

# Benchmarking of Sawmill Industries in North America, Europe, Chile, Australia and New Zealand

*An intensive examination of the costs and efficiencies of sawmilling industries*



**“Over \$10 billion of investment in solid wood product plants will be needed in the next few years if the incremental availability of radiata pine is to be harvested. The optimum location of this investment is a critical issue.”**

**AMEC** (previously AGRA Simons)

*Leading edge engineering to the forestry sector*

**BIS Shrapnel**

*Global business research and forecasting*

# CONTENTS

<b>EXECUTIVE SUMMARY.....</b>	<b>I</b>
Study Background .....	i
Study participants .....	i
Units & Conversions.....	ii
Summary of key findings by region.....	ii
Summary of results by benchmark factor.....	vi
Log costs	vi
Processing costs	ix
Labour costs	x
Costs by operation centre	xiii
Value extraction	xiv
Costs & Returns	xv
<b>1      STUDY BACKGROUND.....</b>	<b>1</b>
1.1      Benchmarking .....	1
1.2      Methodology .....	2
<b>2      PROFILES OF STUDY PARTICIPANTS.....</b>	<b>4</b>
2.1      Number of companies surveyed.....	4
<b>3      GLOBAL SITUATION .....</b>	<b>6</b>
3.1      Consumption .....	6
3.2      Supply/demand balances for sawnwood products .....	8
3.3      North America.....	9
United States	9
Canada	12
3.4      Trade between the US and Canada .....	12
Lumber I	13
Lumber II	13
Lumber III	13
The 1996 Softwood Lumber Agreement	13
Lumber IV	14
The impact of the dispute on lumber prices	14
3.5      Chile .....	16
3.6      New Zealand.....	17
3.7      Future outlook.....	18
<b>4      INDUSTRY OVERVIEWS .....</b>	<b>19</b>
4.1      British Columbia .....	19
BC Interior	19
BC Coast	22
4.2      United States Pacific Northwest .....	28
4.3      United States South.....	32
4.4      Europe .....	36
4.5      Finland .....	37
Resource, Finland	37
Sawn timber production, Finland	39
Domestic consumption, Finland	40
Import sources, Finland	41
Export destinations, Finland	41
Industry structure, Finland	42

4.6	Austria .....	43
	Resource, Austria	43
	Sawn timber production, Austria	43
	Domestic consumption, Austria	44
	Import sources, Austria	45
	Export destinations, Austria	46
	Industry structure, Austria	46
4.7	Sweden .....	47
	Resource, Sweden	47
	Sawn timber production, Sweden	47
	Domestic consumption, Sweden	48
	Import sources, Sweden	49
	Export destinations, Sweden	49
	Industry structure, Sweden	50
4.8	Germany.....	51
	Resource, Germany	51
	Sawn timber production, Germany	52
	Domestic consumption, Germany	52
	Import sources, Germany	53
	Export destinations, Germany	54
	Industry structure, Germany	54
4.9	Chile .....	55
	Resource, Chile	55
	Sawn timber production, Chile	56
	Domestic consumption, Chile	57
	Export destinations, Chile	58
	Industry structure, Chile	59
4.10	New Zealand.....	60
	Resource, New Zealand	60
	Sawn timber production, New Zealand	62
	Sawn timber species, New Zealand	63
	Domestic consumption, New Zealand	64
	Export markets, New Zealand	65
	Industry location, New Zealand	68
	Industry structure, New Zealand	70
	Domestic and export market prices, New Zealand	72
4.11	Australia.....	73
	Resource, Australia	73
	Sawn timber production, Australia	76
	Domestic consumption, Australia	77
	Import sources, Australia	78
	Export destinations, Australia	80
	Industry location, Australia	80
	Industry structure, Australia	82
	Market trends, Australia	83
<b>5</b>	<b>MILL CONSTRUCTION COSTS .....</b>	<b>85</b>
5.1	Mill capacity.....	85
5.2	Mill description .....	86
5.3	Mill capital construction costs .....	86
5.4	Labour costs and productivity .....	90
5.5	Discussion .....	90

<b>6</b>	<b>CONVERSION FACTORS .....</b>	<b>92</b>
6.1	Log conversion factors .....	92
	North America	92
	Europe	92
	Chile	92
	New Zealand & Australia	93
6.2	Lumber conversion factors.....	93
	North America	93
	Europe	94
	Chile	94
	Australia	94
	New Zealand	94
<b>7</b>	<b>LOG SUPPLY .....</b>	<b>95</b>
7.1	Supply sources .....	95
	Ownership type	95
	Resource type	96
7.2	Log costs .....	98
7.3	Residue income/costs .....	102
	Woodchips	102
	Residue income as a percent of log cost	104
	Net log costs	105
<b>8</b>	<b>SAWMILLING COSTS .....</b>	<b>108</b>
8.1	Sawmilling costs by cost type .....	108
	Structural framing mill	108
	Appearance lumber mill	110
8.2	Production costs by operation centre .....	112
	Structural framing mill	112
	Appearance framing mill	113
8.3	Exchange rate impacts .....	114
<b>9</b>	<b>VALUE EXTRACTION .....</b>	<b>116</b>
<b>10</b>	<b>PERFORMANCE BENCHMARKS .....</b>	<b>120</b>
10.1	Cost & returns .....	120
	Structural mills	121
	Appearance mills	123
10.2	Manufacturing benchmarks .....	125
	Planned operating hours	125
	Actual operating hours	126
	Cubic meters per operating hour	128
	Net log cost as % of net sales	129
	Production labour cost as % of net sales	131
	Average hourly labour rate	133
	Log conversion	137
10.3	Labour capitalisation benchmark .....	138
	Structural mills	139
	Appearance mills	140
10.4	Labour productivity .....	141
	Sawn timber output per employee	141
	Net sales per number of employees	143
	Net sales per production employee	146
	Total labour cost as a per cent of net sales	147
10.5	Labour capitalisation versus productivity .....	149

10.6	Inventory.....	151
	Log inventory as a percentage of total input	151
	Sawn wood inventory turnover per year	153
	Finished goods inventory as a percentage of net sales	154
10.7	Distribution & exports .....	155
	Transportation costs	155
	Exports as a percentage of sales	156
<b>11</b>	<b>DELIVERED COSTS.....</b>	<b>158</b>
11.1	Structural sawnwood.....	159
	Japan	159
	US West Coast	159
	US Gulf States	160
	US East Coast	160
	Australia	161
11.2	Appearance grade sawnwood.....	162
	Japan	162
	US West Coast	162
	US Gulf States	163
	US East Coast	163
<b>12</b>	<b>CURRENT OPERATING PRACTICES.....</b>	<b>164</b>
12.1	Manufacturing.....	164
	Conversion factors	164
	Use of automation	1644
	Areas of competitive advantage	155
	Future changes in manufacturing	166
12.2	Quality management .....	168
12.3	Environmental .....	169
	Certification	169
<b>13</b>	<b>INVESTMENT CLIMATE.....</b>	<b>171</b>
13.1	Australia.....	171
	Legislation	171
	Environmental compliance	171
	Labour relations	172
	Foreign investment	172
	Taxation	173
	Investment incentives	173
	Carbon credits	173
13.2	New Zealand.....	174
	Legislation	174
	Environmental compliance	174
	The Kyoto protocol	175
	Labour relations	176
	Attitudes to foreign investment	177
	Taxation & accounting law	177
	Investment incentives	178
13.3	Chile .....	178
	Foreign investment	178
	Incentives	179
	Environmental constraints	179
	Taxation	180
13.4	North America.....	180

**TABLES**

I	Number of benchmarked mills by region and size .....	i
II	Typical grade recoveries for structural mills by region .....	xiv
III	Typical North American grade recoveries for appearance mills by region .....	xv
Table 2.1	Location of mills benchmarked .....	4
Table 2.2	Size of mills benchmarked .....	5
Table 2.3	Export orientation of mills benchmarked.....	5
Table 3.1	US softwood lumber exports by destination – 2001 .....	9
Table 3.2	US softwood lumber exports by species – 2001 .....	10
Table 3.3	Supply sources for imports from Europe, 2000, 2001.....	11
Table 3.4	Softwood lumber exports by species & destination - Canada, 2001 .....	12
Table 3.5	Chilean sawn timber exports by country of destination, 1997–2001. ....	16
Table 3.6	Sawn timber exports by destination – New Zealand, 1998 – 2002.....	17
Table 4.1	Species breakdown for BC Interior log harvest, 2001 .....	19
Table 4.2	Industry profile BC Interior, 2002.....	20
Table 4.3	Typical large efficient mill characteristics, BC Interior.....	22
Table 4.4	Log production by species, 2001.....	22
Table 4.5	Industry profile BC Coast.....	23
Table 4.6	Characteristics of a typical efficient mill, BC Coast.....	27
Table 4.7	Selected log prices – US Pacific Northwest, 2001 .....	29
Table 4.8	Profile of Ponderosa Pine sawmill industry, US Pacific Northwest .....	31
Table 4.9	Characteristics of a typical efficient sawmill, US Pacific Northwest.....	32
Table 4.10	Lumber dimensions produced in the US South.....	34
Table 4.11	Sawn timber industry profile, US South .....	35
Table 4.12	Characteristics of a typical efficient sawmill, US South.....	35
Table 4.13	Profile of Finnish Sawmill Industry .....	42
Table 4.14	Profile of Austrian Sawmill Industry .....	47
Table 4.15	Sawn timber imports by country of destination, Sweden, 1998 – 2001.....	49
Table 4.16	Sawn timber exports by country of destination, Sweden, 1998 – 2001. ....	50
Table 4.17	Profile of Swedish Sawmill Industry.....	50
Table 4.18	Profile of German sawmill industry .....	55
Table 4.19	Area of Chilean plantation forests by species, 2001 .....	56
Table 4.20	Sawn timber exports from Chile by country of destination, 1997–2001. ....	59
Table 4.21	Sawmill industry profile, Chile 2001. ....	59
Table 4.22	Sawn timber production by species, New Zealand, year ended March 2001.....	64
Table 4.23	Sawmill numbers by size and location – New Zealand, 2000.....	71
Table 4.24	Sawn timber production by sawmill size, North Island & South Island – March 2001 .....	71
Table 4.25	Number of hardwood and softwood sawmills by log intake, Australia, 1990 and 2000.....	83
Table 4.26	Supply source for hardwood and softwood sawmills – Australia, 1997/98, 1998/99 .....	83
Table 5.1	Sawmill capital cost requirements – US South.....	87
Table 5.2	Sawmill capital cost requirements - US Inland West .....	87
Table 5.3	Sawmill capital cost requirements – BC Interior.....	87
Table 5.4	Sawmill capital cost requirements – BC Coast.....	88
Table 5.5	Sawmill capital cost requirements - Australia .....	88
Table 5.6	Sawmill capital cost requirements – Chile .....	89
Table 5.7	Structural sawmill capital cost requirements – New Zealand .....	89
Table 5.8	Appearance grade sawmill capital cost requirements – New Zealand .....	89
Table 5.9	Labour rates and productivity index* .....	90
Table 5.10	Capital costs of greenfield mill by region .....	91
Table 8.1	Sawmill operating costs US\$/m <sup>3</sup> – structural mills.....	109
Table 9.1	Sawmill operating costs US\$/m <sup>3</sup> – appearance mills.....	110

Table 9.2	Typical grade recoveries for structural mills by region .....	117
Table 9.3	Typical North American grade recoveries for appearance mills by region .....	118
Table 10.1	Costs & returns for structural mills – Australia, New Zealand, BC Coast, BC Interior, US South, Europe.....	121
Table 10.2	Costs & returns for appearance/grade mills – New Zealand, Chile & US Pacific Northwest .....	123
Table 10.3	Shipping cost by origin and destination.....	155
Table 11.1	Delivered costs of structural sawnwood to Japan by region of origin.....	159
Table 11.2	Delivered costs of structural sawnwood to the US West Coast, by region of origin.....	160
Table 11.3	Delivered costs of structural sawnwood to the US Gulf States by region of origin.....	160
Table 11.4	Delivered costs of structural sawnwood to the US East Coast, by region of origin .....	161
Table 11.5	Delivered costs of structural sawnwood to Australia, by region of origin.....	161
Table 11.6	Delivered costs of appearance grade sawnwood to Japan, by region of origin .....	162
Table 11.7	Delivered costs of appearance grade sawnwood to the US West Coast, by region of origin.....	162
Table 11.8	Delivered costs of appearance grade sawnwood to US Gulf States, by region of origin.....	163
Table 11.9	Delivered costs of appearance grade sawnwood to US East Coast, by region of origin.....	163
Table 11.10	Percentage of mills utilising technology and automation, by region .....	165

**FIGURES**

I	Log Prices-North America, Europe, Chile, New Zealand and Australia .....	viii
II	Residue income as a percentage of log cost .....	viii
III	Net log costs .....	xii
IV	Processing costs .....	xi
V	Unit labour rates.....	xiii
VI	Labour productivity.....	xiii
VII	Labour capitalisation versus labour productivity .....	xiii
VIII	Processing costs by operation centre .....	xiii
IX	Costs and returns for structural mills .....	xvii
X	Costs and returns for appearance mills.....	xviii
Figure 3.1	World lumber consumption .....	6
Figure 3.2	Total sawnwood consumption by region, 1981, 1991 and 2001 .....	7
Figure 3.3	Net trade by region 1999 – 2001 .....	8
Figure 3.4	Softwood lumber imports by country (excl Canada) – United States, 1998–2001 .....	11
Figure 3.5	SPF lumber futures for duty paid prices .....	15
Figure 4.1	Production of lumber in BC Interior, 1990 – 2001 .....	20
Figure 4.2	Delivered log costs – BC Interior, 1992–2001 .....	21
Figure 4.3	Production of lumber on the BC Coast, 1990 – 2001 .....	23
Figure 4.4	Delivered log costs – BC Coast, 1992 – 2001 .....	25
Figure 4.5	Vancouver log market prices for selected grades 1990–2001.....	23
Figure 4.6	Production of lumber in the US West 1989–01 .....	23
Figure 4.7	Ponderosa pine log prices, average of Washington, Oregon & California .....	30
Figure 4.8	Ponderosa pine (and Sugar pine-US Pacific Northwest, 1989 to 2001 .....	41
Figure 4.9	Softwood lumber production – US South, 1983 – 2001.....	33
Figure 4.10	Pine sawn timber stumpage – US South, 1990 – 2001.....	34
Figure 4.11	European production of softwood sawnwood, 1997 – 2001 .....	36
Figure 4.12	Production by country in Western Europe .....	37
Figure 4.13	Dominant trees species in forest stands, Finland .....	38
Figure 4.14	Land Use in Finland .....	38
Figure 4.15	Roundwood production, Finland, 1997–2001.....	39
Figure 4.16	Sawn timber production, Finland, 1997–2001. ....	40
Figure 4.17	Sawn timber consumption, Finland, 1997–2001.....	40
Figure 4.18	Sawn timber imports, Finland, 1997–2001.....	41
Figure 4.19	Sawn timber exports, Finland, 1997–2001.....	42
Figure 4.20	Dominant tree species in forest stands, Austria.....	43
Figure 4.21	Sawn timber production, Austria, 1997–2001. ....	44
Figure 4.22	Sawn timber consumption, Austria, 1997–2001.....	45
Figure 4.23	Sawn timber imports, Austria, 1997–2001.....	45
Figure 4.24	Sawn timber exports, Austria, 1997–2001.....	46
Figure 4.25	Sawn timber production, Sweden, 1997–2001. ....	48
Figure 4.26	Sawn timber consumption, Sweden, 1997–2001.....	48
Figure 4.27	Sawn timber imports, Sweden, 1997–2001.....	49
Figure 4.28	Sawn timber exports, Sweden, 1997–2001.....	50
Figure 4.29	Forest ownership in Germany.....	51
Figure 4.30	Roundwood production, Germany, 1997–2001. ....	52
Figure 4.31	Sawn timber production, Germany, 1997–2001.....	52
Figure 4.32	Sawn timber consumption, Germany, 1997–2001. ....	53
Figure 4.33	Sawn timber imports, Germany, 1997–2001. ....	53
Figure 4.34	Sawn timber exports, Germany, 1997–2001.....	54
Figure 4.35	Area of Chilean plantation forests by species, 2001 .....	56
Figure 4.36	Sawn timber production in Chile, 1980 – 2001.....	57
Figure 4.37	Consumption of sawn timber in Chile, 1980 – 2001 .....	57
Figure 4.38	Exports of sawn timber from Chile, 1980–2001 .....	58
Figure 4.39	New Zealand forest plantation ownership, 1997 and 2002.....	60

Figure 4.40	Past and future plantation sawlog harvest by grade – New Zealand, 1970– 2020 .....	62
Figure 4.41	Sawn timber production, New Zealand, 1990–2002.....	62
Figure 4.42	Sawn timber production by species, 2001 .....	63
Figure 4.43	Sawn timber production excluding Radiata pine, 1990 – 2001.....	64
Figure 4.44	Total apparent sawn timber consumption and consumption per capita – New Zealand, 1971–2002 .....	65
Figure 4.45	New Zealand plantation wood harvest, domestic consumption and exports, 1971 – 2002 .....	66
Figure 4.46	New Zealand annual sawn timber exports to major market destinations, 1990 –2002 .....	66
Figure 4.47	New Zealand sawn timber markets, year ended June 1992 and year ended June 2002.....	67
Figure 4.48	Sawn timber exports by country – New Zealand, 1995–2002.....	68
Figure 4.49	Quarterly regional sawn timber production, 1997 – 2002.....	69
Figure 4.50	Regional Sawn Timber Production, New Zealand – year ended June 1997 & June 2002.....	70
Figure 4.51	Share of sawn timber production by sawmill production size, North & South Island – March, 2001 .....	72
Figure 4.52	Radiata pine sawn timber prices – New Zealand, 1994–2002 .....	73
Figure 4.53	Native forest tenure – Australia, 1997 .....	74
Figure 4.54	Area of newly established plantations, 1995 – 2001.....	74
Figure 4.55	Plantation forest area by state 2001 .....	75
Figure 4.56	Sawn timber production by species group – Australia, 1951–2001 .....	77
Figure 4.57	Sawn timber consumption and detached housing starts – Australia, 1990–2001 .....	78
Figure 4.58	Sawn timber imports by country – Australia, 1993–2002.....	79
Figure 4.59	Sawn timber imports by state – Australia, 1993–2001 .....	79
Figure 4.60	Sawn timber exports by country of destination – Australia, 1996–97 to 2000–01 .....	80
Figure 4.61	Hardwood sawn timber production by state, 1951–2001.....	81
Figure 4.62	Softwood sawn timber production by state – Australia, 1951–2001 .....	82
Figure 4.63	Softwood sawn timber prices & housing starts – Australia, 1994–2001 .....	84
Figure 7.1	Log supply by ownership type .....	96
Figure 7.2	Log supply by forest type .....	97
Figure 7.3	Gross log costs – sawlogs.....	99
Figure 7.4	Woodchip prices –2002, FOB.....	102
Figure 7.5	Residue income as a percent of log cost – structural mills, by region .....	104
Figure 7.6	Residue income as a percent of log cost – appearance mills, by region .....	105
Figure 7.7	Net log cost – structural mills by region .....	106
Figure 7.8	Net log cost – appearance mills, by region .....	107
Figure 8.1	Sawmill operating costs – structural mills.....	109
Figure 8.2	Sawmill operating costs – appearance mills.....	110
Figure 8.3	Sawmill processing costs by operational centre – structural mills.....	112
Figure 8.4	Sawmill processing costs by operational centre – appearance mills.....	113
Figure 8.5	Costs & returns for structural mills – Australia, New Zealand, BC Coast, BC Interior, US South, Europe.....	121
Figure 10.1	Costs & returns for appearance/grade mills – New Zealand, Chile, US Pacific Northwest .....	123
Figure 10.2	Planned operating hours.....	126
Figure 10.3	Actual operating hours.....	127
Figure 10.4	Output per operating hour – structural mills.....	128
Figure 10.5	Cubic meters per hour – appearance mills.....	129
Figure 10.6	Net log cost as a percent of sales – structural mills.....	130
Figure 10.7	Log cost as a percent of sales – appearance mills.....	131
Figure 10.8	Production labour cost as a percent of sales – structural mills .....	132
Figure 10.9	Production labour cost as a percent of sales – appearance mills .....	133
Figure 10.10	Average hourly rates – operational labour .....	134

Figure 10.11	Average hourly rates – maintenance labour.....	135
Figure 10.12	Average rates - management .....	136
Figure 10.13	Log conversion by diameter and region .....	137
Figure 10.14	Labour capitalisation – structural mills.....	139
Figure 10.15	Labour capitalisation – appearance mills.....	140
Figure 10.16	Sawn timber output per operational employee – structural mills .....	142
Figure 10.17	Sawn timber output per operational employee – appearance mills .....	143
Figure 10.18	Net sales per number of employees – structural mills .....	144
Figure 10.19	Net sales per number of employees – appearance mills.....	145
Figure 10.20	Net sales per production employee – structural mills.....	146
Figure 10.21	Net sales per production employee – appearance mills.....	147
Figure 10.22	Total labour cost as a percent of net sales – structural mills.....	148
Figure 10.23	Total labour cost as a percent of net sales – appearance mills.....	148
Figure 10.24	Labour capitalisation versus labour productivity by region .....	150
Figure 10.25	Average log inventory as a percent of total log input.....	151
Figure 10.26	Sawn wood inventory turnover by volume .....	153
Figure 10.27	Finished goods inventory as a percent of sales .....	154
Figure 10.28	Exports as a percent of sales.....	157