Japanese sawmill, and the statistics suggest that there is a large variety of mill types and processing methods (Tables 7 and 8). For this reason, no sweeping generalisation can be made about the equipment used in Japanese sawmills, and there is only limited value in highlighting specific details. However, there are differences between Japan and New Zealand that are worth noting.

The New Zealand industry's perception is that there are differences in the assumptions used to derive recovery percentages in Japan and New Zealand. It is difficult to make direct comparisons for a number of reasons.

General observations of the characteristics of "main stream" Japanese sawmilling, as described by Fenton (1984) and other NZ FRI researchers visiting Japan, are as follows:

- Careful handling of logs and sawn timber.
- Knowledgeable log buying in relation to markets.
- High-cost raw material requiring optimum grade recovery and conversion.
- Slow accurate sawing to produce:
  maximum conversion
  minimum sawing variation
  high surface quality
  good grade recoveries.

TABLE 6–Number of sawmills in Japan and volume (000 m^3) of input of New Zealand and Chilean raw material by prefecture and power class of mill, 1991

Prefecture	Total		Mill power class (kW)											
	No.	Vol.	7.5–22.5		22.5–37.5		37.5–75		75–150		150–300		>300	
			No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.	No.	Vol.
Hokkaido	2	1	–	–	–	–	–	–	1	0	–	–	1	1
Aomori	3	0	–	–	–	–	2	0	–	–	1	0	–	–
Iwate	9	3	–	–	–	–	3	0	3	3	3	0	–	–
Miyagi	13	12	–	–	2	0	5	1	3	0	1	3	2	8
Akita	6	2	–	–	–	–	4	2	2	0	–	–	–	–
Yamagata	19	15	3	0	1	0	7	7	6	3	1	0	1	5
Fukushima	13	16	–	–	1	0	3	0	7	5	1	4	1	7
Ibaraki	29	41	5	2	2	3	13	9	7	9	1	1	1	17
Tochigi	5	9	–	–	–	–	1	2	4	7	–	–	–	–
Gunma	8	6	–	–	1	0	1	0	4	5	2	1	–	–
Saitama	6	3	–	–	1	0	2	0	2	3	1	0	–	–
Chiba	12	15	–	–	1	0	6	5	3	5	2	5	–	–
Tokyo	5	6	–	–	–	–	2	5	1	0	1	1	1	0
Kanagawa	7	4	–	–	–	–	4	1	2	2	1	1	–	–
Niigata	10	4	–	–	2	0	2	1	2	0	2	1	2	2
Toyama	15	24	–	–	1	0	4	1	4	2	2	1	4	20
Ishikawa	13	3	–	–	2	0	5	0	2	1	2	0	2	2
Fukui	8	2	1	0	1	0	4	1	2	1	–	–	–	–
Yamanashi	9	32	–	–	–	–	2	0	5	17	1	6	1	9
Nagano	13	14	–	–	2	3	8	6	2	1	–	–	1	4
Gifu	26	24	–	–	6	2	10	6	8	12	2	3	–	–
Shizuoka	10	3	–	–	1	0	5	2	2	0	2	1	–	–
Aichi	36	161	–	–	7	2	16	15	10	61	2	0	1	138
Mie	23	14	3	2	2	1	10	4	8	7	–	–	–	–
Shiga	31	20	–	–	7	3	15	6	6	6	1	0	2	5
Kyoto	10	3	–	–	2	0	6	2	1	1	1	0	–	–
Osaka	6	4	–	–	3	1	1	2	1	0	–	–	1	1
Hyogo	30	56	–	–	2	11	11	13	10	9	2	7	5	16
Nara	3	4	–	–	–	–	2	4	1	0	–	–	–	–
Wakayama	13	21	–	–	4	2	2	3	4	12	3	4	–	–
Tottori	3	5	–	–	–	–	1	3	1	2	1	0	–	–
Shimani	7	20	–	–	–	–	1	0	3	4	1	2	2	14
Okayama	3	8	–	–	–	–	1	3	2	5	–	–	–	–
Hiroshima	16	255	–	–	–	–	2	2	2	1	8	32	4	220
Yamaguchi	31	86	1	0	1	0	12	23	10	35	6	23	1	5
Tokushima	1	2	–	–	–	–	1	2	–	–	–	–	–	–
Kagawa	8	13	–	–	–	–	3	2	2	2	1	2	2	7
Ehime	21	101	–	–	–	–	6	10	4	14	8	21	3	56
Kochi	13	305	–	–	–	–	2	3	4	89	7	213	–	–
Fukuoka	15	18	1	0	–	–	6	4	7	14	1	0	–	–
Saga	10	8	–	–	1	0	6	1	2	7	1	0	–	–
Nagasaki	2	1	–	–	–	–	2	1	–	–	–	–	–	–
Kumamoto	13	32	3	1	–	–	4	13	2	6	3	9	1	3
Oita	16	24	–	–	2	1	7	8	3	3	3	11	1	1
Miyazaki	16	28	–	–	5	10	2	1	6	7	3	10	–	–
Kagoshima	19	23	–	–	2	1	8	5	5	9	3	6	1	2
Okinawa	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	587	1451	17	5	62	40	220	180	166	315	81	368	41	543

Source: MAFF (1992)

TABLE 7–Numbers of various types of machines in Japanese sawmills, by selected years

Year	Bandsaw				Circular headrig edger ripper	Debarker	Forklift	Conveyor systems (% of mills)
	Carriage	Table feed	Autofeed	Manual				
1960	11 483	7 362	1 426	10 003	56 573	–	–	–
1961	12 614	7 578	2 078	11 182	59 842	–	–	–
1964	15 502	8 426	3 850	12 265	56 786	–	4 768	12.9
1965	15 733	8 625	4 261	12 593	56 293	–	5 896	14.1
1966	16 238	8 888	4 780	13 213	56 193	–	7 379	15.7
1967	17 115	9 117	5 246	14 094	55 972	–	9 364	17.3
1970	18 487	8 889	6 532	14 236	46 004	–	16 940	23.6
1973	18 784	10 477	8 123	15 477	40 530	2910	22 543	28.0
1976	18 938	10 107	8 948	14 850	35 817	3090	25 404	32.0
1979	18 306	9 587	9 757	13 891	30 000	3599	27 590	34.2
1982	17 174	8 576	9 406	12 499	25 774	3503	27 029	36.3
1985	15 524	7 317	8 589	10 989	22 278	3896	25 234	38.3
1990	14 873	5 892	8 397	9 075	18 648	3600	25 639	40.1

Source: All Japan Federation of Lumber Associations (1992)

- Good length specifications with generally short log lengths (less than 4 m).
- Sawyers are knowledgeable regarding log quality and optimum cutting methods.
- Specialised mills, with often one species being cut to one product.
- Little anti-sapstain treatment or wood preservation.
- Limited seasoning generally, but extensive air-drying in radiata pine mills cutting packaging-grade material.
- Limited sawn timber grading.
- Limited sawn timber stocks.

Japanese sawmills are categorised by power class in Fig. 1 and 2. It is probable that virtually all of New Zealand's major mills would fall into the >300 kW class, with most of the smaller mills falling into the 150–300 kW class (J. Doyle pers. comm.).

In Table 9, mill size is put into perspective for New Zealand radiata pine since most is processed in the Hiroshima and Kochi Prefectures. The types of sawing equipment used are detailed for the power class of mills which use the largest volume of radiata pine. The figure suggests that the mills in these prefectures are larger than the national average, and tend to be more automated. The majority of the mills are carriage/band systems with auto-feed, with further automated resawing systems downstream. There is little use of board optimisers.

Perhaps the greatest apparent difference between these mills and those of New Zealand is in the mix of the raw material used. The data for imports of radiata pine logs and radiata pine squares do not distinguish between the two, so it is possible to determine neither which mills cut logs and which cut squares, nor which cut a mix of the two. Obviously, having squares in the raw material mix will influence the estimation of conversion, and this is discussed under Recovery Percentage. It is likely that the system commonly used for sawing logs (normally a carriage) is unnecessary for cutting squares, in which case a table feed system may be adequate. Five of the 32 mills in the Hiroshima Prefecture and 14 of the 41 mills in Kochi Prefecture have table carriage bandsaws (Table 9), but that is by no means conclusive evidence that these mills are processing squares.

TABLE 8–Sawmilling equipment in Japan by mill power class, 1990

Type of equipment	Total mills	Mill power class (kW)					
		7.5–22.5	22.5–37.5	37.5–75.0	75–150	150–300	>300
Total No. mills	16 811	2106	3791	6203	2853	1325	533
Bandsaw with auto-feed carriage							
No. mills with this type of saw	12 580	787	2244	5097	2652	1282	518
Total No. saws*	14 873	795	2291	5398	3253	1977	1159
<1000 mm	2 436	315	563	889	408	193	68
1000–1200 mm	10 269	450	1588	3978	2265	1303	685
>1200 mm	2 168	30	140	531	580	481	406
Bandsaw with table-feed carriage							
No. mills with this type of saw	5 479	1124	1641	1661	648	302	103
Total No. saws*	5 892	1143	1655	1770	747	406	161
<1000 mm	1 925	526	538	540	201	101	19
1000–1200 mm	3 691	591	1072	1147	484	269	128
>1200 mm	276	26	55	83	62	36	14
Table bandsaw with auto-roller feed							
No. mills	6 560	134	646	2525	1837	978	440
Total No. saws*	8 397	137	666	2719	2281	1520	1074
<1000 mm	2 316	60	296	931	584	297	148
1000–1200 mm	5 672	73	357	1687	1579	1150	826
>1200 mm	409	4	13	101	118	73	100
Table bandsaw							
No. mills	7 884	472	1541	3205	1575	787	304
Total No. saws*	9 075	486	1591	3444	1906	1100	548
<1000 mm	4 660	355	1012	1889	842	380	182
1000–1200 mm	4 193	128	552	1474	1001	691	347
>1200 mm	222	3	27	81	63	29	19
Circular saw							
Ripper edger							
No. mills	2 778	101	257	824	751	524	321
No. saws	4 366	127	355	1115	1078	942	749
Others							
No. mills	7 887	790	1650	3001	1459	708	279
No. saws	14 282	986	2452	5100	3005	1802	937
Barker							
No. mills	3 260	44	217	825	1019	773	382
No. barkers	3 600	44	240	859	1077	868	512
Forklift							
No. mills	15 376	1567	3317	5898	2776	1295	523
No. forklifts	25 639	1711	3941	8691	5774	3500	2022
No. sawmills which own power-conveying equipment	6 746	261	784	2408	1830	1003	460

Source: MAFF (1992)

* By nominal dimension (diameter of saw wheel (mm))

TABLE 9–Types of sawmill equipment in Japan for selected prefectures and power classes, 1990

	All mills Japan		>300 kW Hiroshima Prefecture		150–300 kW Kochi Prefecture	
	No. saws	No. mills with this equipment	No. saws	No. mills with this equipment	No. saws	No. mills with this equipment
Total No. mills		16 811		32		41
Bandsaw with auto-feed carriage						
Total	14 873	12 580	88	30	63	39
<1000 mm	2 436		10		3	
1000–1200 mm	10 269		33		48	
>1200 mm	2 168		45		12	
Bandsaw with table feed carriage						
Total	5 892	5 479	11	5	17	14
<1000 mm	1 925		1		3	
1000–1200 mm	3 691		10			
>1200 mm	276		–		–	
Table bandsaw with auto-roller feed						
Total	8 397	6 560	94	25	53	35
<1000 mm	2 316		10		10	
1000–1200 mm	5 672		63		41	
>1200 mm	409		21		2	
Table bandsaw						
Total	9 075	7 884	28	15	26	24
<1000 mm	4 660		12		6	
1000–1200 mm	4 193		9		18	
>1200 mm	222		7		2	
Circular saw						
Ripper edger	4 366	2 778	58	17	25	14
Other	14 282	7 887	66	9	58	25
Barker	3 600	3 260	27	21	29	26
Forklift	25 639	15 376	146	32	104	41

Source: MAFF (1992)

The significant equipment characteristics that contribute to the conversion figures are associated mainly with the raw material cost and the processing method. In general, the need is for slow accurate cutting, product specialisation, attention to grade on a piece by piece basis, and attention to log specification. This allows the use of purpose-designed equipment and handling systems (sometimes manual), with thin kerf and appropriate saw gauges. The speed of cutting is reflected in the configuration of the mills. Generally, larger mills have more machines—in New Zealand larger mills have faster machines.

Probably the single greatest contribution to high conversion would come from the mill's attention to high-quality surface finish, obviating the need to dress further, and removing the wasteful dressing allowance.

LOG COST

Log Costs to the Sawmill

Mid-1991 CIF prices for radiata pine imports in Japan were as follows (assuming a mid-1991 exchange rate (Reserve Bank) of 79.8 yen/NZ$1 and a conversion factor of 1 JAS m^3 = 290 JHDF (Japanese Haakondahl feet):

Log grade	Price	
A-sort (North Island)	4800 yen/100 JHDF	NZ$174/$m^3$
J-sort	3300 yen/Koku (0.278 m^3)	NZ$149/$m^3$

Source: JLR (1991b).

Mid-1991 prices were chosen in order to make valid comparisons with available New Zealand figures and because mid-1993 log prices were at an uncommonly high peak. These prices are the importers' selling prices which include exporters' price, ocean freight, marine insurance premium, banking charges, and importer commission (JLR 1989).

The delivered-at-mill price in Japan would be the importer's selling price plus a discharge charge from vessel, scaling fee, fumigation fee, dock fee, loading charge, and transport to the yard. New Zealand logs are mostly sold directly from the importer to the sawmill (JLR 1989).

Log prices in New Zealand, delivered at mill, in mid-1991 were:

Log grade	Price
Pruned logs	$NZ130/$m^3$
A-grade	$NZ100/$m^3$
J-grade	$NZ60/$m^3$

Source: Edgar *et al.* (1992)

Assumes 1 m^3 = 1 green tonne

These prices are defined as "export equivalent log prices", which recognises that "in the longer term New Zealand forest growers will be willing to supply domestic customers only if pricing provides a parity with the export log alternative, all cost and quality differences being fairly reflected".

According to these figures, in mid-1991 the raw material cost for Japanese sawmillers was considerably higher than the price paid by New Zealand sawmills. Since that date, however, both the export and domestic log prices have risen considerably, although Japanese sawmillers continue to pay higher raw material costs.

Sawnwood Production Costs

The production cost of similar-grade sawn timber produced by New Zealand mills compared with Japanese mills at the same price point in Japan will give an indication of the competitiveness of New Zealand sawmills compared with Japanese mills in Japanese markets.

A recent production-cost estimate was 35,680 yen/m^3 (NZ$580/$m^3$) for radiata pine packaging-grade sawn timber produced by a standard Japanese sawmill located close to port (Japan Link 1993). This figure is the delivered cost to the wholesaler and assumes a 63% recovery (log to sawnwood) and sawing costs of 5,400 yen/m^3 (roundwood equivalent).

Using these figures it is possible to estimate the maximum production cost that New Zealand sawmills would have to achieve to be competitive with their counterparts in Japan. (These figures, however, exclude the re-sale value of wood residues in both countries.)

	NZ$/$m^3$	
Delivered cost – wholesaler/secondary processor Japan	580	
Mark-up charged by Japanese companies (30%)	174	
Unloading at port (Japan)	15	
	391	CIF Japan
Tariff 4.8%	19	
Freight (including insurance and other charges)	93	
	279	
Port charges New Zealand	12	
Transport mill–port (100 km)	15	
	252	ex mill NZ

New Zealand sawmills would therefore have to produce green packaging-grade sawn timber at NZ$252/$m^3$ ex-mill or less in order to compete profitably in the market, assuming the given costs, and an overall sales commission charged by Japanese companies of 30% on the CIF price. The freight charge from port to wholesaler is unknown.

There are a number of other uncertainties in this calculation. The sales commission charged by Japanese companies, for example, may not be high for the major trading companies (Nippon NZ Trading is the largest Japanese importer of New Zealand sawn timber) but there may be several primary and secondary wholesalers before the sawn timber reaches the factory. A mark-up of 30% on the CIF price is likely to be an over-estimate. A decrease of 5% on the mark-up will increase the ex-mill New Zealand maximum production cost requirement, to be competitive in Japan, by NZ$29/$m^3$.

The sawnwood recovery used in this calculation was 63%. Based on the experience of the Tachikawa mill, realistic recovery percentages for Japanese mills sawing similar input to New Zealand mills are more likely to be in the 57–60% range (*see* Recovery Percentage). Lower recoveries in New Zealand mills effectively add to the cost of production by increasing log costs.

The sawn timber cost on-truck, Japan, was based on a high log import price of 5300 yen CIF/100 JHDF (for A-sort logs, about 20% higher than the average for 1992—Japan Lumber Reports 1992). If the log input cost of imported radiata pine in Japan is reduced, New Zealand

sawmillers can produce sawn timber competitively at a cost lower than that calculated. For example, reducing the CIF log input cost to 4400 yen/100 HDF (the price of A-sort radiata pine logs in November 1993) reduces the New Zealand sawmill maximum production-cost requirement to NZ$207/m^3 sawn.

Nominal and real Japanese monthly price trends (in Japanese yen/m^3 and in NZ$/m^3) for New Zealand A-sort and J-sort logs are given in Fig. 8–11 for the period from January 1986 to February 1994. Prices were deflated using the PPI (Producer Price Index), all market groups (New Zealand), and WPI (Wholesale Price Index) (Japan). Figures 10 and 11 are not indexed after November 1993 and June 1993, respectively. The figures indicate that at least some of the dramatic trend in price increases, especially after February 1988, can be attributed to currency variations. Since mid-1992, however, the trend has been similar in both yen and New Zealand dollars.The dramatic rise and fall in log prices in 1993 is similar to the chip shock in 1980 during which Japanese buyers engaged in a buying frenzy, paying high prices in anticipation of a fall in supply.

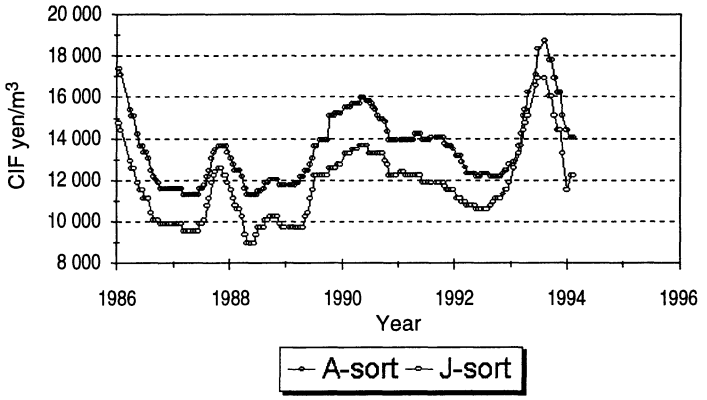

FIG. 8–Radiata pine nominal sawlog prices in Japan 1986–94 (yen/m^3)
Source: *Japan Lumber Reports*, various issues

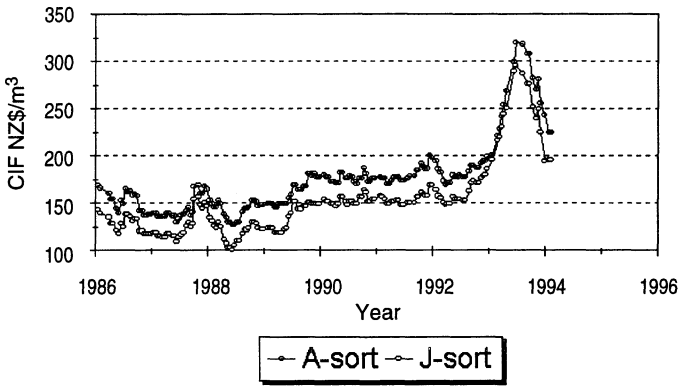

FIG. 9–Radiata pine nominal sawlog prices in Japan 1986–94 (NZ$/m^3)
Source: *Japan Lumber Reports*, various issues; *Key Statistics*, various issues

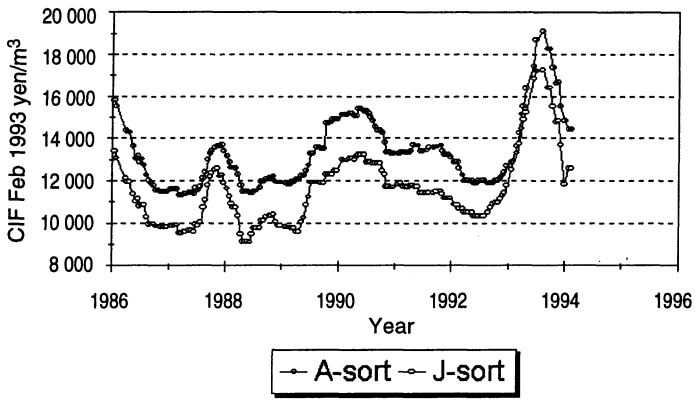

FIG. 10–Radiata pine sawlog prices in Japan 1986–94
Source: *Japan Lumber Reports*, various issues; International Monetary Fund

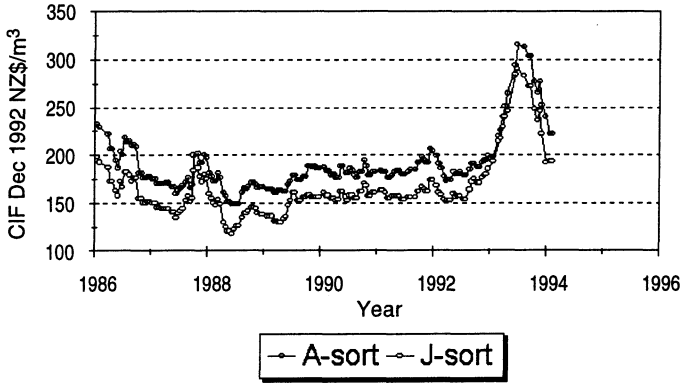

FIG.11–Radiata pine sawlog prices in Japan 1986–94
Source: *Japan Lumber Reports*, various issues; *Key Statistics*, various issues

In response to the increase in log export prices, New Zealand log prices increased rapidly in late 1992 (by up to 350% in the year to April 1993, according to Wayne Coffey of the New Zealand Timber Industry Federation in an interview on Radio Pacific, 19 April 1993), and log availability to the small local sawmillers decreased. This caused some public controversy over the loss of opportunity for expansion of the New Zealand wood-processing industry, with concerns expressed by union organisations such as the Council of Forest Unions (COFU 1993) and by some industry organistaions such as the New Zealand Owned Sawmillers' Group (1993). Sawmilling industry organisations are concerned that log export prices should set the domestic price, with the dominant suppliers setting their best price increases on to domestic grades. Another concern for mills without their own forest resource has been a lack of secure supply contracts, with the potential pressure to reduce the terms of these contracts. Overcutting of the resource to cash in on the favourable log export prices has also been a concern for sustainable log supplies.

Another response to the increase in domestic log prices in New Zealand has been that the competitive position of substitute materials has improved, particularly in the framing market where the use of steel as a framing material has become more economically viable (NBR 1994). The CIF price differential between A- and J-grade logs reached a low in February 1993 (*see* Fig. 12) but, apart from this, the price ratio has been consistently between 1.151 and 1.25 since 1986.

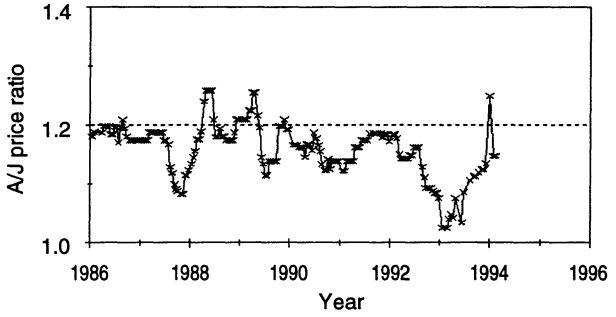

FIG. 12–Radiata pine sawlog A/J-grade price ratio in Japan 1986–94
Source: *Japan Lumber Reports*, various issues

JAPANESE SAWMILL OUTPUT BY MARKET SECTOR

The largest volume of sawn timber output from Japanese sawmills is in the "square" construction category (beams and columns), with large outputs in the other construction categories (boards and scantling) (Fig. 13).

In contrast to that from all other sources, New Zealand material continues to be sawn predominantly for packaging (Fig. 14). In 1991, for example, 85% of New Zealand/Chilean output from Japanese sawmills was destined for packaging uses; in contrast, domestic, N. American, and Russian outputs were all used overwhelmingly (over 80%) for construction. Radiata pine has been progressively used in packaging. In 1971, only 38% of New Zealand output was used for packaging but by 1981 this had risen to 75%, and by 1985 to 85%.

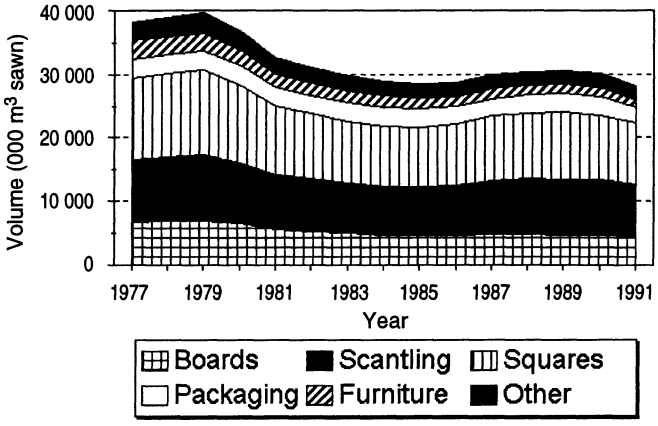

FIG. 13–Sawn timber output in Japan by end-use, 1977–91
Source: JFA (1992a); MAFF (1992)

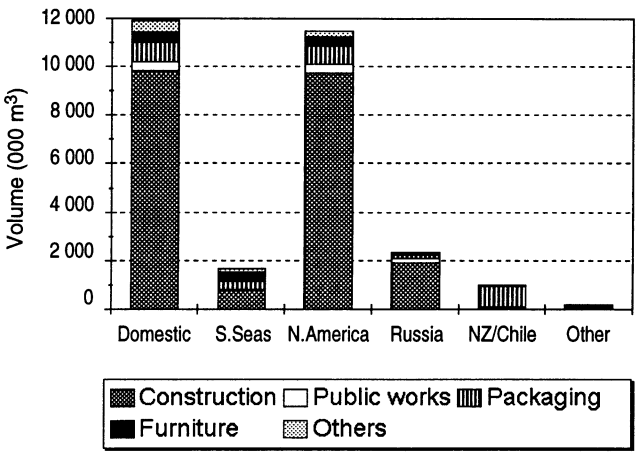

FIG. 14–Sawn timber output in Japan by end-use and source, 1991
Source: MAFF (1992)

Kiln drying is not common in mills producing general construction timber, particularly small mills. It is more commonly used for furniture, dimension lumber, laminated lumber, and mainly for hardwoods. Construction timber is generally used green. In 1988 (the latest available statistics), only 4% of sawn timber used in construction was kiln dried. Kiln drying capacity in that year was 1.3 million m^3, with plants operating at 73% of that capacity.

Sapstain occurs in radiata pine and is a problem for appearance grades, but is not considered a problem for packaging grades since it does not affect strength properties. With future harvesting in New Zealand being of younger trees with a higher percentage of sapwood, there will be a greater requirement for proper seasoning of timber.

RECOVERY PERCENTAGE

Estimates of sawnwood recoveries based on Japanese log input data are subject to speculation, because of the discrepancy between the JAS and actual log volume measurements. Japan Agricultural Standard (JAS) measurements under-estimate the actual volume of radiata pine by approximately 10% for short (<6 m) logs. Long logs (>6 m) are closer to the true log volume (NZ FRI, Forest Mensuration and Management Systems, unpubl. data).

It is likely, therefore, that Japanese sawmills are using more log volume than the sawmill input figures suggest, as these are based on JAS-measured logs. The magnitude of this difference is unknown and difficult to determine since it would require detailed information on log inputs by length class. (With New Zealand imports, J-grade specifications will allow a maximum of 15% of logs in the length class <6 m.) Any differences, however, will tend to over-estimate the sawnwood recovery.

Bearing in mind these uncertainties, overall average log conversions to sawn timber are indicated by source in Fig. 15 from 1986 to 1991 based on log input to sawmills and sawn outputs, as measured by MAFF (1992). They are not differentiated by grade and will be affected by the volume of squares and log grades in the log mix. It is not stated whether the output is green sawn or to nominal/actual sizes.

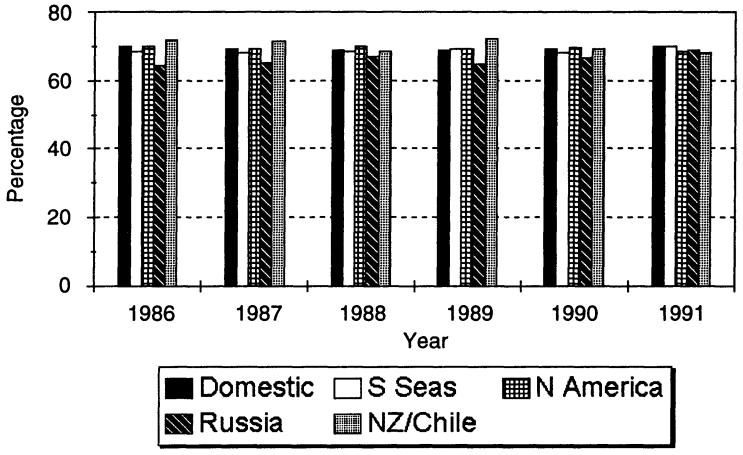

FIG. 15–Sawn timber recoveries in Japan by source, 1986–91
Source: MAFF (1992)

On a more detailed basis, the following are conversion factors for sawmills in Japan in 1991, by source.

	Conversion	Output
Kochi Prefecture—		
Radiata pine (New Zealand/Chile)	68%	100% packaging
Hiroshima Prefecture—		
Radiata pine (New Zealand/Chile)	64%	82% packaging 12% public works 6% construction

Source: MAFF (1992)

(The corresponding conversion estimates for 1990 were 67% and 62% respectively).

In New Zealand, a sawnwood recovery of 50% is considered by the Ministry of Forestry to be the national average for sawmills cutting exotic species and this is considerably less than the Japanese averages given here. It is not possible to estimate historic trends in New Zealand sawnwood recoveries from published data because the statistics on sawlog removals are derived indirectly from the output of the sawmills (MOF 1991). Based on NZ FRI data from actual measurements on-site, the average conversion from log under-bark to nominal sawnwood production for a modern New Zealand sawmill, for example, would be approximately 52–55%, depending on log diameter distribution. The type and combination of product dimensions is also important. A fast-throughput small-log mill in New Zealand, for example, will achieve recoveries of approximately 49–51%, with a specialist mill sawing large pruned logs for grade and clears achieving, on average, a recovery of approximately 60%.

Comparisons of New Zealand and Japanese roundwood–sawnwood conversions are also difficult because of the uncertainty of using like-statistics, particularly when averages are involved. Recoveries are dependent on the end product and accordingly will differ with the log grade. The only sawmill in New Zealand cutting exclusively for the packaging market

is the Tachikawa mill, which achieves recoveries of around 57%. This mill is designed to saw accurately to within 0.5 mm of the target size, and has a relatively narrow saw kerf. It saws mainly J and K grades (20–25 cm) which are smaller than the average log sawn in New Zealand.

The average recovery calculated for radiata pine (producing packaging outputs) in Japan (67%) includes inputs of large squares, and is an average for all the log grade inputs. This recovery percentage would therefore over-estimate sawnwood outputs from exclusively J-grade logs, for example, and would be inappropriate to use.

Most of the differences between Japanese and New Zealand recovery percentages can be explained, however, by:

(1) The JAS under-estimate of log volume, which leads to an over-estimate of actual sawnwood recoveries.
(2) The volume of large squares in the raw material in Japanese sawmills. In New Zealand the input is exclusively of logs.
(3) Finer-kerf saws in Japan. The slow accurate sawing contributes to higher recoveries.
(4) The combination of products and dimensions. Japanese mills are sawing radiata pine predominantly for packaging grades, whereas New Zealand mills are cutting for a combination of products including construction, board, and clears grades.
(5) Sawing of 10.5- and 12.5-cm squares from straight logs which will yield these sizes (so reducing the number of saw cuts) from quite small logs. (Lauan had lower recovery, despite large log sizes).
(6) Markets for boards of less than 25 mm thickness (for outer walls of dwellings which are then cement plastered) (R.T.Fenton unpubl. data).

THE PACKAGING SECTOR

The packaging sector in Japan is worth examining because of the large component of New Zealand material destined for packaging end-uses.

One of the characteristics of the Japanese packaging sector is the trend to establishment of large-scale sawmills as a result of increased domestic competition, competition from Chilean sawn imports, and the prospects of increasing supplies of radiata pine from New Zealand (Kawata 1992). An example is Nakahama Timber Co. Ltd which has reconstructed a large-scale sawmill in Matsunaga near a major consumption area. Matsunaga in Hiroshima Prefecture is described as a typical packaging-lumber producing district in Japan, and is one of the major discharge ports for New Zealand logs. The sawmill covers 28 000 m^2, has two production lines, and is equipped with four twin bandsaws. It consumes around 14 000 m^3 roundwood/month and sawing costs are estimated at less than US$25/$m^3$ when the operation is at full capacity (Kawata 1992).

Danchi (integrated industry complexes) exist in the packaging sector as well as the housing and wood-utilising industries. In the Susaki area, for example, an industrial complex was completed in 1978, consisting of seven sawmills, six of which are manufacturing packaging timber. Three other sawmills involved in the packaging industry are located outside the complex. All mills utilise only imported logs. A co-operative association called "Susaki Mokuzai Kogyo Danchi Kumiai" co-ordinates the members and performs business

functions such as log purchase, bark incineration, log bucking, and log delivery to the member's plant.

Sawn packaging timber is a dominant material for packaging heavy export goods such as cars, electrical appliances, and industrial machinery, but the industry is under increasing competition from other materials such as paperboard, plastic, and expandable polystyrene. The currently high radiata pine log prices must be putting further pressure on radiata pine sawmillers in Japan whose predominant clients are packaging manufacturers facing an increasingly depressed market.

FUTURE TRENDS

In 1991, a survey of medium- to large-scale Japanese sawmills indicated that two-thirds had invested in production facilities and equipment during the previous 5 years (JLR 1991a). The main reason for this investment was to save labour costs, which were seen in 1991 as a major problem for the sawmilling industry. The most important management issues were seen as:

Shortage of workers	32%
Log supply shortages	15%
High log prices	15%
Reduced sawnwood demand	12%
Pollution	5%
Difficulty in getting successor	3%
Others	15%

As a proportion of the total value of investment in the surveyed sawmills, 56% of investment was for solving problems associated with labour shortages, and 21% for replacement of old facilities and machinery. The major areas of diversification into value-added processing employed by the mills surveyed were:

Kiln drying	28%
Pre-cutting	21%
Planing	18%
Manufacturing laminated lumber	12%
Processing for housing parts	5%
Manufacturing furniture/joinery	4%
Wood preservation/treatment	3%
Processing packaging stock	3%
Others	2%

Although the important current issues are more likely to be high log prices and reduced log supply, these figures indicate that Japanese sawmillers are considering adopting strategies to diversify processing. Of importance to radiata pine processors is the relatively high proportion of sawmillers who consider kiln drying an important diversification strategy and, on the other hand, the low proportion considering wood preservation as a possible diversification for mills. (The volume of sawn timber preservative-treated in Japan is only around 1% of total sawn timber production—MAFF 1992.)

As well as diversification in processing, another suggested solution to these management problems was to become involved in distribution and supply systems. The concept of

integrated industries is not new in Japan, where some housing companies, for example, have their own material supply systems with their own manufacturing industries and large booking facilities in exporting countries, with discharge and distribution equipment at major ports in Japan. Sakai (1992) also observed that sawmills are diversifying not only into timber selling but also into related businesses such as housing construction and real estate.

The rapidly declining availability of high-quality logs is well documented (*see* 1992/93 issues of *Japan Lumber Reports* and *Japan Lumber Journal*) and is of considerable concern to the Japanese industry. Exchange rates have always been of importance to sawmillers, with the appreciation of the yen in relation to the US dollar (and the New Zealand dollar) in recent years making the prices of imports more favourable, particularly value-added highly processed products. The failure of the New Zealand industry to penetrate the Japanese market under these conditions should be of concern.

CONCLUSIONS

It is difficult to make comparisons between the Japanese and New Zealand sawmilling sectors because there are differing levels of detail for the two sectors, and, in some instances, there is no common basis for comparison of statistics. However, some conclusions can be drawn from the information presented in this report:

The number of sawmills in Japan is decreasing, but the average mill size and volume of roundwood sawn per mill are increasing. The level of employment in the Japanese sawmilling sector has also decreased but labour productivity has improved with increasing mechanisation in the industry. The comparatively high wage rates in Japan have contributed to some Japanese companies investing in other countries (including New Zealand) with lower labour costs.

The overall Japanese demand for roundwood for sawmilling is decreasing, although New Zealand log exports to Japan have increased dramatically over the last 3 years. The proportion of squares in the raw material import mix from New Zealand is still significant, and is in contrast to imports from other sources. Radiata pine is utilised mainly in two prefectures—Kochi and Hiroshima.

Japanese sawmills cutting radiata pine are larger than the national average and tend to be more automated. In contrast to New Zealand, Japanese mills utilise both radiata pine logs and squares, which will influence sawnwood recovery. The high raw material cost and processing methods also contribute to the recovery figures. In general, the need is for slow accurate cutting, product specialisation, attention to grade on a piece by piece basis, and attention to log specification. This allows the use of purpose-designed equipment and handling systems with thin kerf and appropriate saw gauges.

Raw material costs are considerably higher for Japanese than for New Zealand sawmillers. Since late 1992, the increase in CIF radiata pine log prices, both nominal and real, has been dramatic. There is some difference in the overall trend in yen compared to New Zealand dollars, indicating that some of the sharp trend in price increases since February 1988 can be attributed to yen appreciation.

New Zealand material continues to be sawn predominantly for packaging in Japan, in contrast to other supplies which are sawn overwhelmingly for construction uses. Overall

recovery percentages for New Zealand material sawn (for packaging) in Japan are of the order of 64–68% which is much higher than the national average in New Zealand of approximately 50%. The higher recovery in Japan can be explained by the JAS underestimate of log volume; the volume of large squares in the raw material input; the high raw material cost which has instigated slow, accurate, finer kerf sawing; and the combination of products and dimensions, which for radiata pine is mainly thin board packaging grades. Sawmills in Japan producing predominantly packaging sawnwood have tended to restructure to large-scale sawmills and to development of industrial complexes. Wooden packaging is facing increasing competition from other material such as paperboard, plastic, and expandable polystyrene, and imports of packaging grade timber from other sources.

The Japanese sawmilling industry is adapting to rising raw material costs, and reduced raw material supplies. In addition to off-shore investment, Japanese companies are adopting, or considering adoption of, strategies such as diversification into value-added processing, the establishment of industrial complexes, downstream integration such as housing construction, and real estate.

ACKNOWLEDGMENTS

The assistance of John Doyle in writing the sections on sawmilling equipment and sawnwood recoveries is appreciated. The writer is also grateful to Lesley Caudwell for typing the text.

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APPENDIX 1

LIST OF SPECIES

Common name	Country	Species
Radiata pine	New Zealand	*Pinus radiata* D.Don
Lauan	"South Seas"	Over 50 species of *Dipterocarpus* and allied species
Hemlock	N. America	*Tsuga heterophylla* (Raf.) Sarg.
Spruce	N. America	*Picea sitchensis* (Bong.) Carr.
Douglas fir	N. America	*Pseudotsuga menziesii* (Mirb.) Franco
Noble fir	N. America	*Abies procera* Rehder
Spruce/pine/fir (S/P/F)	Canada	*Pinus contorta* Loudon **Picea glauca* (Moench) Voss **Abies amabilis* (Loudon) Forbes *Abies grandis* (D.Don) Lindley
Sugi	Japan	*Cryptomeria japonica* (L.f.) D.Don
Hinoki	Japan	*Chaemaecyparis obtusa*
Akamatsu/karamatsu (pine/larch)	Japan	*Pinus densiflora* Sieb. et Zucc./ *Larix kaempferi* (Lamb.) Carr.
Nara/Buna (oak/beech)	Japan	*Quercus* sp./ *Fagus* sp.

* and other species