

**THE USE OF TIMBER AND
RECONSTITUTED WOOD IN THE
AUSTRALIAN FURNITURE INDUSTRY**

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1988 GOTTSTEIN FELLOWSHIP REPORT

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Bill Gottstein was an outstanding forest products research scientist working with the Division of Forest Products of the Commonwealth Scientific Industrial Research Organisation (CSIRO) when tragically he was killed in 1971 photographing a tree-felling operation in New Guinea. He was held in such high esteem by the industry that he had assisted for many years that substantial financial support to establish an Educational Trust Fund to perpetuate his name was promptly forthcoming.

The Trust has three major forms of activity,

- (1) Fellowships - each year applications are invited from eligible candidates to submit a study programme in an area considered to be of benefit to the Australian forestry and forest industries. Study tours undertaken by Fellows have usually been to overseas countries but several have been within Australia. Fellows are obliged to submit reports on completion of their programme. These are then distributed to industry if appropriate.
- (2) Study Tours - industry group study tours are arranged periodically and have been well supported.
- (3) Seminars - the information gained by Fellows is often best disseminated by seminars as well as through the written reports.

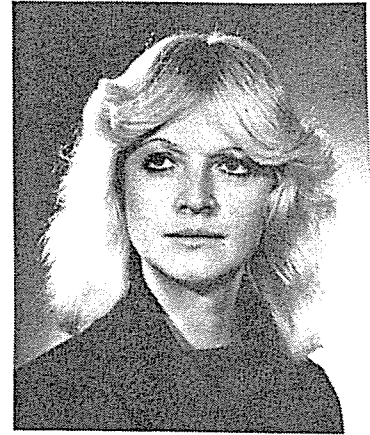
Further information may be obtained by writing to, The Secretary, J.W. Gottstein Memorial Trust Fund, P.O. Box 56, Highett, Victoria, 3190. Australia.

ABOUT THE WRITER

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Previously she was a Research Fellow at the University of Melbourne working on a project "To Optimise the Use of Timber in Furniture Manufacture in Australia".

Dr. Ozarska is highly qualified in wood technology from the Academy of Agriculture, Poznan, Poland (Masters Degree in Wood Technology, PhD in Timber Engineering).



She is particularly interested in the strength design and testing of furniture. She expanded her experience in this field at the Swedish Furniture Institute in Stockholm, Sweden.

The Gottstein Fellowship helped her to evaluate the Australian furniture industry and to identify the complexity of problems which it is facing. In this Gottstein report she recommends ways and means of improving the competitiveness of Australian furniture.

Dr. Ozarska is a Member of the Institute of Wood Science and a Member of the Institution of Engineers, Australia.

APOLOGY

The writer apologises for any mistakes and inaccuracies in English style and grammar. English is her second language and she has put much effort into writing this report as correctly and accurately as possible.

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CONCLUSIONS AND RECOMMENDATIONS

1. The Australian furniture industry encompasses a wide range, having regard to the size of companies and the number of employees involved.

The majority of furniture manufacturers are private firms. However, there is a growing number of public companies aiming at high specialisation of production.

- It would seem essential:
 - to investigate the possibility of improved efficiency in such types of furniture production;
 - to increase the cooperation between companies involved in the manufacture of components.

2. It has been recognised that there is a lack of communication between timber suppliers and representatives of the furniture industry.

The main problems concern the availability of required species and the desired sizes of timber.

The majority of timber suppliers do not regard the furniture industry as their important customers.

- The time delay between ordering timber, both imported and local, and its supply is often too long.
- Currently, a limited range of available thicknesses of timber has been recognised as a factor restricting the design of furniture.
- There is a demand in the timber industry for packs of timber made to standard lengths, thicknesses and widths for each desired quality.
- Top quality timber is scarce. The main problem concerns the moisture content of the timber, particularly imported species. The drying of thick timber has been reported to be difficult. It would be essential to develop methods of drying hardwoods more than 50 mm thick.
- There is a lack of uniform terminology in timber grading between the states. It is strongly recommended that a national grading system for timber used in the furniture industry be developed in accord with the international system.

3. There is a predominance of solid furniture in Australia. A promotion of reconstituted wood with a strong emphasis on the use of top quality veneer from Australian species should be developed.
4. Furniture manufacturers are facing many problems which should be resolved in the near future. The main difficulties evolve around the following issues:
 - (a) a lack of innovative design:
 - a more competitive market, both national and international, could be established by the development of Australian style furniture based on local timber and veneer;
 - design should take cognisance of both artistic and engineering aspects, while having regard to a minimum wastage of timber, and should be formulated with a view to efficient mass-production by a particular company.
 - (b) a lack of resource material regarding modern technical methods, new technology and machinery:
 - furniture manufacturers should be provided with comprehensive information and advice on the use and availability of new materials, fittings, finishes, technology and machinery.
 - (c) a lack of expertise and research on material and product failure and a lack of instructions on the use of finishes for different species.
 - (d) a lack of quality control:
 - quality of furniture could be improved by rigorous quality control over the whole process of furniture manufacture;
 - the Australian furniture industry does not have quality standards. A substantial majority of surveyed manufacturers indicated a need to establish quality control standards for both the manufacturing process and the final product.
 - (e) a lack of uniformity in training:
 - the training system varies between states. This would seem to be an important factor to be considered in the development of the furniture industry.

INTRODUCTION

In recent years, a growing interest in the Australian furniture industry has been recognised. There are a number of areas where opportunities exist which, if developed, could be beneficial to the industry.

It appears that furniture manufacturers need assistance and help in meeting increasing requirements regarding quality of furniture, design and technology.

It is essential to recognise all problems and difficulties which the furniture industry is facing in order to develop and improve its input to the national economy.

Therefore, a study tour proposal was prepared aimed at appraising the current situation in the furniture industry in Australia. The study was approved and supported by the Gottstein Memorial Trust Fund.

The study tour focussed on the following topics:

1. The use of solid timber and reconstituted wood in furniture manufacturing.
2. Identification of any supply problems from the point of view of the furniture manufacturer and the timber supplier.
3. Identification of the main problems encountered in furniture manufacturing, with an emphasis placed on:
 - design of furniture,
 - technology,
 - machinery,
 - quality of furniture,
 - market,
 - training.

The survey included furniture manufacturers and timber suppliers in Queensland, Western Australia, South Australia, New South Wales, Victoria and Tasmania.

The list of companies to be visited was discussed with the Guild of Furniture Manufacturers and the Furniture Industry Training Council in each state.

The actual selection reflected the necessity to investigate a whole range of Australian furniture manufacturers. The following criteria were taken into consideration in the selection:

1. Size of business.
2. Type of furniture produced.
3. Methods of manufacture.

The list of surveyed furniture manufacturers has been attached in Appendix 1.

The list of timber suppliers included both solid wood and reconstituted wood suppliers (see Appendix 2).

To investigate the methods of furniture design, training and research in the furniture industry, the survey also included some research institutions, designers, and design and training centres (see Appendix 3).

THE USE OF FOREST PRODUCTS IN THE AUSTRALIAN FURNITURE INDUSTRY

SECTION 1

CHARACTERISTICS OF FURNITURE MANUFACTURERS

This section includes various characteristics of furniture manufacturers regarding:

- size of companies;
- type of furniture produced.

1.1 Size of Furniture Manufacturers

Australian furniture manufacturers vary in size of business and number of employees. Companies range in size from small businesses employing three people to large firms with 100-300 employees.

The majority of large companies employing more than 100 people are located in New South Wales and Victoria. The smallest furniture manufacturers are located in Tasmania (2-46 people employed), and in Western Australia (2-60 employees). Generally, one can say that the furniture industry consists mainly of small companies employing an average of 29 people.

The majority of furniture manufacturers are private firms. However, there is a growing number of public companies. An example of such a company is Allwood Furniture Holdings Limited, Belmont, Western Australia.

The company consists of seven furniture manufacturers in three states and has been recognised as the largest domestic flat panel furniture manufacturer in Australia.

Company structure has been presented in Figure 1.

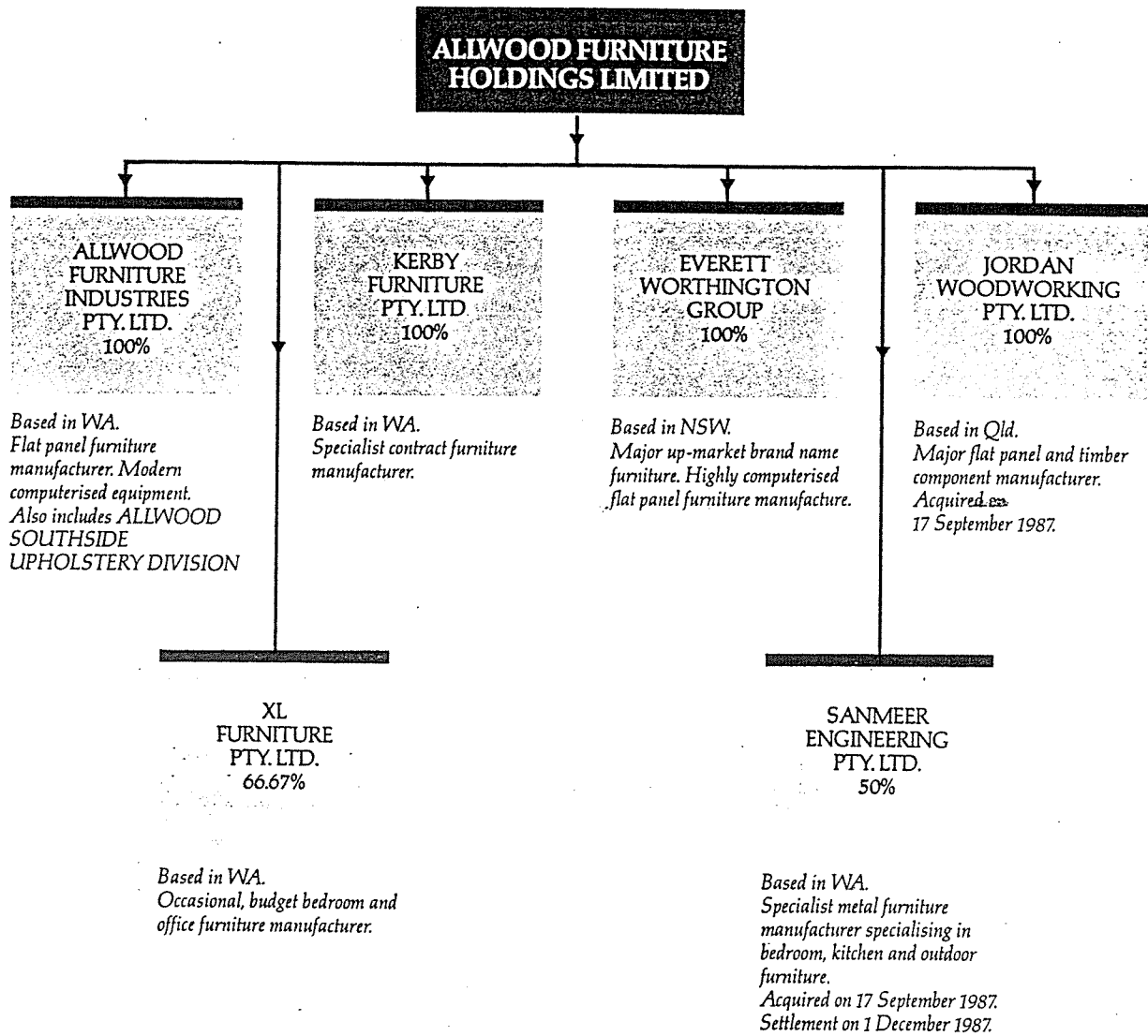


FIGURE 1: THE STRUCTURE OF THE ALLWOOD FURNITURE HOLDINGS LIMITED

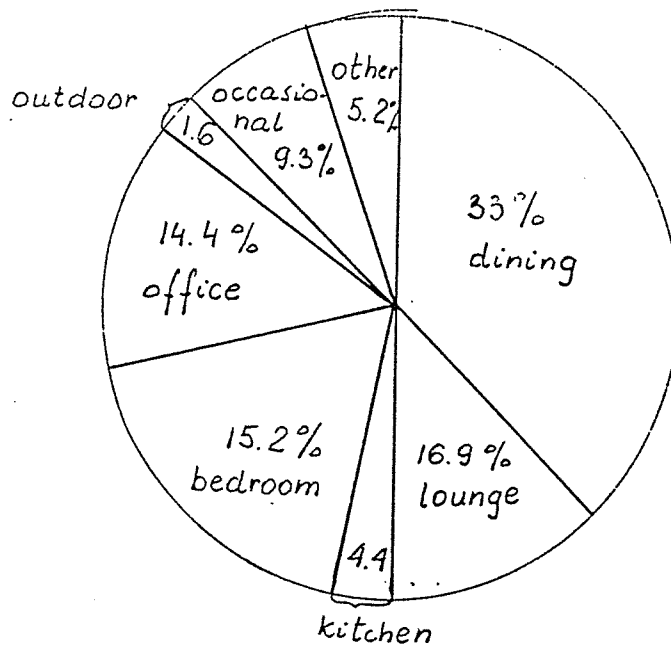
The prime objective of the Allwood group is to enhance their shareholders' investment in the company by achieving significant growth. The main idea of a public company is a horizontal integration and cooperation into complementary areas such as upholstery, timber furniture and metal furniture. A high specialisation of production allows a greater efficiency in manufacture. This type of company is very common in Europe.

1.2 Types of Furniture

The majority of furniture manufacturers produce domestic furniture. However, there is a growing number of companies which manufacture commercial furniture, i.e. detailed joinery and fitments for banks, hotels, offices and other institutions. These companies offer a large range of products manufactured from wholly, or at least predominantly, locally made components. Examples of very successful manufacturers of this type of production are:

1. Rintoul Pty Ltd - Sydney.
2. Batoma - Sydney.
3. Architectural Products - Hobart.

Diagram 1 specifies the types of furniture manufactured by the companies surveyed.



The category described as "other" furniture includes: detailed joinery, fitments for shops, banks, offices, hotels, and display furniture.

The majority of surveyed furniture manufacturers have been involved in production of dining furniture, followed by lounge furniture.

51.4% of surveyed companies produced two or three types of furniture. "Types of furniture" relates to the eight types of furniture as specified in Diagram 1.

TABLE 1: VARIETY OF FURNITURE MANUFACTURED BY COMPANIES UNDER SURVEY

NUMBER OF TYPES OF FURNITURE PRODUCED BY ONE COMPANY	PERCENTAGE OF TOTAL NUMBER OF SURVEYED COMPANIES
	%
1	18.6
2	25.9
3	25.5
4	16.2
5	11.6
>5	-

Each type of furniture includes an average of six different designs. Consequently the variety of products is very large.

Photos 1-4 present examples of different types of furniture.

PHOTO 1: CLASSIC DINING SET DESIGNED BY CATT PTY LTD (WA)



PHOTO 3: LOUNGE FURNITURE BY NOBLETT FURNITURE PTY LTD (SA)

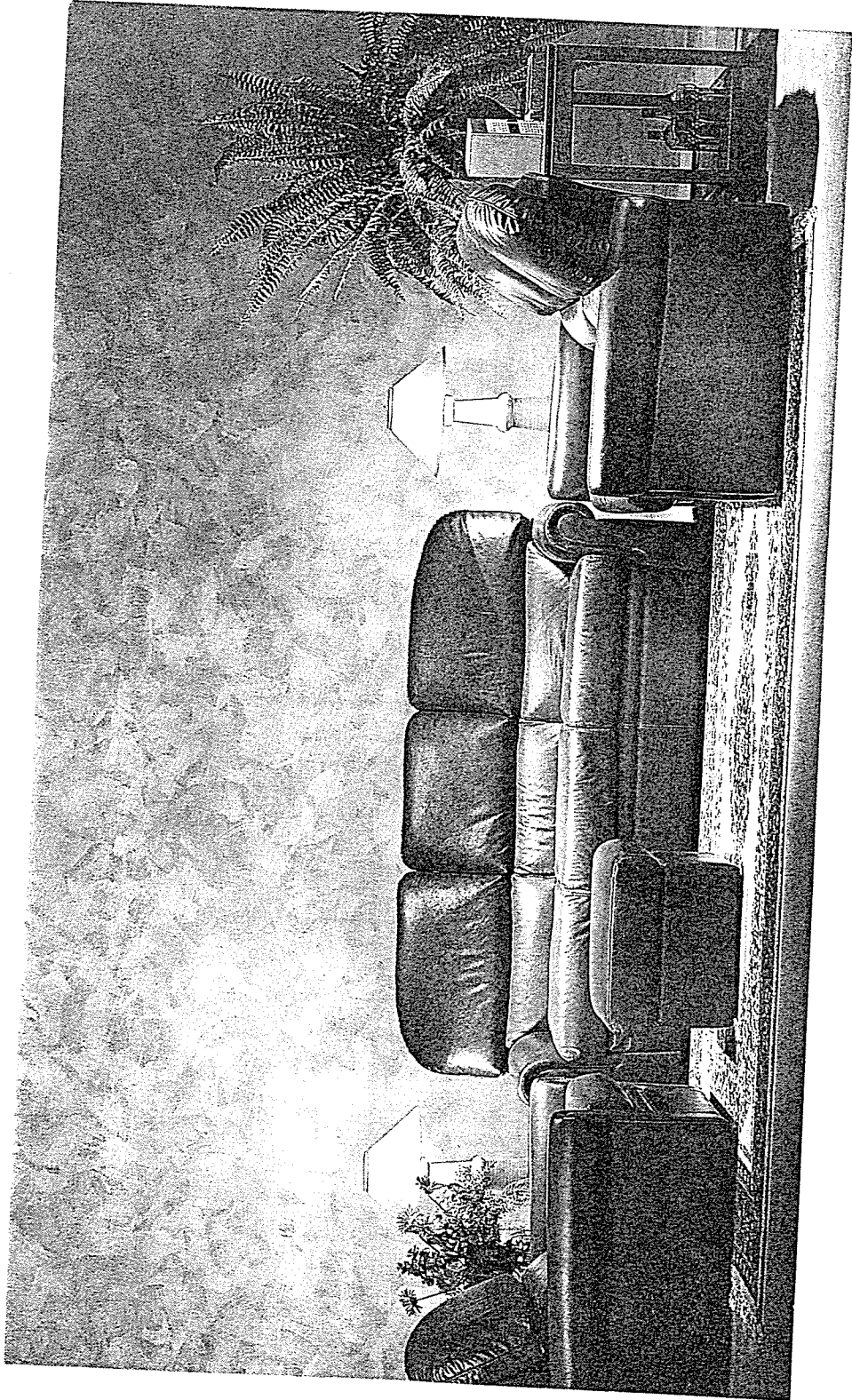
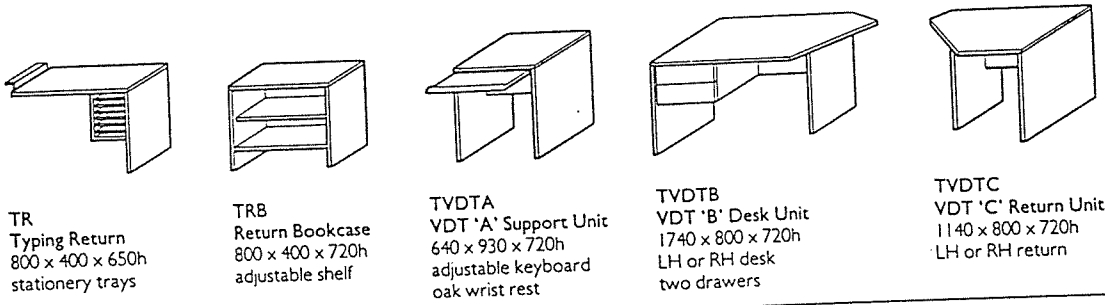


PHOTO 4: TANDEM - AN OFFICE MODULAR SYSTEM
 OFFERS A WIDE VARIETY OF ASSEMBLED CONFIGURATIONS
 TO PROVIDE A TOTALLY INTEGRATED WORKSTATION
 (ATELIER FURNITURE & INTERIORS PTY LTD - WA)



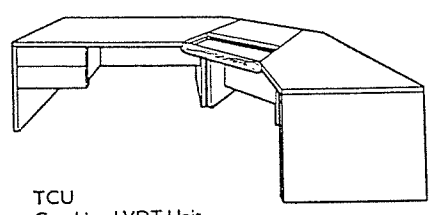
TR
 Typing Return
 800 x 400 x 650h
 stationary trays

TRB
 Return Bookcase
 800 x 400 x 720h
 adjustable shelf

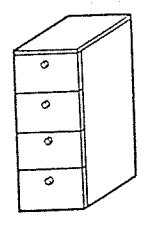
TVDTA
 VDT 'A' Support Unit
 640 x 930 x 720h
 adjustable keyboard
 oak wrist rest

TVDTB
 VDT 'B' Desk Unit
 1740 x 800 x 720h
 LH or RH desk
 two drawers

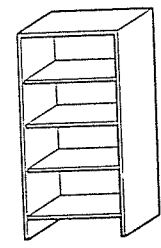
TVDTC
 VDT 'C' Return Unit
 1140 x 800 x 720h
 LH or RH return



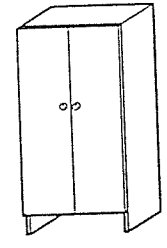
TCU
 Combined VDT Unit
 comprising support, desk
 and return units A, B & C



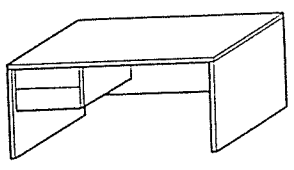
TFC
 Filing Cabinet
 500 x 500 x 1260h
 four filing drawers



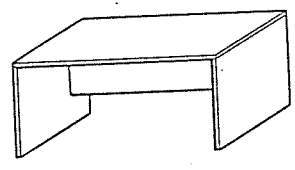
TS
 Storage Unit
 800 x 400 x 1600h
 one fixed, two
 adjustable shelves



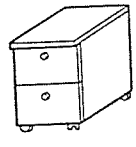
TCD
 Cupboard
 800 x 400 x 1600h
 adjustable shelves



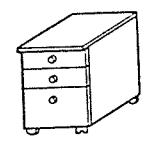
TDP
 Desk with pedestal
 1600 x 800 x 720h
 two drawers, LH or RH



TD
 Desk
 1600 x 800 x 720h



TMP2
 Mobile Pedestal
 500 x 500 x 660h
 two filing drawers



TMP3
 Mobile Pedestal
 500 x 500 x 660h
 two drawers and
 filing drawer



TMP4
 Mobile Pedestal
 500 x 500 x 660h
 four drawers

SECTION 2

SOLID WOOD AND RECONSTITUTED WOOD USED IN FURNITURE MANUFACTURE

2.1 The Relationship Between the Use of Solid Wood and Reconstituted Wood

The majority of furniture manufacturers produce solid furniture. 54.6% of surveyed companies use both solid wood and reconstituted wood for furniture. The percentage varies however between states: in Queensland - 84%; in Tasmania - only 32%.

32.2% of companies specialise only in solid furniture, and 14.2% only in reconstituted wood furniture (Table 2).

TABLE 2: NUMBER OF COMPANIES PRODUCING SOLID WOOD, RECONSTITUTED WOOD OR BOTH TYPES OF FURNITURE

TYPE OF MATERIAL USED FOR FURNITURE	NUMBER OF COMPANIES IN %						AVERAGE
	QLD	WA	SA	NSW	VIC	TAS	
ONLY SOLID WOOD	12.0	40.0	37.5	14.2	40.0	60.0	32.2
ONLY RECON. WOOD	4.0	10.0	12.5	14.2	20.0	8.0	14.2
BOTH	84.0	50.0	50.0	71.6	40.0	32.0	54.6

2.2 Solid Wood Species

The variety of solid wood species used for furniture is fairly large. Forty-three different species, both native and imported were reported in use.

The majority of surveyed companies use only native species for furniture manufacture. A large number of companies use both native and imported species. However, there are furniture manufacturers using only imported timber.

The proportion between the use of native and imported species in different states has been presented in Table 3.

TABLE 3: THE USE OF SOLID WOOD SPECIES IN DIFFERENT STATES

ORIGIN OF TIMBER	NUMBER OF COMPANIES IN %					
	QLD	WA	SA	NSW	VIC	TAS
ONLY IMPORTED	14.2	-	17.0	14.3	7.2	-
ONLY NATIVE	57.3	86.6	50.0	28.5	60.5	83.3
BOTH	28.5	13.4	33.0	57.2	32.3	16.7

The largest use of native species has been reported in Western Australia, followed by Tasmania.

In these states, the most common species are local ones, i.e. in Western Australia the most popular species is Jarrah, in Tasmania most companies use local Blackwood and Tasmanian Oak.

In South Australia the most common timber is Radiata Pine, followed by Tasmanian Oak, the preferred species in New South Wales, Queensland and Victoria is Tasmanian Oak.

"Tasmanian Oak" is a collective name for three different species of eucalypt hardwoods: *Eucalyptus delegatensis*, *Euc. regnans* and *Euc. obliqua*. The species belong to the Ash group of Eucalypts and are known also as Australian Oak or Victorian Ash.

The most common imported species is Teak, followed by American Oak, Cedar and Mahogany.

TABLE 4: THE MOST COMMON SPECIES USED BY SURVEYED FURNITURE MANUFACTURERS IN DIFFERENT STATES

SPECIES	QLD	WA	SA	NSW	VIC	TAS
<u>Native Species:</u>						
1. Radiata Pine (Pinus radiata)	17.5	15.5	43.5	5.8	11.4	8.3
2. Tasmanian Oak (Euc. obliqua, regnans and delegatensis)	21.7	4.7	27.0	46.1	38.3	18.1
3. Jarrah (Eucalyptus marginata)	1.4	54.2	2.9	4.2	3.0	-
4. Blackwood (Acacia melanoxylon)	-	-	-	3.8	11.2	65.2
5. Hoop Pine (Araucaria cunninghamii)	19.2	-	-	-	-	-
The following species are used in small quantities.						
6. Slash Pine (Pinus elliottii)						
7. Blackbutt (Euc. pilularis)						
8. Blue Gum (Euc. saligna)						
9. Sheoak (Casuarina inophlora)						
10. White Birch (Schizomeria ovata)						
11. Turpentine (Syncarpia laurifolia)						
12. White Beech (Gmelina fasciculiflora)						
13. Blackbean (Castanospermum Australe)						
14. Silver Ash (Flindersia spp.)						
15. Myrtle (Nothofagus cunninghamii)						
16. Huon Pine (Dacrydium franklinii)						
17. Celery Top Pine (Phyllocladus aspenifol)						
18. Australian Cedar (Cedrela Toona)						
19. Qld Maple (Flindersia Brayeyana)						
20. Qld Silky Oak (Cardwellia sublimis)						
<u>Imported and Exotic Species:</u>						
21. Fijian Cedar (Myristica chartacea)						
22. Oregon (Douglas fir)						
23. Meranti (Shorea spp.)						
24. Nyatoh (Palaquium sp., Payena sp.)						
25. European Ash (Fraxinus excelsior)						
26. Aqua						
27. Teak (Tectona grandis)						
28. Central American Mahogany (Swietenia macrophylla)						
29. New Guinea Cedar (Cedrella toona)						
30. Kalantas (Toona Calantas)						
31. American White Ash (Fraxinus americana)						
32. Fijian Mahogany (Swietenia macrophylla)						
33. New Guinea Rosewood (Pterocarpus indicus)						
34. White Beech (Solomon Island) (Gmelina salomonensis)						
35. Kauri, Damar Minyak (Agathis spp.)						
36. Brazilian Walnut, Imbuia (Phoebe porosa)						
37. New Guinea Pencil Cedar (Palaquium spp.)						
38. American White Oak (Quercus alba)						
39. American Black Walnut (Juglans spp.)						
40. Sapele (Entandrophrangma cylindricum)						
41. African Mahogany (Khaya ivorensis)						
42. East Malaysian Red Cedar (Cedrela spp.)						
43. Baltic Pine (Pinus Sylvestris)						

2.3 Sizes of Solid Wood Bought by Furniture Manufacturers

2.3.1 The length of bought timber

The majority of furniture manufacturers are buying timber of random length and then cutting it into the required length. The length of timber varies between 0.9 m and 6.0 m.

2.3.2 The width of bought timber

37.7% of furniture manufacturers are buying timber at or near finished width. 21.5% of companies prefer to buy oversized timber and cut it to required width.

The widths of timber used for furniture vary from very narrow to fairly wide, as specified below:

<50, 50, 75, 100, 125, 150, 175, 200, 250, >250 [mm].

The most common widths specified are: 75 mm, 100 mm, 150 mm and 200 mm.

2.3.3 The thickness of timber

The majority of timber has been purchased in the following thicknesses:

<25, 25, 38, 50, 75 and 100 mm.

The most common thickness is 25 mm, followed by 38 mm.

TABLE 5: SIZES OF BOUGHT TIMBER

DIMENSION OF TIMBER	HOW SOLID WOOD IS BOUGHT	NUMBER OF COMPANIES BUYING THIS TYPE OF SOLID WOOD (%)
LENGTH	AT RANDOM LENGTH	64.5
	AT FINISHED LENGTH	8.2
	BOTH	27.3
WIDTH	OVERSIZE TO CUT	21.5
	AT OR NEAR FINISHED	37.7
	BOTH	40.8
THICKNESS	OVERSIZE TO CUT	73.5
	AT OR NEAR FINISHED	16.5
	BOTH	10.0

70.2% of furniture manufacturers are buying rough-sawn timber, and 29.8% dressed timber.

2.4 Grades of Solid Wood Used in Furniture Manufacture

There is a big variety in terminology describing grades of timber used in furniture manufacture, which indicates a lack of uniform specification in timber grading in different states.

Western Australia is the only state which has developed a uniform specification in grading of timber used for furniture (8). The survey made in Western Australia (5) indicates a variety of terminology used by timber suppliers and furniture manufacturers to describe different grades of timber (Table 6).

TABLE 6: SOLID WOOD GRADE TERMINOLOGY (5)

GRADE 1	GRADE 2	GRADE 3	GRADE 4
Terms used 1st No. 1	Select Appearance	Standard Dressed	Lower 2nd
Premium	A	Appearance 3	Merch
Polishing quality	Finished	Structural	Ungraded
Clears	Joinery	B	Rough seasoned
A and up	Top	F14, F8, F6, F5	Medium
Select for polish	Dry select	Dry dressed	Economy
Top select	Furniture quality	Mixed	
	Dressed select	Select Appearance 3	
		Sound and better	
		At or near finished	

The lack of uniform grading terminology in states makes it difficult to determine the use of particular grades of timber for furniture manufacture.

The majority of furniture manufacturers use timber grade 2 (select grade) for exposed components of furniture. Unexposed components are made of lower grades of timber (grade 3 and 4).

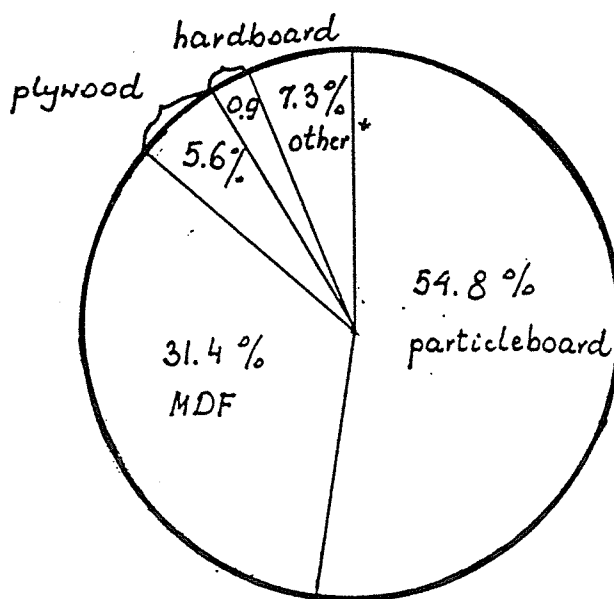
The majority of companies purchase graded timber. However, upgrading of timber during manufacture has also been reported.

SECTION 3
RECONSTITUTED WOOD USED IN FURNITURE MANUFACTURE

3.1 Types of Reconstituted Wood

According to Table 2, 14.2% of surveyed manufacturers specialise in manufacture of furniture from reconstituted wood. 54.6% of manufacturers use both reconstituted and solid wood. This proportion varies between states. The largest number of companies using reconstituted wood has been reported in Queensland, followed by New South Wales and South Australia.

Types of reconstituted wood used in furniture manufacture has been specified in Diagram 2.



*LVL, triboard.

The most common reconstituted wood used in furniture manufacture is particleboard, followed by customwood (MDF).

3.2 Particleboard

Particleboard is used in three grades, veneer, melamine and plain in approximately equal amounts.

Furniture makers use more veneer, cabinet makers and joiners prefer melamine particleboard.

The most common sheet size used is 2.4 m x 1.2 m, followed by 3.6 m x 1.8 m, 3.6 m x 1.2 m, 1.8 m x 1.2 m and 2.1 m x 0.9 m.

The most common thickness of particleboard is 18-19 mm, followed by 16 mm.

TABLE 7: THICKNESSES OF PARTICLEBOARD USED IN FURNITURE MANUFACTURE

THICKNESS (MM)	AMOUNT OF USE IN %
<13	0.4
13	1.1
16	23.5
18-19	38.5
25	9.8
30-35	13.7
>35	13.0

3.3 Medium Density Fibreboard (Customwood)

Medium Density Fibreboard is used mainly for wall units, cabinets, office furniture and contract furniture.

The most common sheet size used is 2.4 m x 1.2 m followed by 1.8 m x 1.2 m, 3.6 m x 1.8 m, 2.4 m x 1.8 m and 1.8 m x 0.9 m.

The most common thickness of MDF is 18-19 mm followed by 16 mm.

TABLE 8: THICKNESSES OF MEDIUM DENSITY FIBREBOARD USED IN FURNITURE MANUFACTURE

THICKNESS (MM)	AMOUNT OF USE IN %
16	30.0
18-19	36.6
25	20.0
32	6.6
>32	6.8

The main reason why particleboard is more popular than customwood is lack of confidence of customers towards customwood as a new, unknown material. MDF is more expensive than particleboard, however, customwood was reported as a very good material for furniture manufacture due to its very good workability. Customwood is purchased partly from Australia, and partly from New Zealand.

3.4 Plywood

The use of plywood in furniture manufacture is fairly small (only 5.6% of total amount of reconstituted wood). Plywood is mostly used as backing for wall units and cabinets, internal components of lounge frames, bottoms of drawers and other supported elements.

The most common grade used is interior, one surface top grade. For unexposed components a structural grade has been used.

The most common sheet size is 2.4 m x 1.2 m, the preferred thickness is 4 mm. Other common thicknesses are: 3 mm, 5 mm, 6 mm, 10 mm and 12 mm.

Most furniture manufacturers consider plywood as not a strong material, and therefore plywood has been used mostly as supported elements, not as stressed members of furniture. A lack of skill on mechanical properties and strength of plywood has been noticed in most furniture companies. This subject should be included in furniture training courses.

3.5 Hardboard

The use of hardboard in furniture manufacture is very small (only 0.9% of total amount of reconstituted wood). Some furniture manufacturers use hardboard instead of plywood as backing for wall units and cabinets.

The main thickness of hardboard is 4 mm followed by 3 mm. The most common sheet size is 2.4 m x 1.2 m.

3.6 Laminated Veneer Lumber (LVL)

Laminated veneer lumber is used by furniture manufacturers mainly as shaped elements of chairs, armchairs, table legs, moulded seats of chairs and decorative curved components of wall units. Most curved components are purchased directly from manufacturers who produce moulded plywood and bent laminated lumbers.

A large number of bent elements for furniture manufacturers are made to their specified orders. Some furniture manufacturers have their own equipment for producing moulded laminated veneer lumber in small radio-frequency presses. The most common wood species for LVL are Tasmanian Oak, Radiata Pine, Slash Pine, Blackwood and Jarrah. A few companies import bent components made from European Beech.

PHOTO 5: CURVED COMPONENTS MADE FROM LVL BY PANELVENEER PROCESSORS PTY LTD

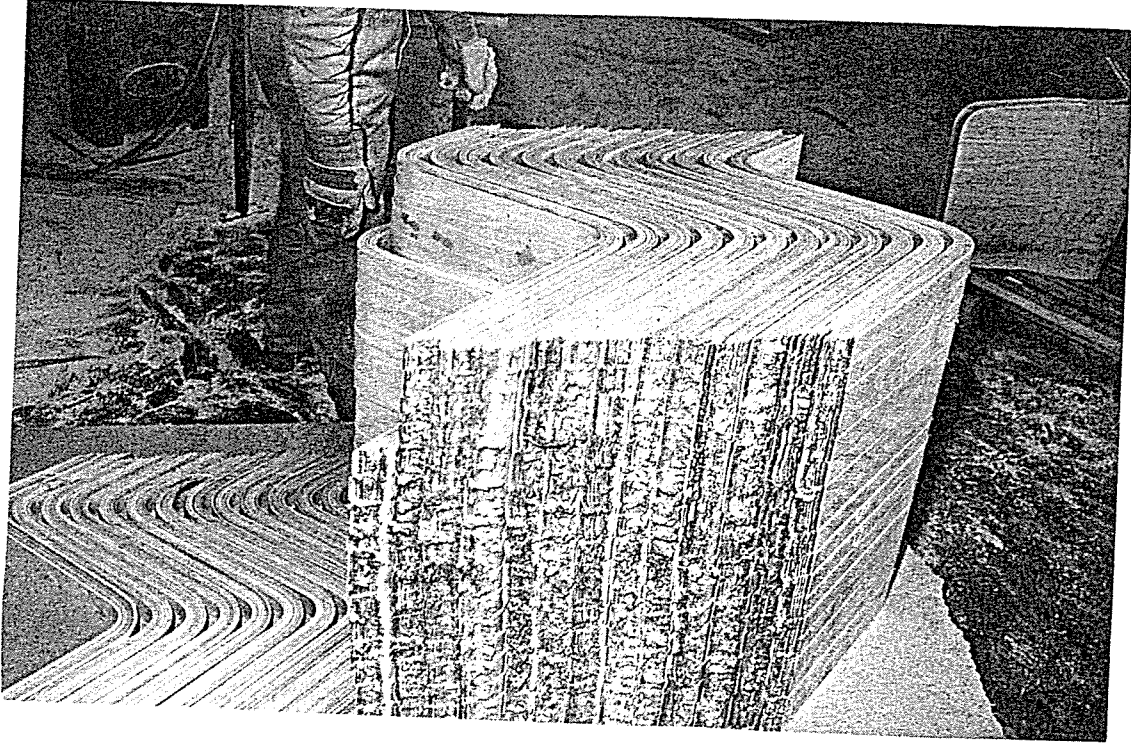
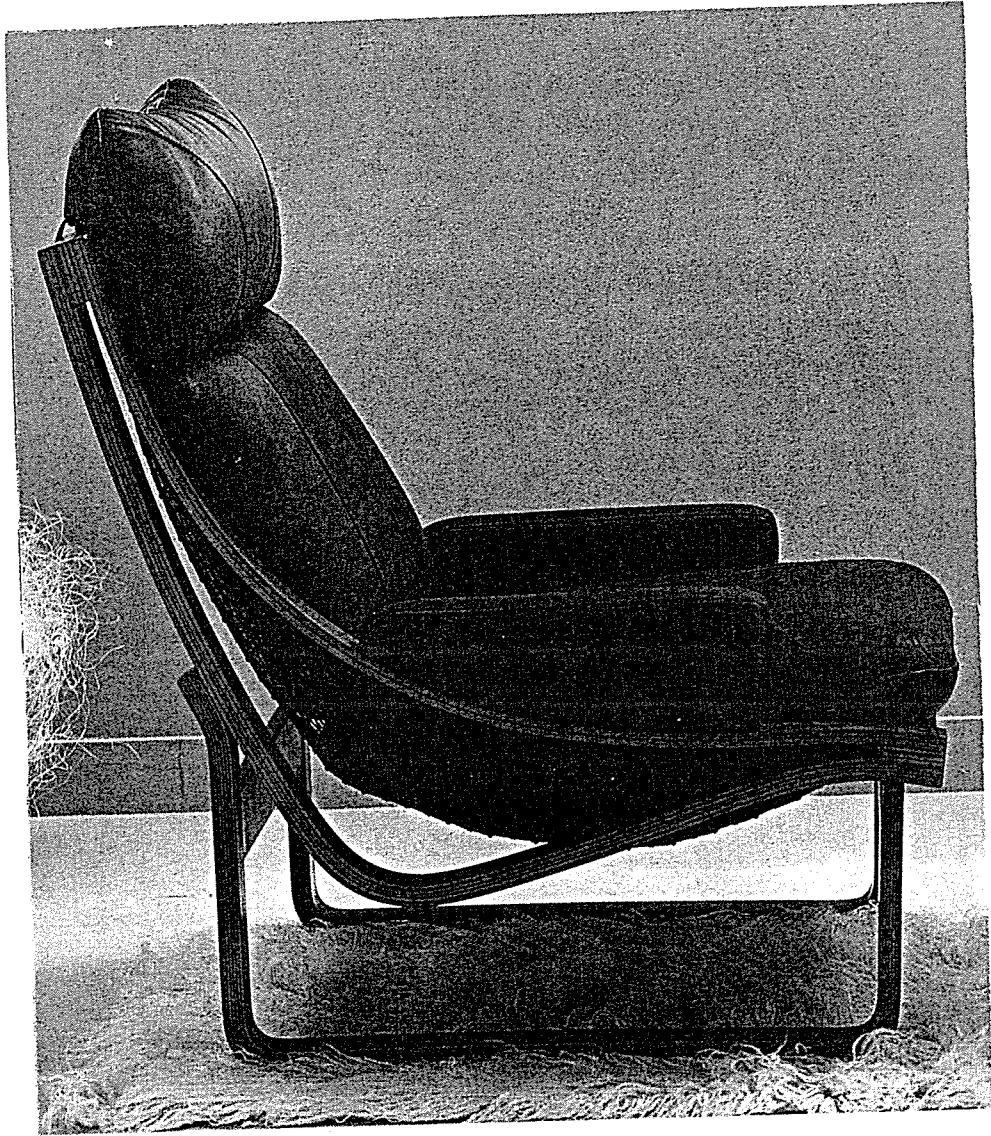


PHOTO 6: A FRAME OF THE ARMCHAIR IS MADE OF HEAT-MOULDED LAMINATIONS (TEAK OR WALNUT) BY TESSA



SECTION 4
TIMBER AND RECONSTITUTED WOOD SUPPLIERS

4.1 Where Timber is Purchased

The majority of furniture manufacturers purchase timber from timber merchants. The purchasing of timber directly from sawmills applies mainly to local species. In this case, furniture manufacturers purchase local species from local sawmillers. In Tasmania, Blackwood and Tasmanian Oak are supplied by local sawmillers.

A similar situation has been reported in South Australia with regard to Radiata Pine, in Western Australia with regard to Jarrah, in Victoria and New South Wales with regard to Victorian Ash.

The specification of species, sizes of timber and grading has been set out in Section 2.

One of the purposes of the survey was to analyse the cooperation between furniture manufacturers and timber suppliers. Thus, furniture manufacturers evaluated their timber suppliers regarding the availability of species, sizes of timber and the quality of purchased timber.

Timber suppliers explained the main problems which they faced in meeting the requirements specified by furniture manufacturers.

4.2 The Evaluation of Timber Suppliers by Furniture Manufacturers

The majority of furniture manufacturers are not fully satisfied with timber purchased from timber suppliers.

The main problems which have been reported centre around the following issues:

- the availability of required species;
- the availability of required sizes of timber;
- quality of timber.

4.2.1 Availability of required species

The most common problem for furniture manufacturers is the availability of imported species. In most cases, timber has to be ordered 2-8 months in advance, and finally it is not delivered on time. This problem is encountered with the following species: Kalantis from Phillipines, Teak, Mahogany and Cedar.

The lead time required for ordering native species is also often too long. For example, Jarrah has to be ordered 3-6 months in advance if furniture manufacturers are not located in Western Australia. Such long waiting times force furniture companies to plan in advance the required quantities and sizes of timber. However, there are furniture manufacturers who experience no problem with the availability of timber and the waiting time is very short (2-8 weeks). In these cases, there is good communication between furniture companies and timber suppliers.

It seems ironic that Tasmanian furniture manufacturers have a problem buying a good quality Blackwood and Tasmanian Oak. Most of the Tasmanian species have been exported to mainland states, and only a small percent of timber is supplied to local furniture manufacturers.

4.2.2 The availability of required sizes of timber

The majority of furniture manufacturers are not satisfied with the available sizes of timber. The most common problem relates to the thickness of timber.

Timber may be purchased mostly in limited thicknesses, i.e. 25; 38; 50; 75; and 100 mm, however the furniture industry would prefer a bigger choice of thicknesses such as 16; 20; 30; 35; 45; 60; 65 mm.

The limited variety of available thicknesses has been considered as a factor restricting the design of furniture. For example, the design of thinner components of furniture would cause a great wastage of timber. Therefore, it is highly recommended that the scale of thicknesses of timber for the furniture industry be increased.

Only 5% of surveyed timber suppliers are able to supply whatever thickness of timber is called for by the furniture manufacturer's specifications.

The majority of furniture companies are satisfied with the available width of timber. A few companies have problems with purchasing particular widths of Jarrah (200-250 mm, and 600 mm).

Considerable dissatisfaction has been expressed in the fact that timber is sold in packs at random length, and often also at random width. One pack of timber has different lengths and widths of board.

Furniture manufacturers would prefer to buy a standard pack with the length, width and thickness required for actual manufacture. In their opinion, timber should be cut to length and width, and then selected into standard packs.

This type of standard pack is available from some countries. For example, Teak has been delivered in excellent, standard packs. Radiata Pine from New Zealand is also sorted by sizes of board. The majority of furniture manufacturers consider this problem as one very important to be resolved.

There is a problem in purchasing required widths of timber in select grade. Therefore, furniture manufacturers have to buy the width which is available, and cut the timber to the required size. Unfortunately, this is time consuming.

Sometimes, in one pack, there are very short boards which can't be used for any purpose at all.

It is recommended that standards size blanks be developed for the furniture industry, similar to the USA. There, furniture manufacturers can buy standard-size blanks or panels cut to standard dimensions for each desired quality. Blanks can be solid or edge-glued (2),(3).

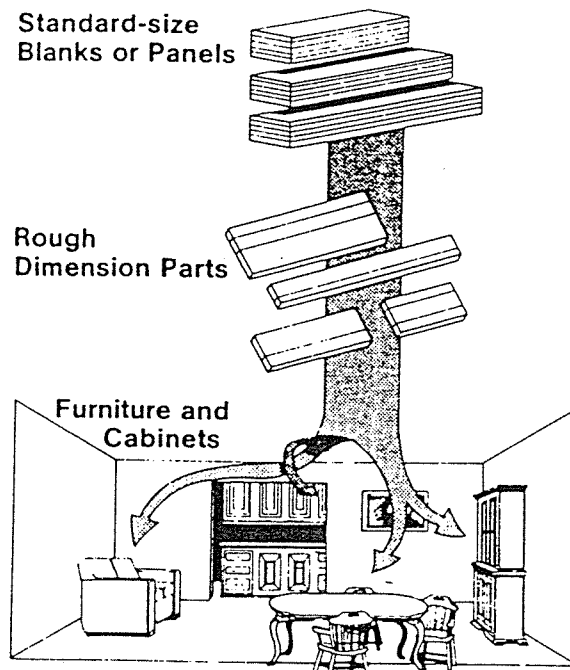


FIGURE 2: STANDARD-SIZE BLANKS FOR FURNITURE AND CABINETS DEVELOPED IN USA (1).

Western Australia has already started to produce edge-glued panels from Jarrah. Furniture manufacturers are very interested in this type of timber and some of them are using it successfully for furniture manufacture, for example, table tops.

4.2.3 Quality of timber

The majority of furniture manufacturers are not satisfied with the quality of purchased timber. The most common problems regarding quality of timber are as follows:

1. A grade of timber is lower than specified. Furniture manufacturers pay for select grade timber, but the quality doesn't conform to such a grade.
2. Top quality timber is often not available.
3. It may happen that there is a mixture of different grades in one pack of timber.
4. A large number of surveyed companies are not satisfied with the quality of Tasmanian Oak. This species is very hard to buy in select grade. The most common imperfections are: splitting, internal and surface checks, gum veins, knots, cupping and twisting. In Tasmanian Oak a great variation in colour has also been observed. Consequently, one pack of timber may often contain different shades of colour, which entails an additional input of work to match timber colours.
5. Furniture manufacturers in Tasmania have problems in purchasing select grade Blackwood and Tasmanian Oak, because the good quality timber is exported to the mainland.
6. The majority of quality problems results from the drying process. Some furniture manufacturers reported that timber for the furniture industry is dried too fast. Consequently, there is a lot of checking and splitting in timber. Timber for furniture has been dried in the same way as for structural timber. The furniture industry requires a good quality timber. However, timber is not seasoned for the length of time required. Moisture content is often too high. Sometimes moisture content in one pack varies between 8-20%, for example in Radiata Pine.
7. The problem with moisture content relates mostly to imported species. Timber from Brazil is sold as "shipping dry", however, moisture content is very high. Similar problems have been reported regarding timber from Fiji. Pencil Cedar from island countries is also too wet (~ 30%).

4.3 Cooperation with Furniture Manufacturers - The Timber Suppliers Point of View

4.3.1 Availability of species and sizes of timber

The majority of timber suppliers have most problems with availability of exotic species. The waiting period for some imported exotic species is up to 6 months long. Therefore, timber can not be delivered to furniture manufacturers on specified time.

The waiting time for delivery of timber to furniture manufacturers is shorter for rough sawn timber than for dressed timber.

The most common problem for timber suppliers is a lack of standard sizes of timber for the furniture industry. There is a problem in preparing different sizes of timber for each furniture company. It is a very costly and time-consuming process, especially for modern, automatic sawmills. Each furniture company most commonly orders only small amounts of timber. It would be much easier to prepare large volumes of timber to a standard size.

The most common difficulties reported by timber suppliers in supplying timber are the following:

- lack of wide timber above 200 mm in furniture grade, because of imperfections (e.g. Radiata Pine);
- shortage of 100 x 100 mm and 75 x 75 mm of Hoop Pine and Slash Pine;
- shortage of Jarrah 25 mm thick and 150 mm wide; the waiting period is up to 6 months long;
- shortage of 75 mm and 100 mm thick Jarrah.

4.3.2 Quality of timber

The majority of timber suppliers have reported that the main reasons for rejection of timber by furniture manufacturers are as follows:

- surface and internal checking of timber;
- splitting;
- variation in colour of Tasmanian Oak;
- gum veins;
- borers.

Most quality problems relate to the excessively high moisture content of imported timber, especially from New Guinea, Fiji and island countries.

To overcome this problem, some timber suppliers import unseasoned timber and then they season it over a 12-24 month period until a moisture content of 12% is reached. In this way, the number of rejects is very small.

There is a problem in terms of drying thick native hardwoods above 50 mm thick. For example, thick boards of Tasmanian Oak and Blackwood have much checking and splitting due to poor drying process.

Timber supplied to furniture manufacturers is available in a few different grades. However, high grade timber is very expensive and therefore some furniture manufacturers buy lower grade timber and upgrade themselves.

There is a problem with lack of standard grades in different countries. For example, American Oak is imported under a different grading system. This causes difficulties in communication between furniture manufacturers and suppliers regarding the actual grade required.

There is a shortage of some species in high grade, for example Radiata Pine in Tasmania is limited in furniture grade.

Timber suppliers reported that some furniture manufacturers pay a low price for timber and expect top quality.

Furniture manufacturers don't provide clear and detailed specification requirements to suppliers and this inadequate communication often causes problems.

4.4 Reconstituted Wood Suppliers

The most common types, sizes and grades of reconstituted wood used in furniture manufacture have been specified in Section 3.

The results of the survey have shown that cooperation between furniture manufacturers and reconstituted wood suppliers is very good. The majority of required types and sizes of reconstituted wood are available, and the waiting period is reasonably short. Particleboard may be purchased as plain board, veneered or melaminated.

In most cases particleboard can be cut to size by suppliers according to specified orders. Dissatisfaction is most commonly expressed with regard to the different sizes of melamine sheets and particleboard. Furniture manufacturers have to cut melamine into required size and waste a lot of material. Quality of particleboard is satisfactory. There are many different grades of particleboard available ranging from top to poor quality.

Customwood is supplied to furniture manufacturers by timber merchants. Both native and imported customwood is available, however, as reported, customwood imported from New Zealand is about 20% cheaper than the native one.

Plywood purchased by furniture manufacturers is not always available at top grade. However, no complaints have been reported regarding plywood quality.

Most furniture manufacturers using laminated veneer lumber in production have problems with splitting of laminations, cupping and twisting of laminated components. Therefore, a number of furniture manufacturers produce LVL themselves by using radio-frequency press. The quality of such manufactured LVL was reported as very good.

SECTION 5

IDENTIFICATION OF THE MAIN PROBLEMS IN FURNITURE MANUFACTURE

5.1 Design of Furniture

A substantial majority of surveyed companies strongly indicated the necessity to improve the furniture design.

At present, most of Australian furniture manufacturers base their design on overseas market penetration. Manufacturers strongly agreed that a more competitive furniture market could be achieved by, among other factors, development of Australian style furniture based on local timber.

It is clear from the survey that a lack of designers is the main problem for most furniture manufacturers. The majority of firms introduce an average 4-6 new designs in the course of a year. This fact indicates that the design process is a substantial part of the company's activity. A lack of innovative design has been reported.

Currently, furniture manufacturers cope with the design problem in three different ways:

1. company employs full-time or part-time designers;
2. furniture is designed by manager or owner of company;
3. designs are fully copied or based on catalogues, overseas furniture, other companies designs, exhibitions.

In the first case, manufacturers don't report any problems regarding design. Most employed designers are qualified interior or industrial designers.

Their design is based on ergonomic principles, especially in relation to design of chairs. However, they also reported a necessity for the development of an Australian standard for furniture design.

A number of designers have been recognised by the Industrial Design Council of Australia through the granting of the Australian Design Award.

In some large manufacturers there are groups of designers acting as a team. They design furniture mostly from an artistic point of view, considering such factors as the current fashion in the furniture market, customers' requirements and the general trend in design. Such prepared design is discussed with the technical manager who works on technical and technological details. Then, a prototype of the designed furniture is made. An example of this type of design exists in Parker Pty Ltd in Sydney.

In the majority of cases, manufacturers have their furniture designed by the manager of the firm. A large number of them admitted that they copy or modify designs from overseas, catalogues or furniture exhibitions. Design process also includes marketing: interviewing consumers, gathering retailers' indications, new technology, overseas fashion. It is therefore necessary to travel overseas to penetrate the market and to investigate new designs. This activity is obviously very expensive and time consuming. The majority of manufacturers involved in this type of design consider this to be a basic problem for them. They emphasise that the furniture industry would welcome and benefit from help from an appropriate institution which could provide them with such information. A suggestion has been made to establish a design centre with the primary objective of helping furniture manufacturers in the design of furniture.

There are a number of good designers/craftsmen who would be ready to help furniture manufacturers in innovative design. Manufacturers should have access to their designs through consultancy and contractual work.

In Australia, there are a few furniture design and ~~manufacture~~ courses located in TAFE, institutes of technology, universities or private woodcrafting schools. The main purpose of such courses is to educate furniture makers and designers. Design of furniture is focussed on artistic creation and doesn't include engineering and strength criteria for design.

Most manufacturers made the comment that designers don't design furniture for mass production. They should understand the needs of particular companies and therefore a close cooperation and good communication is essential.

Most furniture is overdimensioned, too heavy, made of too thick components. Manufacturers and designers have explained this fact, putting forward the following reasons:

- (a) The Australian market prefers traditional heavy style, solid furniture.
- (b) The design of furniture is limited by available sizes of timber.
- (c) There is a lack of a standard for furniture design, lack of information on strength of components, joints, new material, strength criteria for design.

5.2 Machinery, Technology and New Techniques

The Australian furniture industry cannot be considered as being innovative with regard to production techniques and machinery. However, it is important to remember that the majority of furniture manufacturers are small firms employing an average 29 people, with rather small productivity.

It is obvious, that under such circumstances, the use of automatic or computerised equipment would not be efficient and profitable. Therefore, it is very difficult to evaluate technology, machinery and the application of new techniques by this type of manufacturer. Traditional, old-fashioned machinery predominates in most small firms. However, most manufacturers have reported that this type of machinery meets their needs regarding quality, efficiency and productivity. The average age of machines is ten years, however some are up to forty years old, while others are very new and modern, even computerised.

The majority of equipment has been imported from Europe (RFN, Italy, England). Furniture manufacturers can be divided into three groups in so far as technology and machinery is concerned:

1. Companies using old equipment and traditional techniques/methods.
2. Companies using both old and new equipment.
3. Very modern firms with high productivity, automated production lines.

Most companies work only on one shift. 95% of furniture manufacturers do not utilise the full working capacity of their machinery. A common statement made was that companies could produce more furniture if they had a bigger market. Therefore, it would be necessary to investigate the possibility of exporting furniture. A substantial majority of surveyed firms complained of the lack of:

1. information on new machinery available on the market;
2. advice on choice of equipment for particular production;
3. services and instructions regarding new equipment purchased from overseas.

The furniture industry may be characterised by a large number of manufacturers with very similar or identical product lines and techniques/methods. Technology and production methods are rather traditional. Only a small percentage of enterprises are up with the latest international trends.

Surveyed furniture manufacturers agreed that the furniture industry is very isolated with its problems and it doesn't have any help from research institutions regarding:

1. valuable information on new materials, fittings, joints, product finishes, adhesives and improvements in production techniques;
2. adaptability of new technology, materials and products to Australian conditions of manufacture;
3. lack of expertise and research in resolving technological problems which occur in some companies;
4. lack of expertise evaluating component or material failures.

A lot of new product finishes, fittings and adhesives don't apply themselves to Australian timber. Therefore, the use of new, modern technology and new material is limited by lack of instruction and expertise. It is essential to assist industry in resolving such problems.

Currently, most manufacturers are forced to carry out many experiments by engaging in "trial and error" methods, all of which are time consuming as well as expensive. Lack of instructions on the use of laquers and adhesives was reported by most manufacturers as an important problem.

The most common joints used by furniture manufacturers are dowels and tenon-mortise joints. The increasing use of "biscuits" joints was pointed out.

There is an international trend to use "knock-down" joints. This type of fittings is widely used in Western Australia. Furniture manufacturers in Western Australia are highly export orientated and their modern technology, machinery, and the use of new materials would be a good example to be copied by other states.

Western Australia, isolated in its location, managed to resolve most problems regarding technology, drying of timber, new product finishes, and machinery.

Excellent liaison between manufacturers promotes the exchange of experience, providing information on new international trends, market, design, new products, and new techniques methods. Furniture manufacturers in Western Australia work in close cooperation with research centres like: The Wood Utilisation Research Centre, The Department of Conservation and Land Management and The Curtin University. A lot of research was undertaken with particular reference to local resources.

On the other hand, the Tasmanian furniture manufacturers are very isolated with their manufacturing problems. Design and training problems have been recently resolved there, however there is a lack of information on new materials, product finishes, machinery and latest techniques methods available on the market. This problem should be resolved, because the Tasmanian furniture industry is very progressive and promising.

5.3 Quality of Furniture

The Australian furniture industry is facing a period of growing competition from imported furniture, which is often more innovative, fashionable and of good quality. Meanwhile, the consumers' requirements are becoming more demanding.

Therefore, furniture manufacturers must realise the necessity for the improvement of the quality of furniture. Such improvement can be achieved by rigorous quality control over the whole process of furniture manufacture, commencing from the very first step of production up to the final completed product.

The Australian furniture industry does not have quality manufacturing standards which would require control and quality testing of materials, components, adhesive, product finishes and technological aspects of manufacture. The preparation of appropriate quality standards seems to be essential. Most countries are using I.S.O. standards, which could be adopted to Australian conditions.

The survey indicated that only a few manufacturers are using quality control in each step of production. However, in these cases, the quality control is not based on standards, but mostly on experience and skill of staff. The quality of furniture manufactured in such companies is usually very good.

The most common reasons for rejection of furniture by retailers are:

- checking, splitting of furniture during transport;
- twisting and cupping of table tops;
- failure of joints;
- poor quality surface finishing.

The main reason for such faults is a too high moisture content of the raw material used in the manufacture of furniture.

It is hard to believe that most furniture manufacturers ignore such an important factor as moisture content. Some companies admitted that they didn't check moisture content during the manufacture of furniture. Some of them didn't even have a moisture meter!

Quality control based on quality manufacturing standards would help to find all the the "weak points" of production in each company.

There is a big range of quality on the market - from cheap, poor quality furniture to expensive, high quality products. The question can be asked: should we accept poor quality furniture on the market, even if its price is very low?

5.4 Market

The Australian furniture industry is orientated towards the domestic market. Only 4% of surveyed manufacturers export furniture and in these cases export is only 3-5% of their total production. Furniture is exported to New Zealand, Singapore, Hong Kong, Japan, New Guinea; a very small proportion of furniture is exported to Europe and America. Most companies exporting furniture are located in Western Australia.

Although the amount of exported furniture in Western Australia is currently not extensive, the majority of manufacturers are export orientated and they have penetrated the international market. Hopefully the export of furniture from Western Australia will increase in the next few years.

Generally, furniture manufacturers in other states have not geared themselves towards export. It seems that manufacturers lack enough self-confidence to compete on the international market.

Some manufacturers indicated that the Australian furniture industry doesn't have the quality standards, testing and certification system which would be required by the international market.

5.5 Training

The progressive improvement of the furniture industry requires the development of training. The majority of manufacturers strongly emphasise this factor as one of the most important in the development programme.

The survey clearly indicates that the training system varies between states. The best situation was reported in Tasmania and South Australia, where there were only a few dissatisfied opinions expressed as to lack of skilled labour and lack of training courses. The other states pointed out that the industry requirements relating to training have not been met. The following comments were made on the training system in the furniture industry:

- (1) The lack of skilled workers is a very common problem for the majority of furniture manufacturers.
- (2) Apprenticeship courses should be more practical. Workers should be trained in the factory environment on both old and modern equipment. Currently there is a shortage of good, skilled operators on new machinery.
- (3) Training courses should include management programmes, like financial and business planning, marketing and production control.
- (4) A strong emphasis should be put on wood-finishing courses. A lack of skill in lacquering, gluing and polishing was indicated by the majority of manufacturers as a difficult problem to be resolved.
- (5) Training in new technology such as veneering should be developed.
- (6) It was considered essential to increase a number of courses on new international trends in furniture manufacture, i.e. new machinery, fabrics, product finishes, new production methods.
- (7) Some apprenticeship courses are too short.

- (8) The wage system should be improved. Currently, wages are too low, and the furniture industry is not viewed as prestigious enough in the labour market.
- (9) Training is highly fragmented. A broader approach in understanding the whole furniture manufacturing process should be adopted. There are not enough courses on wood and reconstituted wood: physical and mechanical properties of wood, wood anatomy, plywood, particleboard, hardboard, MDF, LVL. It would help workers in the better understanding of the process of manufacture and in improving the quality of the manufacturing system.
- (10) Training should also incorporate retailers. It would help them in promoting products, evaluating quality and controlling the price of furniture.

SECTION 6
GENERAL COMPARISON OF THE AUSTRALIAN AND EUROPEAN FURNITURE
MANUFACTURERS

Australian and European furniture manufacturers have totally different structures. First of all, the small population of Australia in comparison with European countries has a significant influence on the size of furniture companies, and consequently the quantity of production.

The majority of furniture manufacturers in Europe are large firms (about 1000 employees) with high specialisation of products. Such type of manufacture requires high efficiency which can be met due to high technology, modern machinery and new techniques methods.

The majority of Australian furniture manufacturers produce a wide range of furniture. Usually, such type of production is not efficient. Most companies which own NC equipment use only 30% of its capacity. Therefore, it would be essential to increase cooperation between furniture companies in manufacturing of components. In Europe this type of cooperation is widely developed.

The Australian furniture industry is privileged in the availability of solid timber which has been used in furniture manufacturing. Therefore, solid furniture is predominant on the Australian market.

The variety of timber species used in furniture manufacturing is fairly wide with a predominance of hardwood species.

In Europe, solid furniture is considered as a "luxury" product due to the high prices of timber and its limited availability. Therefore, timber is very well utilised, there is no wastage of timber during the manufacturing process.

The majority of furniture manufacturers cooperate with timber and material supplies. This cooperation is based on longterm planning of their needs.

Sizes of timber and its grade are previously specified and ordered a long time ahead (usually on a one year plan).

There is an established specification available in the furniture industry regarding quality of timber and reconstituted wood, which facilitates a communication between furniture manufacturers and timber suppliers.

The majority of countries, for example Scandinavia, developed standard-size timber panels, i.e. timber is cut to standard dimensions for different qualities. In this case, cooperation between furniture manufacturers and timber suppliers is really excellent.

The main difference between the Australian and European furniture industries relates to quality control. In every European country there is a very rigorous system of quality control used in each step of manufacture. Furniture manufacturers are equipped with measuring instruments (to check dimensions, flatness, straightness, surface evenness, smoothness, proper angles of components), moisture meters, instruments for checking parameters of machinery, properties of glue, lacquer, etc. A similar system should be developed in Australia.

The training system in Europe varies from the Australian one. In the majority of countries there are specialised training colleges aimed at furniture design and manufacturing. Such courses, which last 3-4 years, train highly qualified specialists in furniture manufacturing. The main objective of courses is to introduce not only practical skills but to "understand" timber as well. Students become familiar with all topics connected with timber and reconstituted wood from wood anatomy, physical and mechanical properties of wood, drying, production of panel board, wood machinery, management and marketing skills, timber mechanics, etc.

It should be understood that this type of course commenced in January 1989 in Melbourne, at the Department of Furniture Technology, Royal Melbourne Institute of Technology. The course, lasting four years, offers full time training in the furniture technology. This activity deserves support from the furniture industry and cooperative institutions.

In Australia, there is a noticeable growing interest in European methods of manufacturing and training, which should be considered as a potential improvement in the Australian furniture industry.

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APPENDIX 1 - THE LIST OF FURNITURE MANUFACTURERS UNDER SURVEY

1. Queen Anne Furniture
34 Annerley Road
WOOLLOONGABBA QLD 4102
2. Innova Design Furniture
127 Viking Drive
WACOL QLD 4076
3. H Thorne Furniture
Saunders Street
RACEVIEW QLD 4305
4. Ellaway and Lord
424 Bilsen Road
GEEBUNG QLD 4034
5. Jordan Woodworking
2 Enterprise Street
WULKURAKA QLD 4305
6. Furnir Manufacturing Co
Shed 4, Sandra Place
Bilsen Road
GEEBUNG QLD 4034
7. Janda Furniture
Lisgar Street & Robinson Road
VIRGINIA QLD 4014
8. Catt Furniture
Cnr Bannister & Vulcan Road
CANNING VALE WA 6155
9. Timberline Pty Ltd
12 Gympie Way
WILLETTON WA 6155
10. Atelier Pty Ltd
11 Whyalla Way
PERTH WA 6000
11. Joyce Corporation
68 Forsyth Street
O'CONNOR WA 6163
12. Steve Scott Designs Pty Ltd
Unit 3, 31 Peel Road
O'CONNOR WA 6163
13. Giletedge Cabinet Makers
89 Dixon Road
ROCKINGHAM WA 6168

14. Swan Valley Furniture Co
28 Morgan Street
ROCKINGHAM WA 6168
15. Manley Furniture
22 Sussex Street
MAYLANDS WA 6051
16. Gascoigne Furniture
7-11 Elliott Street
MIDVALE WA 6056
17. Inglewood Products Group
267 Victoria Road
MALAGA WA 6062
18. M A Jensen Timber Products
59 Cook Street
BUSSELTON WA 6280
19. Burgtec Pty Ltd
1-3 Kirke Street
BALCATTWA WA 6021
20. Timbercraft Bunnings
100 Pilbara Street
WELSHPOOL WA 6106
21. BTH Industries Pty Ltd
2-6 Konando Terrace
EDWARDSTOWN SA 5039
22. John Hamra (Snr)
9 Bray Avenue
TORRENSVILLE SA 5031
23. Noblett Furniture Manufacturers Pty Ltd
72 Kinkaid Street
NORTH PLYMPTON SA 5037
24. Mathews Pty Ltd
37 Jacobsen Crescent
HOLDEN HILL SA 5088
25. Pfitzner Furniture Manufacturers
Mt Barker Road
LITTLEHAMPTON SA 5251
26. Woodstock Furniture Pty Ltd
Russell Street
ROSEWATER SA 5013
27. Marshall Furniture Pty Ltd
144 Daws Road
EDWARDSTOWN SA 5039

28. Artica Furniture Pty Ltd
40 First Street
BROMPTON SA 5007
29. Colonial Living
2B/13-15 Fred Street
LEICHARDT NSW 2040
30. Woodworks Leon Sadubin Furniture
199 Pennant Hills Road
THORNBY NSW 2120
31. Everett Worthington Pty Ltd
96 Milperra Road
REVESBY NSW 2212
32. Batoma Detail Joinery & Furniture Pty Ltd
Unit 21C, 4 Nelson Avenue
PADSTOW NSW 2211
33. Chiswell Furniture Pty Ltd
368 Newbridge Road
MOOREBANK NSW 2170
34. Parker Furniture Pty Ltd
45 Powers Road
SEVEN HILLS NSW 2147
35. Rintoul Pty Ltd
26 Powers Road
SEVEN HILLS NSW 2147
36. Danish Deluxe (Australia) Pty Ltd
12 Edinburgh Street
HUNTINGDALE VIC 3166
37. R G Davis Furniture (Vic) Pty Ltd
10-12 Clare Street
BAYSWATER VIC 3153
38. Swaeder Furniture Pty Ltd
138 Springvale Road
SPRINGVALE VIC 3171
39. Tessa Pty Ltd
10 Jersey Road
BAYSWATER VIC 3153
40. Nova Furniture Pty Ltd
3/15 Ramage Street
BAYSWATER VIC 3153
41. Architectural Products Pty Ltd
156-158 Main Road
MOONAH TAS 7009

42. James Bradley's Pty Ltd
18-22 Herbert Street
INVERMAY TAS 7248

43. Clifton Furniture
Brooke Street
INVERMAY TAS 7248

44. Pipers Tru.line
31a Victoria Street
ULVERSTONE TAS 7315

45. Wellington Furniture
16 Hull Street
GLENORCHY TAS 7010

46. Fenton Timber Products
43 Forster Street
LAUNCESTON TAS 7248

47. Clarke Furniture Products Pty Ltd
Donalds Avenue
LAUNCESTON TAS 7250

APPENDIX 2 - THE LIST OF TIMBER AND RECONSTITUTED WOOD SUPPLIERS UNDER SURVEY

1. Charlie Henry Timbers
Rosebank Square
SALISBURY QLD 4107
2. Hancock Pty Ltd
47 Park Road
HILTON QLD 4064
3. Maritime Timbers
18 McArthur Street
HAMILTON QLD 4007
4. Softwoods Qld
Henzel Road
CABOOLTURE QLD 4510
5. Bunnings Jarrah Sawmill
YARLOOP WA 6218
6. Wesfi Particleboard Factory
DARDANUP WA 6236
7. Bunnings Manjimup Production Centre
MANJIMUP WA 6258
8. Bunnings Limited
255 Adelaide Terrace
PERTH WA 6000
9. Mt Gambier Pine Industries
(Wood and Forest Department)
MOUNT GAMBIER SA 5290
10. Le Messurier Timber Co Pty Ltd
346 Port Road
PORT ADELAIDE SA 5015
11. CSR Softwoods Ltd
Millicent Road
MT GAMBIER SA 5290
12. Duncan's Holdings Ltd
3-5 Underwood Road
HOMEBUSH NSW 2140
13. Eljay Timbers
Australian Hardwoods
Lismore Road
BANGALOW NSW 2479

14. Trend Timbers Pty Ltd
Cunneen Street
MULGRAVE NSW 2756
15. Duncan's Kyogle
Summerland Way
KYOGLE NSW 2474
16. Murwillumbah Sawmilling Company
148 Pacific Highway
MURWILLUMBAH NSW 2482
17. Peter Adams
maroondah Highway
COLDSTREAM VIC 3170
18. Australian Furniture Timbers Pty Ltd
351 Plummer Street
PORT MELBOURNE VIC 3207
19. Furniture Timber Group
Boundary Road/Japaddy Street
MORDIALLOC VIC 3195
20. Mattews Timbers Pty Ltd
125 Rooks Road
VERMONT VIC 3133
21. Panelvener Processors Vic Pty Ltd
4 Walter Street
GLENROY VIC 3046
22. Britton Bros Pty Ltd
Sawmillers and Timber Merchants
PO Box 369
SMITHTON TAS 7330
23. French Enterprises Pty Ltd
PO Box 166
SCOTTSDALE TAS 7260
24. Burnie Timber
WESLEY VALE TAS 7307
25. Tasmanian Timber Engineering Pty Ltd
1063 Cambridge Road
CAMBRIDGE TAS 7170
26. Burnie Timber (Veneer & Sawmilling)
SOMERSET TAS 7322
27. Tasmanian Board Mills Ltd
Killafaddy
LAUNCESTON TAS 7250

APPENDIX 3 - THE LIST OF RESEARCH ORGANISATIONS, DESIGNERS, DESIGN AND TRAINING CENTRES UNDER SURVEY

1. Queensland Furniture Industry Training Council
25 Raven Street
WEST END QLD 4101
2. Forestry Commission
Nr 80 Meirs Road
Gate Nr 3
INDOOROOPILLY QLD 4068
3. WA Guild of Furniture Manufacturers
279 Lord Street
EAST PERTH WA 6000
4. Department of Conservation and Land Management
Wood Utilisation Research Centre - Harvey
50 Hayman Road
COMO WA 6152
5. Fine Wood Project
Timber Park
MANJIMUP WA 6258
6. Local Designers and Furniture Manufacturers - Manjimup
(Meeting with designers.)
7. SA Furniture Industry Training Council
136 Greenhill Road
UNLEY SA 5061
8. SA T.A.F.E. - Wood Design
Adelaide
9. NSW Furniture Industry Training Council
76 Penshurst Street
PENSHURST NSW 2222
10. Leon Sadubin - Designer
199 Pennant Hills Road
THORNBY NSW 2120
11. Colonial Living Antique Gallery
106 Victoria Road
DRUMMOYNE NSW 2047
12. Australian Forest Industries Journal
203 Castlereagh Street
SYDNEY NSW 2000
13. Forestry Commission of New South Wales
Oratava Avenue
WEST PENNANT HILLS NSW 2120

14. Nick Hill - Maker & Designer of Fine Woodwork
16 Chiltern Road
INGLESIDE NSW 2101
15. Parliament House Construction Authority
CAPITAL HILL ACT 2603
(Brian Stephens - Furniture Group Leader)
16. Rollin R La France, ARAIA - (Designer)
Endeavour House
Franklin Street
ACT 2603
17. Mr W S Green
C.C.A.E. - "Furniture Design Course"
PO Box 100
BELCONNEN ACT 2616
18. The Australian National University
Department of Forestry
(Dr Ken W Groves)
19. High Court of Australia
CANBERRA ACT 2600
20. Idiom Corporation
Latrobe Street (cnr Elizabeth St)
MELBOURNE VIC 3000
21. Melbourne School of Woodcraft
219 Argyle Street
FITZROY VIC 3065
22. RMIT - Department of Furniture Technology
(Mr Don Chapman)
23. National Furniture Industry Training Council
370 St Kilda Road
MELBOURNE VIC 3004
24. Commonwealth Department of Industry, Technology and Commerce
State Office - Technology Victoria
Jensen House, 339 Swanston Street
MELBOURNE VIC 3000
25. Tasmanian Furniture Industry Training Council
20 Brisbane Street
LAUNCESTON TAS 7250
26. Tasmanian State Institute of Technology
Design in Wood Course
Design and Technology
School of Architecture
LAUNCESTON TAS 7250
(PO Box 1214)

27. Tasmanian Timber Promotion Board
Research Division
68 York Street
LAUNCESTON TAS 7250

28. Office of Science and Technology
10 Murray Street
HOBART TAS 7000

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