The design of Indoor Furniture for Export Markets from Queensland Hardwood Timbers.

By

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Executive Summary

Queensland hardwood timbers, particularly the economically important species Spotted Gum have a higher density and more various extractive content than those species more traditionally used in furniture production. While posing some advantages, such as better strength properties which allows for furniture sections to be produced in thinner and more elegant forms, the high density of the timber comes with two inherent disadvantages.

- The timber is classified as a high movement timber, meaning that it expands and contracts more than most timbers with changes in the moisture content of its environment
- The high extractive content of the timber means that after the timber is cut, the natural oils leach from the timber making the surface slippery and very difficult to glue.

Furniture produced from Spotted Gum timber has previously been developed by manufacturers and placed in the market. However, soon after sale the items have been retracted due to the failure of joints. The problems have cost the industry a lot of money and although various research projects in the past have been dedicated to solving these problems, the issue remains unresolved.

The Co-operative Research Center for Wood Innovations, through which this investigation has been funded, has developed a process for modifying wood that has the potential to:

- Prevent the changes timber size due to changes in environment and therefore the moisture content of the timber
- Stop the extractive leaching
The product of this modification process is called Vintorg. The process of modification was originally intended to be applied to Queensland hardwood timbers, providing this investigation with a material development design research brief, the intended design work conducted with this superior material meaning that the furniture would not fail in service life.

The commercial development of Vintorg for the Queensland hardwood timbers was too slow for this to happen. This left this design led investigation with the extremely difficult task of using the timber in its natural state to produce fine furniture.

Using conventional forms of joinery, traditionally applied in high quality furniture was not an option. However, joining systems do exist that are immune to swelling and extractive leaching. These joining systems are mechanical and usually associated with cheap “flat pack” furniture. The challenge was therefore to produce designs that use “flat pack” joining systems, but the final form, or product, must be desirable to customers as high quality furniture.

This design investigation was tackled along the following lines:

- An extensive study of the Queensland furniture industry and the original failures with Queensland hardwood timbers, and the close study of the scientific properties of Spotted Gum, in comparison to most other commonly used furniture timbers.

- Two completely different target markets were selected to develop the designed outcomes for and eventually test the final designs in to see if the concept had aesthetic appeal in each intended market and if the potential customers in each were prepared to pay top quality prices for these designs from Spotted Gum timber.

The markets chosen for the design research were Japan and Germany. The results of this design study and design research were both encouraging and surprising.
Abstract

Within the furniture and forestry industries, there is a need for high value products to be developed for international markets utilising Australian hardwood timbers. This investigation has addressed this requirement, with a focus upon a particular timber species - Spotted Gum (*corymbia citriodora subsp. variegata*), a diversely eminent species of Queensland hardwood timber.

The investigation was initiated by collaborating parties within the Co-operative Research Center for Wood Innovations (CRCWI) particularly the Department of Primary Industries – Forestry Research (DPI&F) in Queensland. It was decided by the DPI&F that an industrial design contribution, through the instigation of a design research led investigation would be a beneficial avenue for addressing prevalent issues in the forestry and furniture industries.

Background research processes undertaken in both the forestry and furniture industries in a geographically specific area of Queensland were vital in establishing immediate investigation parameters. Following the establishment of these parameters and their accepted relevance to broader national industry concerns, the consequent development of an appropriate research method in this investigation was undertaken.

The method generated needed to address two major issues. First, to address technical problems in the application of Spotted Gum timber to the production fine furniture, surpassing various initiatives to resolve these issues in the past, secondly, to address a lack of market knowledge, with regard to product design parameters for export markets within the participating Queensland furniture manufacturing industry.

The method employed seeks to establish the degree of cultural difference that must be accounted for by manufacturers in developing products specifically for export market integration. This theory was tested by the development of two experimental indoor dining chairs, that were designed and prototyped, recognising to the best degree possible the exceptional technical requirements of Spotted Gum timber.
Each of the two chairs were developed to the requirements of pre-determined market and user oriented needs of a separate case study destination, determined through qualitative and quantitative information generation. The specific niche market design parameters applied to design development, created a precursory theory that the products would have a greater degree of success in market integration if they were designed for specific niche market parameters.

Each of the chairs was then exhibited in an appropriate market arena for the destination for which it was designed. A series of questions seeking preferences for each of the chairs, and the reasons for those preferences were solicited from those attending both of the exhibitions.

The testing process resulted in a conclusion that there is little cultural difference that must be accounting for in approaching design development for the two international markets identified tested as case studies. The initial chair designs, developed and used in the testing role within the investigation, were according re-designed given the findings of the market testing process.
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Declaration

I hereby declare that, except as stated herein, this thesis contains no material which has been accepted for the award of any other degree or diploma in any university and that, to the best of my knowledge or belief, this thesis contains no copy or paraphrase of material previously written or published by any other person except where due reference is made in the text of this thesis.

Lucy Allnutt
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Appendix 1
Initial Design Brief

Glossary

CRC – Co-operative Research Centre
CRCWI – Co-operative Research Centre for Wood Innovations
DPI&F – Department of Primary Industries and Fisheries
CSIRO – Commonwealth Scientific and Industrial Research Organisation
IFFT – International Furniture Fair Tokyo
CIFF – Cologne International Furniture Fair
MFF – Milan Furniture Fair
MT – Machine Tool Industries
SME’s - Small to Medium Size Enterprises

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Chapter 1
Issues relevant to the forestry industry and furniture manufacture within a specific geographic region of Australia

1 Introduction

This thesis reports on research into the use of a Queensland hardwood timber, species *Corymbia citriodora ssp variegata*¹ (known by the common name of Spotted Gum) for the production of fine indoor furniture for export to foreign markets. The economic value of the timber resource was a primary reason for the investigation. The specific properties of the timber investigated required the development of new joining mechanisms in the production of the furniture outcomes required. These new joining mechanisms, were then considered in the context of product development for market requirements particularly export integration to assist Australian furniture manufacturers in sustaining and expanding market share.

The fundamental background elements of consideration in this investigation are issues relevant to the furniture and forestry industries in question were translated into an appropriate research method, most relevant to the skills of an industrial designer through a design research process. These relevant issues include the exploitation of technical design expertise aligned with appropriate technical knowledge of the material and manufacturing abilities of companies involved, also export environment conditions, and their potential effects on the materials, and the requirements of products developed from those materials. In addition to technical issues were the important factors of the generation of market knowledge and direction.

The market parameters of the investigation included identification of appropriate market development directions for the export of indoor Spotted Gum furniture. The testing method applied was based on the particular knowledge embodied in two purpose

designed products. Two dining chairs were developed within the proposed parameters; one chair was developed for each of two separate case study markets. The knowledge gained through the comparative testing of these two products when placed in the appropriate export market forums provided valuable indicators to designers and manufacturers.

This style of research contributes to new knowledge in two distinct ways. Firstly, new product development in the design research process adds a novel aspect to the investigation. The unique properties of these products given the background parameters for their design, allows that entirely new information be generated through the market testing method applied. The use of specifically designed products in the testing process has established the use of industrial design based product development as an advancement of new techniques for design research, therefore, creating a new mechanism that contributes to design research knowledge.

The final stage of the investigation included re-evaluation and redesign of the original products, with the advantage of information gathered through the international market testing process. The redesign also included an analysis and change of technical aspects of the products. The changes required in the technical sense were identified through the prototyping, transportation and environmental conditions of the exhibiting process. Finally, an analysis of successful and unsuccessful aspects of the total process, and the establishment of better testing methods, for projected future investigation were completed.

_CRCWI_

This PhD research was initially intended to contribute to the development of microwave modified wood, mainly ‘Vintorg’ and design development derived from this new material. Due to delays technology, objectives within design research postgraduate investigations undertaken within the CRCWI were required to be altered at an early stage. It was stated with regard to Vintorg that “Upon enrollment, it was anticipated that the
technology would be commercialised before the end of the candidature, this has not occurred forcing candidates to think laterally about how to position and communicate their research”. The result of the slower than anticipated technology development, within this investigation was that of a market led design strategy for an un-altered timber product. This would be the focus of the investigation, rather than working on a technology led design strategy, or what was later modified to a pre-commercial technology push design process.

DPI&F

An important factor in the context of this investigation is that it was initiated from the satellite location of the DPI&F, located in Brisbane, Queensland. The role of DPI&F - Forestry Research Department is to provide research and development for the forestry industries within the State of Queensland. The Innovative Forest Product Program specialises in tropical and subtropical forest and timber research and technology transfer solutions.

The geographical specificity of this institute has logically led to the focus on research projects relating to the development and utilisation of local timber resources. Several of these projects are related to the concerns of using local resources, and have importantly influenced this investigation.

Although the major focus areas for this investigation were pre-determined by resource and industry needs, the project direction and strategy were developed following collection of important scientific and empirical information amassed during the first stages of the project (see chapter 2). The reasons for involving an industrial designer in this research investigation are important, and a driving factor in development. Further

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2 Anderson, L, Allnutt, L & Thong, C 2004, ‘Designing research within a co-operative research center: a flexible approach to working with scientists, government and industry,’ Proceedings of Futuregrounds, International Design Conference, Monash University, Faculty of Art and Design Australia, p. 8
reasons and advantage for industrial designer involvement are discussed in chapter 3 - Method.

A major objective of the investigation, given the considered economic importance of the timber species in question is value adding. Value adding to the timber resource through furniture manufacture is intended to extend the use of Australian hardwoods currently utilised for low value product such as domestic house framing into furniture and other high value appearance products. The Queensland hardwood resource is small but highly significant from both research and industry perspectives. At present, the resource is badly underutilised in higher value capacities.

Currently, Spotted Gum is the highest volume native hardwood harvested in Queensland, equivalent to 60% of the total. Spotted Gum is regarded as an important timber for Queensland industry and therefore has been a major target for the focus of experimental value adding activities. The promotion and popularity of using hardwood plantations producing high value products compared with the existing regrowth resource of particular timbers has recently been given increasing attention.

There is no Queensland hardwood plantation timber available for processing at present, and it may be some time before these fast grown timbers will be available on the market. Preliminary testing of plantation timbers has begun, and more information on the physical characteristics of these timbers will be available in the future.

1.1 Indoor furniture manufacturers in Australia

Indoor furniture manufacturers within a specific geographic region of South Eastern Queensland had expressed interest in exploiting the unique properties of the local timber

---

resource (mainly Spotted Gum) to give them a significant advantage in approaching export markets. At the commencement of this investigation, a surveying process involving visits to the production sites of interested manufacturers was undertaken. The information derived from their current practices and past experiences contributed significantly to the strategies employed in this investigation.

The Australian furniture manufacturing industry is important, accounting for 7.8% of Australian manufacturing, and half is timber furniture. The concern growing over the need to value-add to the Australian Hardwood resource within the furniture manufacturing community is evident.\(^7\)

**Export, and the changing reality of furniture manufacture in Australia**

It was soon established, through initial investigations into the furniture manufacturing industry, that the low value utilisation problems related to the timber resource works in tandem with difficulties that the local industry were facing due to increased competition in the domestic market. There is a pressing need to broaden the market objectives and create higher value product strategies within the local furniture manufacturing community for more than one reason.

Over the past five years, export totals in the Australian furniture sector have remained more or less constant, while imports have risen steeply. Imports increased from just over US $300 million in 1995 to over US $595 million in 2000. In 2000, furniture exports from Australia totalled around 60 million dollars US, while furniture imports into Australia totalled about 600 million dollars.\(^8\)

To counter the reduced market share in Australia due to imports, it is logical to focus upon the export of products from Australia, and to maintain or grow manufacturing organisations in this country. Some manufacturers saw the exploitation of Queensland

\(^7\) ibid. p. 1  
\(^8\) CSIL Milano 2001, *The furniture industry in Australia and New Zealand*, CSIL Milano Furniture Industry Research, Milan, p. 16
hardwood timber with its unique properties as a means of promotion of Australian furniture on an international scale, as a tool to combat the dual problems of import saturation in the Australian market, and to compensate for the decrease of imported and local tropical timber resources. The increase in high value production would then create a follow-on effect, by creating a greater demand for high-grade native hardwood resource supply.

1.2 How did the investigation progress? Background

Previous related activities in both research and manufacturing formats had indicated that a new and untried approach needed to be developed to further pursue this issue, given unsuccessful attempts in the past.

There were two major research objectives focused on within the initial months of the investigation that provided a fundamental information base required for more specific direction development.

1.
Analysis of relevant information gathered owing to the resources of the DPI&F, This analysis included:

- Economic importance of various Queensland hardwoods, including:
- Growth rates and quantities, their present supply and use and their future availability forecasts.
- Scientific analysis of the properties of those species found most relevant, and understanding the manufacturing capabilities of those outstanding species.
- Investigation of the history of the species in commercial use.
- More specifically, the past and projected uses of the species within the furniture manufacturing area.
- History of research projects utilising Queensland Hardwood timbers, in which DPI&F researchers had been involved in some capacity.
2.
Empirical investigations in the form of informal visits to furniture manufacturers in the South Eastern Queensland region. Significant information gained from these visits included:

- History of furniture manufacturing in the region, in particular the history of manufacturing attempts using Queensland hardwood timbers.
- Manufacturing capacities and facilities.
- Present situations and future ambitions of the manufacturers, including market sustenance and expansion, in both domestic and export areas.
- Use of design and market direction within each of the companies investigated business plan.
- Analysis of all antecedents of the use of Queensland hardwood species, within the furniture-manufacturing realm, including past research projects conducted.

Given that manufacturers had in the past not been able to produce successful products from the Spotted Gum resource, new products specifically dealing with technical challenges of the material and export environments needed to be developed in this investigation.

Both of these background areas, as important contributors to the investigative direction will be outlined in further depth in chapters 2 and 4.

1.3 Foreign market targeting as a design research strategy

Global export strategy, (particularly foreign market targeting,) and niche market infiltration as a recognised modern business survival and expansion technique for small manufacturers, are topics highly relevant to this investigation, with an appropriate experimental format for design research.
The need to develop new joining systems to overcome technical problems indicated that new furniture products must be designed for this investigation. There was little point in developing products for the domestic market and altering their characteristics for export when there is no requirement for further product integration on the domestic market. Therefore it was decided that products designed in this investigation would be designed specifically for international markets, further reasons for this decision will be discussed in depth chapter 4. It is intended that this export specific design orientation, would reduce risk for Australian manufacturers when placing product in an international market environment.

The theory of international specificity as an exporting tactic employs industrial design skills as the crucial link in its implementation. Furthermore, the theory of foreign market targeting through design as an exporting mechanism lends this particular design research investigation a unique opportunity. The creation of a case study where the primary researcher is a designer working in collaboration with industry can create a near complete test of this process.

**Generation of ‘Design led’ market information**

At the commencement of this investigation, there was little existing market information in the related research (CRCWI) or relevant manufacturing areas to assist in the compilation of market information and a resultant testing method for this investigation.

Given this, the market knowledge generated for the investigation can be broken down into two steps.

1. Identification of ‘design led’ market knowledge requirements which can be applied to any global market, including:

   - Correlation of quantitative information required to meet ‘design led’ market needs
• Identifying which markets will be most appropriate for the case study and conducting further in-depth market oriented study of those markets as a prerequisite to further product design

2. Undertaking qualitative market information gathering through foreign study tours including international furniture fairs and manufacturer investigations.

1.4 Designed product outcome testing

This investigation has focused on the development of two flat-packed indoor dining chairs, developed for the specific needs of the allocated case study export markets, and the testing of those chairs through a discussion process undertaken in appropriate forums in those destinations.

The properties of the two chairs developed for the product testing process have been based on fundamental elements of consideration mainly technical and market as discussed previously in this chapter.

Important elements of consideration contributing to the design research testing process in this investigation include:

• Identification of market direction and generation of appropriate design led knowledge of that market.
• Design expertise aligned with appropriate technical knowledge of the material and export environment parameters.
• Testing in the appropriate international market capacity,
• Re-evaluation of product post international market testing process.

To gain an understanding of the success or otherwise of the products developed, a strategy was devised for the testing of the products. To implement the strategy devised,
one indoor dining chair, was developed for each of two specifically chosen case study markets.

The two products were then exhibited in each of the case study markets, or as close to each market as possible, given time frame and funding allowances. During the exhibitions, questions were asked on the appropriateness of each product for that specific designation, and what was liked or disliked about the product and why, as well as other general questions.

**What was found out?**

In this investigation, the available funding has allowed the designers skills’ to be exploited in the generative research stage of product development, particularly due to the advantage of first hand investigation of the foreign end user’s environment. The product outcomes have then been tested in the formative research sense though the implementation of an appropriate international testing environment, and the re-design of the product following the assessment of gathered information. This design research process creates the opportunity for a unique and innovative generation of information.

The process of exhibition of the two purpose designed dining chairs showed that in each market a preference for one of the two chairs could be established. The preference was established without those surveyed knowing which chair was specifically designed for that market.

Analysis of the responses to the chairs allowed conclusions to be drawn on the success of both the products created in each of the markets used for case studies. The reasons for the success or otherwise of that chair in each market could then be considered. Given the structure of the testing method, there was scope for general comparisons to be made in regard to the overall market and environments the chairs were exhibited in, and how this affected the process.
The information gathered through this testing process was important as it generated new knowledge in a number of areas including:

- Within the limitations of the testing parameters (discussed in chapter 11.) The extent to which cultural differences influence purchasing decisions in major world furniture markets
- New information for practising designers regarding approach to export market design
- Information for manufacturers in developing product design and development processes for export market integration
- Important information on the usability of Spotted Gum timber, and its value adding potential

Having applied a design and testing system within the parameters of the investigation, Suggestions for future testing systems, made following the learning curve of this investigation are also included (chapter 11).
Figure 1.1: The diagram explains the research method applied for this investigation
1.5 Structure of Thesis

In this chapter, the significant factors that inspired the conception and development of the investigation have been identified and will be discussed further where appropriate throughout the thesis. The context of this investigation being funded through the CRC Wood Innovations, and managed by the DPI&F, within the CRCWI have played significant roles in the conception and direction of the investigation.

Chapter 2 summarises the major sources of literature reviewed in all areas of exploration relevant to the investigations development. The discussion of issues in this chapter includes:

- Technical properties of Queensland hardwood timbers specifically Spotted Gum, which is of particular importance to design concept development.

- Queensland furniture manufacturing industry the investigation of which in conjunction with issues established by the CRCWI and DPI&F, largely contributed to establishment of project method and outcomes.

- Timber joinery, both a general summary and particular examples from past design research and manufacturing projects. The timber joinery reviewed is relevant to design exploration undertaken within this investigation.

- A summary of market related literature (this is broken down into sections). The summary starts with, a general market analysis to determine the countries most appropriate for case study investigation.

- Two international study tours these were undertaken to each of the appropriate export markets Germany (Europe) and Japan. The study tours produced
Chapter 3 focuses on key research areas, particularly prior research projects that have been undertaken within the scientific, design and manufacturing areas. This chapter discusses what information came from these prior research projects, and how they have contributed to the creation of hierarchical importance. These areas include timber species selection, technical design knowledge such as trials of joining systems, and providing information that contributed to overall methodological choices in this investigation.

Chapter 4 discusses the method that was developed for the investigation. Export and specific market knowledge are the basis for a market-led method, which are highly appropriate to the issues at hand and appropriate to application of product development in the design research process.

Chapter 5 discusses the designed outcome component of the investigation. Several ideas in experimental joinery and technical, pre-market investigative design were undertaken during the exploration of technical and manufacturing knowledge. Although the design work undertaken at this time did not involve market specific orientation, many of the technical elements explored in this concept work contributed to later, more relevant design experimentation.

Chapter 6 discusses the parameters of the Japanese and German markets as the chosen case study markets in this investigation. The market information compiled in this chapter is important as it provides the basis of information on which the two dining chairs, used for market comparison in the investigation are designed on.

Chapter 7 explores the market-oriented design work undertaken at a later stage of the project, given that research in the market area was required before market specific design could be developed. The design work discussed in this chapter leads to the generation of qualitative research information from a design perspective in both the Japanese and German markets.
three final concepts, two of which were developed to prototype, as the objects required for the exhibition phase of the investigation.

Chapter 8 is a summary of the next stage of the designing process, involving the final concepts for the Japan and German chairs generated in the previous chapter being brought into prototype for exhibition. This discussion details the concepts being brought into technical relevance through the generation of engineering drawings and the construction of prototypes from these.

Following the production of the prototypes, discussion in Chapter 9 centres on the international exhibition process undertaken that generated the experimental information and a contribution to new knowledge. The chairs were exhibited at both the International Furniture Fair Tokyo, and the Salone satellite, an exhibition of a slightly different context within the Isaloni or Milan Furniture Fair. Exhibition, surveying procedures and initial results are presented.

Chapter 10 discusses the analysis of results taken from the surveying process undertaken in both Tokyo and Milan. The analysis of exhibition results relates directly to the generation of criteria for re-design of the two chairs, from both a technical and market perspective. The re-designed products generated as a result of this process are presented and discussed in this chapter.

Chapter 11 provides a summary of the objectives of the project and a summary of the conclusions found. This chapter discusses ideas of how a comparative testing procedure, as part of a design research investigation could be better conducted in the future.

1.6 Summary of Thesis

As a result of research undertaken through the CRCWI necessarily being closely linked to industry, research conducted with direct industry reference in this investigation relates to the position of design and designers within the Australian furniture manufacturing
industry. Following the placement of this design investigation within the context of the CRCWI and therefore industry, it becomes highly relevant that design is not currently applied in a traditional designer-industry context rather than a design research context.

Discussion of the application of design research in this investigation (including the use of designed outcomes) as important information generating mechanisms within process of investigation, allows problems to be bridged, for example: market direction, technical material issues, and international market testing. The use of design led research strategy in this investigation creates a previously untried approach to developing value-adding solutions for issues in the forestry and furniture industries.
Chapter 2
Literature review

2 Background investigation on furniture manufacturing in Queensland

Investigation of a sector of the Queensland timber furniture manufacturing industry
was essential to gain a thorough understanding of issues faced within the South Eastern region of Queensland and to establish direction for this investigation. The
information developed through this investigation is intended to directly benefit and enhance Australian, and particularly Queensland, furniture manufacturing industries.

Eleven manufacturing companies were visited at the commencement of this investigation in early 2002 and an internal report for the CRCWI was formulated as a result of these visits. However, rapid and diverse changes within the manufacturing industry have required constant updating of empirical knowledge and direction in this investigation. Several of the manufacturers listed below have been visited several times throughout this investigation.

- **Paragon Furniture:** Producing reproduction period furniture, with experimentation in modern domestic timber furniture
- **Janda Furniture:** Upholstered and timber dining furniture
- **Furniture Concepts:** Office furniture with experimentation in outdoor timber furniture
- **Tradway Furniture:** Indoor timber furniture, dining furniture and cabinetry
- **FMCA:** Various styles of furniture, majority indoor, from various materials including timber
- **Furnir Furniture:** Bedroom furniture
- **Queensport Furniture:** Commercial furniture, high-end timber office furniture and custom timber fit outs
- **Wattle Products:** A timber furniture component producer

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(all of the above manufacturers were involved in the Metaform Australis group)

- Ausgum Furniture
- Gumnut Furniture

Both are outdoor timber furniture manufacturers. These manufacturers produce furniture from Spotted Gum and Kwila (an imported rainforest species) respectively.

- Pegar Furniture.

(upholstered furniture manufacturer, some timber products in their range)

When initially making contact with industry, a requirement was that a general picture of industry be generated. The history of manufacture in the respective companies needed to be understood, especially with regard to Queensland hardwood timber experimentation, an issue that was a focus of various discussions held with the companies.

The issue of foreign market infiltration, where manufacturers were exporting, areas the companies would like to develop in the future, and what was inhibiting these ambitions was discussed.

The general discussion question included questions on:

- Facilities within Queensland that are available for furniture manufacture at present?
- What types of products these manufacturers are producing?
- Background and philosophies of the companies
- To whom and where they are selling their product?
- As industry members what are their opinions of furniture manufacture in Queensland and future propositions?
- What are the future directions for their own companies?
Innovative technology and the potential effect that this could have on the industries future and how it affects them?

Establishment of contacts for possible design experimentation in the future.

2.1 Metaform Australis - Furniture manufacturers

Some of the companies visited at the commencement of this investigation had been involved in the Metaform Australia group, those involved in the Metaform group generally had some experience in producing furniture from Queensland hardwood timbers.

The furniture manufacturing companies represented in Metaform are small to medium sized by Australian standards, with yearly turnovers ranging between one million to seven million dollars. Most of these furniture manufacturers presently supply local markets with various timber products, while some companies have experience in the export of furniture produced from various timbers and other materials.

Many of the problems related by the manufacturers pertained to long-term export issues and the financial difficulties involved. Other more specific problems related to the performance of products trialled from Queensland hardwood timbers.

2.1.1 Summary of important manufacturer raised issues

Technical problems in utilisation of Queensland hardwood timbers for furniture:

- Timber joints are a major problem, an issue raised by all the manufacturers
- Problems with gluing joints, and finding the appropriate glue
- Traditional expectations in industry for timber furniture forms
- Limited willingness to experiment with design to solve the more practical problems and produce variations on forms due to lack of funds and market knowledge
- Seasoning of timbers before production to correct moisture content which then changes with varying environmental conditions
• Movement of timbers over time after manufacture

*Lack of market knowledge/Unit costs in global competition*

• Little market knowledge or research, manufacturers reluctant to make investments into research due to lack of funds
• The manufacturers see an inevitable need to reduce unit costs to export furniture, in competition with manufacturers in lower wage earning countries that is impossible
• Competition from manufacturers from low wage earning countries is seen as a major deterrent to attempting to establish markets. There is no knowledge of how to gain access and then establish a reputation for higher end markets or to investigate different market brackets.

*Reliability of timber supply and the quality of that supply*

• Concerns over the reliability of making new products where the timbers have not been tested in those specific forms. This lack of confidence in reliability and concern over consequences if the product deteriorated over time is a major deterrent
• Improper seasoning of timbers by Queensland suppliers contribute to this problem. Because there is not a large export industry in furniture products from Queensland there is currently a poor supply of furniture grade hardwood. Due to the small-scale furniture production, the sawmills do not recognise the furniture industry as a potential market. Not all sawmills have the kilns to dry the better quality timber.

*Production capacities (small scale of local manufacture)*

• The small scale output capacities of the Metaform companies and the associated lack of capital for investment is a major problem
Manufacturers fear receiving overseas orders that they do not have the collateral to produce.

It was apparent from this time that there was not a great deal of confidence in the industry, either from the perspective of industry prospects and company expansion, or the utilisation of Queensland hardwood timbers in the production of furniture.

Major projects were undertaken by several of the manufacturers where furniture was produced from Spotted Gum timber and in some instances released onto the market. There was little success gained by manufacturers through their previous product development process. It became apparent that new joining mechanisms would be required to be developed in new products for export market infiltration, if any further progression on these issues through industrial designer involvement could be made.

The Metaform manufacturing projects are discussed in further detail in this thesis where appropriate, illustrating particular problems and solutions in product design development. A description of all Queensland hardwood manufacturing projects is given in the Internal CRCWI “Report on Timber Furniture manufacture in Queensland”

Also further information on these manufacturing projects is available through:

**Janda Furniture**

Janda Furniture 2003, *Cape York range catalogue*, publicity brochure available from Janda furniture, a copy is also held at Swinburne University, National Institute of Design. Contact: Mr Paul Reinhardt, (previous Managing Director of Janda Furniture.)

**Tradway Furniture**

Tradway Furniture n.d, *Tradway Furniture Wivenhoe collection catalogue*, Promotional brochure available from Tradway furniture, a copy is also held at Swinburne University, National Institute of Design. Contact: Mr. Timothy Cox, Owner, manager, Tradway Furniture.

**Paragon Furniture**

*Queensport Furniture*
Contact: Mr Mark Robba, Owner/Manager Queensport Furniture.

2.2 **Why indoor domestic dining furniture for experimentation?**

Most of furniture manufacturers with an interest in producing from Queensland hardwood timbers are indoor furniture manufacturers who have less success than outdoor manufacturers when utilising Queensland hardwood timbers and integrating export markets. It was therefore decided that indoor furniture would be targeted for this investigation.

2.3 **Technical Information Selection**

The major scientific research investigation, which aimed to determine the properties of selected Queensland hardwood timbers with regard to furniture design, and production was commissioned by the Metaform Australia group shortly after the commencement of the initiative. This research project was undertaken by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in collaboration with the DPI&F.

The recommendations made through this scientific process of experimentation was recorded in a series of reports, headed by the report ‘State of the Art Report on the Use of Australian Hardwoods for Furniture Manufacturing,’ and provided important background information for this investigation. A brief summary of important recommendations made in these project reports, with particular regard to adhesive and structural testing of some traditional furniture jointing systems, is included in this chapter as the findings impact largely on the design processes employed.

Species of timber identified by the Metaform group for investigation, both in commissioned scientific and design projects, are given in the table below.
<table>
<thead>
<tr>
<th>Botanical Name:</th>
<th>Common Name:</th>
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<tr>
<td><em>Eucalyptus cloeziana</em></td>
<td>Gympie Messmate</td>
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<tr>
<td><em>Eucalyptus pilularis</em></td>
<td>Blackbutt</td>
</tr>
<tr>
<td><em>Corymbia citriodora ssp variegata</em></td>
<td>Spotted Gum</td>
</tr>
<tr>
<td><em>Eucalyptus Grandis</em></td>
<td>Rose Gum</td>
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Table 2.1: Queensland hardwood species investigated by the Metaform group

The problems in processing hardwoods for high value wood products as presented in the report ‘State of the Art Report on the Use of Australian Hardwoods for Furniture Manufacturing,’ are as follows:

- Appearance grading: Lack of grading rules
- Drying: Drying degrade ‘collapse’ lack of drying schedules and stability data
- Machining: Unknown machining parameters and tooling requirements for high density hardwoods
- Gluing and jointing: Gluing dense timbers, types of glues for different applications, gluing procedures
- Finishing: sanding techniques, staining systems
- Final products: Furniture and joinery, parquetry and panelling.²

Timber quality issues such as defects due to growth rates, growth stress and strain, pests, preservatives, treatments, and seasoning are all universally acknowledged in their impact on the timber supplied for furniture production. Quality of timber supply is a major concern to furniture manufacturers, and has a direct effect on furniture produced.

However, the technical information presented in this section of thesis has been assembled with emphasis on knowledge required of the inherent properties of timber for the design and production of furniture from Queensland hardwoods. Particular references have been made to Queensland hardwood timbers where their properties differ to those of other timbers, and these differences directly affect their application in furniture production.

Technical design decisions have been made within the designing process of this investigation, drawing on information based on past experiences of scientific and design researchers and manufacturers in testing and producing indoor furniture from Spotted Gum timber. The technical information in this chapter has been taken from general testing conducted on the regrowth resource of Queensland hardwood timbers, as information on plantation grown Spotted Gum, was as yet in early stages.

2.3.1 Introduction to Stability

In the Metaform Australis project report: (“The use of Queensland Hardwoods for Fine Furniture - Timber stability”), it is stated that the stability of timber is of crucial importance where the timber is to be used in furniture. The problem of stability in timber is generally referred to as the movement of timber. Timber shrinks and swells in size due to movement of moisture until it is in equilibrium with its surroundings.³

Carl Eckelman in his paper ‘The shrinking and swelling of wood and its effect on furniture,’ elaborates on this, he states that there are four factors that account for most of the shrinking and swelling problems seen in furniture:

- Wood was not dried to the proper moisture content before manufacture that subsequently lead to excessive shrinkage.
- Construction of the furniture is such that the wood is mechanically restrained from shrinking and swelling.
- Excessive drying takes place through the ends of the members
- Designs are used that accentuate visual differences in shrinking and swelling in members oriented perpendicular to one another, rather than minimizing them.⁴

⁴Eckelman, C, A n.d. ‘The shrinking and swelling of wood and its effect on furniture,’ Purdue University, West Lafayette, Indiana, p. 10
Timber stability issues are created by several anatomical factors of wood, and the following section will review those factors and how they impact on furniture production.

### 2.3.2 Growth Rings

The properties of timbers native to Queensland are similar to those of timbers from other tropical and subtropical areas of the world, rather than other areas of Australia. In the tropics, the seasons have less temperature change. Queensland lies between the low latitudes of 10° S and 29° S, and experiences tropical and subtropical climatic conditions. Tree growth in tropical and sub tropical climates contributes to the varying properties of the timbers harvested in these regions.

Climate as well as species has an impact on the density of timbers. Bootle states “In cool climates, growth has a seasonal pattern, often reflected in the formation of growth rings. The wood produced in the flush of growth in springtime is called early-wood and it produces fibres which are larger in diameter, shorter in length and with thinner walls than those produced later in the growing season in the late wood”.

Growth rings are annual rings, which in softwoods consist of early wood and latewood. The variations in hardwoods are less distinctive.

Prominent growth rings occur in Southern Australian species such as Mountain Ash, *Eucalyptus regnans* Alpine Ash (*E. delegatensis*) and Messmate (*E. obliqua*) In warm and tropical climates growth rings are less common. Spotted Gum, Gympie Messmate (*E. cloeziana*) and Blackbutt (*E. pilularis*) harvested from native forests and plantation resources will have higher wood density consistent with the absence of growth rings and dictated by the climate in which they grow.

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5 Discussion with Gary Hopewell, Senior timber technician, Department of Primary Industries, Forestry Research, 5 March 2003.
8 ibid. p
The following wood density statistics are from ‘The State of the Art Report on the use of Australian Hardwoods for Furniture Manufacturing.’

Air-dry density statistics for Queensland hardwood timbers are
(that is at 12% moisture content)

<table>
<thead>
<tr>
<th>Timber</th>
<th>Density (Kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spotted Gum</td>
<td>1010</td>
</tr>
<tr>
<td>Blackbutt</td>
<td>930</td>
</tr>
<tr>
<td>Gympie Messmate</td>
<td>1010</td>
</tr>
</tbody>
</table>

Table 2.2: Air dry density statistics for selected Queensland hardwood timbers

In comparison, to the densities of American Hardwoods commonly used in furniture production are as follows:

<table>
<thead>
<tr>
<th>Timber</th>
<th>Density (Kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quaking Aspen</td>
<td>380</td>
</tr>
<tr>
<td>Yellow Poplar</td>
<td>420</td>
</tr>
<tr>
<td>Sweet Gum</td>
<td>520</td>
</tr>
<tr>
<td>White Oak</td>
<td>680</td>
</tr>
</tbody>
</table>

Table 2.3: Air dry density statistics for selected American hardwood species

These data come from Forest Products Laboratory Forest Service. US Department of Agriculture.

The wood density of other Australian timbers commonly used in furniture production is as follows:

<table>
<thead>
<tr>
<th>Timber</th>
<th>Density (Kg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tasmanian Oak</td>
<td>724</td>
</tr>
<tr>
<td>Mountain Ash</td>
<td>677</td>
</tr>
<tr>
<td>Alpine Ash</td>
<td>620</td>
</tr>
<tr>
<td>Jarrah</td>
<td>863</td>
</tr>
<tr>
<td>Blackwood</td>
<td>640</td>
</tr>
</tbody>
</table>

Table 2.4 Air dry density of other species of Australian hardwoods

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2.3.3 Equilibrium moisture content

According to McNaught, the equilibrium moisture content of timber or (EMC) can be described as the moisture content at which the timber neither loses nor gains moisture from the surrounding atmosphere.\(^\text{11}\) Once milled, timber must dry because its green moisture content is much higher than the EMC of the air surrounding it. Eventually the moisture content of the timber will be in equilibrium with the moisture content in the air. Being a hygroscopic material (i.e. it readily absorbs or desorbs water), wood moves toward a moisture content that is in equilibrium with its surrounding environment.\(^\text{12}\)

EMC is very important when considering production of furniture from timber, as change in moisture content results in shrinking and swelling of timber components. If shrinkage occurs as a result of moisture loss, gaps will open in joints (of furniture) and squeaking may develop in floors. On the other hand, swelling as a result of moisture uptake can result in buckling and poor fit of joinery components.\(^\text{13}\)

The issues of moisture content changes in timber furniture in service life and transit are probably the largest technical problem for the furniture industry in their endeavors to export.

2.3.4 Shrinkage from green and unit shrinkage

There are two types of shrinkage of timber that can be referred to, i.e. shrinkage from green unit shrinkage. Shrinkage from green is the term for how much a piece of timber will shrink when it is seasoned from the green state to the EMC required for production or service.

The shrinkage most relevant to designers is unit shrinkage. Unit shrinkage is a measure of shrinkage (or swelling) of the timber with each 1% change in EMC.


\(^{13}\) Mc Naught, A, op. cit. p. 2
Timber boards cut from the log are either backsawn, with the growth rings parallel to the face or quarter sawn, with growth rings at right angles to the face. Most hardwood timber produced in Queensland is backsawn as opposed to quartersawn, which is used more predominantly with southern timber species. Most Spotted Gum timber produced is therefore backsawn.

Shrinkage problems in flooring and table tops are exacerbated when using backsawn compared with quartersawn boards, because the tangential shrinkage is approximately double the radial shrinkage and the tangential side is the face on a back sawnboard.

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14 Eckelman, C, A, op. cit. p. 5
15 ibid. p. 4
Figure 2.3: Illustrates timber shrinkage.16

The unit shrinkage rates for tangential and radial shrinkage are:

<table>
<thead>
<tr>
<th></th>
<th>Unit shrinkage % (tan)</th>
<th>Unit shrinkage (rad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackbutt</td>
<td>0.37</td>
<td>0.26</td>
</tr>
<tr>
<td>Spotted Gum</td>
<td>0.38</td>
<td>0.32</td>
</tr>
<tr>
<td>Gympie Messmate</td>
<td>0.37</td>
<td>0.21</td>
</tr>
</tbody>
</table>

Table 2.5: Shrinkage rates selected Queensland hardwood timbers

Unit Shrinkage rates of other Australian timbers include:

<table>
<thead>
<tr>
<th></th>
<th>Unit shrinkage % (tan)</th>
<th>Unit shrinkage (rad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mountain Ash</td>
<td>0.31</td>
<td>0.20</td>
</tr>
<tr>
<td>Blackwood</td>
<td>0.27</td>
<td>0.16</td>
</tr>
<tr>
<td>Radiata Pine (softwood)</td>
<td>0.27</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Table 2.6: Shrinkage rates other Australian hardwood timbers

Data are from “The State of the Art Report on the use of Australian Hardwoods for Furniture Manufacturing.”17

The Queensland hardwood timber data is included in the report ‘The use of Queensland Hardwoods for Fine Furniture - Timber stability.’ This includes Spotted Gum, which is more susceptible to movement or swelling than some traditional furniture timbers, as illustrated by the movement percentages listed above. It is recommended in the report that the furniture manufactured from these species must be

carefully designed to allow for the movement in timber. In this report, the description of shrinkage in relation to Spotted Gum is described as high.\textsuperscript{18}

The “State of the Art Report on the use of Australian Hardwoods for Furniture Manufacturing” suggests that in furniture wood swells with increasing moisture content that results in high stresses imposed on the glue line. the higher the density the greater the stress\textsuperscript{19} The relationship is illustrated in the diagram below.

![Diagram](image)

Figure 2.4: Relationship Between swelling pressure and wood density.\textsuperscript{20}

The above information illustrates the problem of how stability and movement in timber has a particular effect on its application in furniture. It is important to note here the impact that the properties, particularly the greater stability issues that of Queensland hardwood timbers (including Spotted Gum) encounter when applied in a fine furniture context.

### 2.3.5 Climate changes and effect on equilibrium moisture content

Below is a graph showing the relative humidity and temperature measurements of the outdoor environments of cities in three countries in different climatic zones. The readings that follow below provide EMC predictions for each month of the year in

\textsuperscript{18} Thompson, R, Ilic, J, Molenaar, S, Truville, G, Roberts, G, Allyson, P & Spillane, B, op. cit. p. (i)

\textsuperscript{19} Ozarska, B, Thompson, R & Hopewell, G 1998, \textit{The use of Queensland hardwoods for fine furniture user manuals part 1 Overview}, C.S.I.R.O. and the Department of Primary Industries, Forestry, p. 24

\textsuperscript{20} ibid. p. 63
relation to the temperature and relative humidity of the example city in each month. The results show the variation in timber moisture content that can occur though twelve months of the year.

Although these are outdoor environment readings this type of variation also effects uncontrolled indoor environments.

It also must be considered that for indoor furniture, the atmospheric conditions (i.e. EMC) will vary with heating and air-conditioning in internal conditions. The average EMC for timber kept in an air-conditioned environment is generally between 8 and 10%.\textsuperscript{21}

The climatic conditions that this furniture will encounter in transit to reach its destination will impact on the ECM of the timber.

\textit{Saudi Arabia}

\textit{(Riyadh)}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure2.5}
\caption{Temperature and relative humidity in Riyadh\textsuperscript{22}}
\end{figure}

Approximate timber equilibrium moisture contents. (Average outdoor temperature/humidity)

\begin{itemize}
\item \textsuperscript{21} Mc Naught, A, op. cit. p. 2
\end{itemize}
January - 8-9%
February - 6%
March - 5-6%
April - 3-4%
May - 2-3%
June - 2-3%
July - 2-3%
August - 2-3%
September - 2-3%
October - 4-5%
November - 7-8%
December - 8-9%

Unit shrinkage will be a problem for furniture in this arid region. It would be advantageous to have timber seasoned to below 12% to be sent to this environment.

2.3.6 Extractives

Another technical aspect of timber which is very important to the success of furniture production, particularly from Queensland hardwood species, is extractive content. In addition to cellulose, hemicelluloses and lignin, wood also contains a wide variety of compounds that can be extracted by solvents, termed extractives. Extractives are of particular concern in timber furniture production when gluing joints and finishing. It is the extractives that give timber its unique and varying colours.

Further discussion on the effect of extractive contents and stability of timbers and their impact on glued joints will be discussed later in this chapter.

2.4 Furniture components

One of the major advantages of Spotted Gum, apart from its economic importance in Queensland and North East New South Wales, is related to design and promotional opportunities. Spotted Gum, and other Queensland hardwood timbers, could be used for aesthetic and design advantage by manufacturers due to the greater strength of the

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timbers in comparison to lower density timbers used in the production of furniture, and the unique visual appeal of the timber.

This would give two advantages: unique forms could be created by taking advantage of thinner stronger sections. Secondly, short length smaller-sized timber sections could be used. The utilisation of shorter components in furniture production helps with sawn recovery rates from sawmills. This uniqueness is difficult to emulate using other timbers.

The major strength properties are Modulus of Elasticity (MOE) and Modulus of rupture (MOR). MOE is the measure of timbers stiffness and resistance to deflection, MOR measures the ultimate short-term load-carrying capacity of the timber.\textsuperscript{24} The following tables give these properties for selected Queensland and other Australian timbers.

<table>
<thead>
<tr>
<th>Timber Species</th>
<th>MOE (GPa)</th>
<th>MOR (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackbutt</td>
<td>18.85</td>
<td>143.8</td>
</tr>
<tr>
<td>Spotted Gum</td>
<td>18.78</td>
<td>141.0</td>
</tr>
<tr>
<td>Rose Gum</td>
<td>15.69</td>
<td>119.0</td>
</tr>
<tr>
<td>Gympie Messmate</td>
<td>17.00</td>
<td>137.0</td>
</tr>
<tr>
<td>Tasmanian Oak</td>
<td>11.08</td>
<td>83.9</td>
</tr>
<tr>
<td>Mountain Ash</td>
<td>16.37</td>
<td>110.1</td>
</tr>
<tr>
<td>Jarrah</td>
<td>12.93</td>
<td>111.5</td>
</tr>
<tr>
<td>Blackwood</td>
<td>14.10</td>
<td>109.4</td>
</tr>
<tr>
<td>Alpine Ash</td>
<td>15.00</td>
<td>110.0</td>
</tr>
</tbody>
</table>

Table 2.7: MOE and MOR properties of Australian hardwood timbers \textsuperscript{25}

The strength properties of Blackbutt and Spotted Gum in particular are far greater than those of the other species.

2.4.1 Traditional joinery

\textsuperscript{24} Discussion with Gary Hopewell, Senior timber technician, Department of Primary Industries, Forestry Research, 5 March 2003.

\textsuperscript{25} Ozarska, B, Manley, S, Rozsa, A, Spillane, B & Palmer, G, op.cit. p. 7
While trying to take advantage of the greater strength properties of species such as Spotted Gum, manufacturers have encountered problems in splitting of joints and sections of the finer pieces of timber.

According to the “State of the Art Report on the use of Australian Hardwoods for Furniture Manufacture,” methods for the joining of timber in the production of furniture are in four main categories:

**Summary of typical furniture Joints**

*Butt Joints:* edge-to-edge or side-to-side, either plain or reinforced with tongues dowels or screws, e.g.

![Figure 2.6: Doweled butt joint, Butt joint with keys or biscuits, butt joint with tongue or feathering, mitred butt joints](image)

*Interlocking Joints:* where one piece of wood is cut or shaped to fit a corresponding socket in the other piece.

![Figure 2.7: T-shaped bridle joint, L-shaped bridle joint, mitred bridle joint, bridal joint with pin, timber and metal](image)
Figure 2.8: Mortise and tenon joint, mortise and tenon joint with wedge, metal pin and dowel, stub mortise and tenon joints

Figure 2.9: Single and group, secret, and half dove-tail joints

Figure 2.10: Stopped halving joint and crossed halving joint, mitered halving joint

The above joint images were referenced from “Carpentry and Joinery: Timber Preparations, Timber Joints.”

Knock down metal or plastic fittings - that secure the various wood sections to form rigid structures.

26 Australian Department of Employment and Youth Affairs, op. cit.
Mechanical joints: that permit controlled movement

Corner Reinforcements

Plastic, steel, or brass reinforcements for every type of intersection are readily available in most hardware stores.

Brass corner reinforcement

Plastic corner reinforcement

Steel flat corner reinforcement

Steel T-strap reinforcement

Wood corner leg brace

Metal corner leg brace

Wood glue block

Use double nuts on a hanger bolt's machine threads to ratchet in its wood-threaded end, then tighten the wingnut onto a wood or metal corner leg brace.

Traditional wood reinforcing glue blocks can be made to fit any corner, but are best cut so the grain runs parallel to that of the reinforced parts.
2.4.2 Determination of optimal component thickness for Queensland hardwood timbers

27 Noll, T 2002, The Joint Book, the complete guide to wood joinery, Quarto, Sydney.
The report “Determination of component sizes for furniture produced from Queensland hardwoods” states that generally furniture should be based on the technical characteristics of the timber from which it is made.28

It asserts that traditionally, Australian furniture design has been based on large section components. Such design has been suitable for timbers with low and medium density, low to medium strength and stiffness. Dimensions of each component should be adapted to the strength of the timber in question, and the type of load that the timber will carry in service.29

A stress analysis of a chair was produced, based on International Standards.30

Figure 2.13: A model chair used in the stress analysis in the report.

It was determined that a structure between the front and back legs significantly reduces stresses in the critical joint located between the seat and back rail. Research studies were carried out to determine the optimal position of the stretcher in a chair to provide high stress reduction in the back joint and to improve the stiffness of the chair. Stress analysis revealed that the best position of the stretcher is a distance of 0.75 of the leg length from the floor.

29 ibid. p.1
30 Industry standard R6-114-94 (1994) Fixed Height Chair Requirements for Function, Strength and Durability, and Stability. AFRDI.
The stress analysis was then transferred to the four timbers used by Metaform, i.e. Spotted Gum, Blackbutt, Rose Gum and Gympie Messmate.

According to these results the thickness of the chair components can be satisfactorily reduced from 25 mm to 19 mm by increasing the width of the components, without affecting the strength of the chair.

<table>
<thead>
<tr>
<th>Species</th>
<th>Thickness of Components (mm)</th>
<th>Width of Components (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackbutt</td>
<td>25</td>
<td>Minimum 28</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>Minimum 29</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Minimum 30</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Minimum 32^{31}</td>
</tr>
<tr>
<td>Spotted Gum</td>
<td>25</td>
<td>Minimum 28</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>Minimum 29</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Minimum 30</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Minimum 32^{32}</td>
</tr>
<tr>
<td>Gympie Messmate</td>
<td>25</td>
<td>Minimum 31</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>Minimum 33</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Minimum 34</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Minimum 36^{33}</td>
</tr>
<tr>
<td>Rose Gum</td>
<td>25</td>
<td>Minimum 35</td>
</tr>
<tr>
<td></td>
<td>23</td>
<td>Minimum 36</td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>Minimum 38</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>Minimum 40^{34}</td>
</tr>
</tbody>
</table>

Table 2.8: Information taken from the report ‘The Determination of Component sizes for Furniture Produced from Queensland Hardwoods’

It is stated in the report that joint design is one of the most important steps in the strength design process. It can be carried out only after the final sizes of all the components have been determined so that the internal forces acting on each joint are known. It must be understood that the joints are the weakest part of a furniture item, and they are a primary cause of structural failure.

^{32} Ozarska, B, Thompson, R & Hopewell, G 1998, The use of Queensland hardwoods for fine furniture user manual part 3 Spotted Gum. C.S.I.R.O. and the Department of Primary Industries, Forestry, p. 10
^{34} Ozarska, B, Thompson, R & Hopewell, G 1998, The use of Queensland hardwoods for fine furniture user manuals part 4 Rose Gum, C.S.I.R.O. and the Department of Primary Industries, Forestry, p. 10
These component widths were developed with the particular recommendation that bridle joints with timber dowels be used as the best method of joining (from traditional joint types) for Queensland hardwood timbers, including Spotted Gum.35

Furniture made from high strength timbers can be built from thinner narrower components than furniture made from low and medium strength timbers.36 In this investigation, further experimental parameters for section size will be discovered, as glued interlocking joints such as bridle joints will be abandoned for new mechanical joining methods.

2.4.3 Adhesives: relation to Queensland hardwood timber furniture joints

The most significant factors in relation to the gluability of Australian hardwoods are the high density of the species compared with overseas hardwoods and the large quantity and types of extractives.37

The report, “State of the Art report on the use of Australian Hardwoods for Furniture Manufacturing” states that Australia has a range of timbers whose densities may be double those of American species and may contain many different types of extractives. These higher density, extractive rich hardwoods are difficult to glue, and to maintain bonds that withstand high moisture, high temperature, or alternative wetting and drying.38

The following section of this chapter provides a summary of scientific research commissioned by the Metaform group, involving adhesive manufacturer conducting testing to assess how joints produced from Queensland hardwood timbers perform under various testing conditions. The results of this testing process were included in the report ‘Gluability of Queensland Hardwoods.’

36 Ozarska, B 1997, op. cit. p. 1
37 AV Syntec 1998, Adhesive solutions, bonding Australian hardwoods, AV Syntec, Brisbane, p. 4
38 Ozarska, B, Manley, S, Rozsa, A, Spillane, B & Palmer, G, op. cit. p. 61
2.4.4 Structural and climatic testing of glued joints using Queensland Hardwood timbers

One set of tests carried out by the Metaform commissioned experimentation into Queensland hardwoods determined the glueability of (selected) Queensland hardwood timber species. During this research, cyclic humidity tests were combined with a block shear test and creep test to determine the most appropriate glues for Queensland hardwood timber joints.

This type of testing information is important to this investigation because it is evident that for export furniture, the joint, if sent assembled, will pass through different climatic zones and subject to changing environmental conditioning. These conditions can only be simulated in an environment chamber.

Through various forms of past evaluation and testing with the timbers specified for the current testing, the following adhesives were used within the three testing processes stated above:

- Two pack crosslink PVA (AV260)
- Modified Urea Formaldehyde (AV203)
- Koyo bond (KR 181)
- Epoxy.\(^{39}\)

For a full explanation and discussion on the testing processes undertaken and results found see project report content\(^{40}\)

The final conclusion in the report stated that these (tested) species “must be considered as difficult to glue. It was not possible to satisfactorily glue these species in all situations likely to be encountered in furniture gluing. There was no doubt that the large moisture content induced swelling and shrinking forces were greater than

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\(^{40}\)Ibid. p. entire report.
bond strength. If these types of adhesives are to be used, initial choice and uniformity of wood moisture is essential. It is also evident that a better adhesive is required to glue these and other high-density species for furniture products.\textsuperscript{41}

This report identified the need to develop more appropriate adhesives for gluing these species of timber, or the interpretation with regard to this investigation must be, to create more appropriate jointing systems not using adhesives.

Given this recommendation and the experience of the Metaform manufacturers, it would be advisable to consider the second two categories of joints, i.e. mechanical fastenings and knock down joints, for indoor furniture produced for export from Queensland hardwood timbers, or any jointing mechanism that falls outside the gluing category.

\textbf{2.4.5 Structural joint testing}

The report ‘Development of Jointing Systems for furniture’ discusses the process of development undertaken in developing joints and exploiting the strength properties of Queensland Hardwood timbers, including Spotted Gum. From all the types of furniture, the chair is undoubtedly subjected to the highest level of loads in service.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{figure2.14.png}
\caption{Joints targeted for strength testing.\textsuperscript{42}}
\end{figure}

- A - T type joints (back joints)
- B - L type Joints (corner joints)

\textsuperscript{41} ibid. p. 42
Based on the two stress points on the chair form that have been indicated, the following joints were constructed and tested. The joint specifications for testing purposes were designed by Mr Keith Ward of Arcimix Crafts Arts Design on behalf of the Metaform group.

The tests were conducted on the four specified timber species. Dimensions of the joints tested varied between species, according to the results of the stress analysis test to determine optimal component sizes for their four Queensland hardwood species.

Corner L joints

- Bridle joint with timber dowel

- Mechanical joint Hafele Minifix mitre connector

Back T joints,

- Bridle joints with timber dowels
- Bridle joints with steel dowels
  As above with steel dowels.
  - Mortise and tenon through joint
  - Mortise and tenon stub joint.

Figure 2.15: Joints specified by Mr Keith Ward for testing in the ‘Development of Jointing Systems for furniture’ investigation

For a full explanation and discussion on the testing processes undertaken and results found in this project report see: 43

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The results showed that mortise and tenon joints should not be used in furniture produced from the four major Queensland hardwood species studied by the Metaform group. Bridle joints performed better than the mortise and tenon joints in the strength testing but it was concluded that:

“the failure due to glue delamination in some joints proves that the Queensland hardwoods are a difficult-to-glue species. For this reason, the joints should be designed in such a way that even if glue failure occurs, the joint is still held together by another joint component.”

The conclusion was that there was no outcome that conclusively demonstrated the successful adhesion of hardwood timbers without the joint being assisted in some way.

2.5 Prior design research undertaken at the Canberra School of Art

The Metaform group commissioned designers at the Canberra School of Art to produce design-oriented, and technically focused solutions to the use of Queensland hardwood timbers in furniture applications.

There were two sections to this project. The first section was producing a range of joints designed for four designated Queensland hardwood species (including Spotted Gum) identified for focus by the Metaform group. The statistical results and conclusive data that accompanied the testing of these joints were unable to be located.

The joints developed through this research project, although experimental in their forms, are generally derivatives of traditional butt and interlocking joints. It is important to note when assessing this project for direction in this investigation, that the experimental work undertaken by the Canberra School of Art was not well received or applied by the Metaform manufacturers in the production of furniture for the domestic market.

44 Ozarska, B, Collins, P, Manley, S, Tendrill, S & Gillman, S, op. cit. p. 46
Image 1

Drawing on elements of the halving joint, this joint creates a three way locking mechanism, giving the joint much structural strength however, the surface to surface attachment of the timber pieces results in grain running in various directions. In the evaluation of cyclic humidity creep testing of Queensland hardwood timbers in the report ‘Glueability of Queensland hardwoods’ it was concluded that none of the adhesives (commercially available types tested) are truly satisfactory when the angle between the grains of the glued components is large and when the moisture content changes in the extreme. 45

Image 2

Image 2 shows a bridle joint, it was recommended in the structural joint testing analysis report, ‘Development of Joining systems for furniture,’ that bridle joints were the preferable joints when producing furniture from the Queensland Hardwoods tested. However, as the strength of the glued joint alone was not completely conclusive in shearing tests conducted, structurally the joint should be designed so as to be held together with another component such as a pin. 46

The bridle joints that were tested by scientists in the ‘Development of Joining systems for furniture’ were held with steel and timber dowels. The bridle joint shown therefore does not conform to this recommendation.

Image 3

Image 3 depicts three joints, first is a mechanical fastening, and as this mechanism appears to be quite large as represented on large sections of timber, perhaps it was trialled with outdoor timber furniture as an intended product. This type of fixing denotes a fairly particular type of aesthetic, and products that utilised this type of joining would need to be designed with specific market intention.

The width of timber that is required with this joiner is also contradictory to the promotion of thin furniture section exploitation intended for use with Spotted Gum timber. As one of its major advantages, however, these joints were developed with various applications beyond indoor furniture as projected products.

The middle image is a variation on a bridle joint, with much smaller sections of timber reducing the strength of the joint, and this joint is also not pinned.

The final joint in this image is a three way mitred butt joint, with an intersecting dowel. This joint again encounters various grain directions that may pose stress issues in a furniture application, as discussed in Image 2.

Image 4

This joint is also a variation on a halving joint. The lack of secondary structure in this joint may cause issues if the glue fails. Compression strength on this joint would be good but shear strength far weaker.
Image 5

This cross halving joint is reliant on adhesives and with no pinning or secondary structure. Movement issues with the Spotted Gum timber would likely detract from the strength of this joint in a furniture application.

Image 6

The image depicts an adaptation of a cross rail joint, a loose wedged through mortise and tenon, which is often used in the construction of tables for central support between two the two end leg rails.

Again an interlocking joint reliant on adhesives, the pin element of this joint, provides a secondary structure beyond the glued overlapping part of the timber applicable to the use of Queensland hardwood timbers as recommended through the scientific testing process. Again, this joint produces a certain type of visual effect which must be calculated for aesthetic appeal in an overall piece of furniture.

Conclusions: Joint assessment

The joints depicted above in general are interlock or butt between two or more pieces of timber, and rely on adhesives for their major bonding and structure. From the scientific research and the later manufacturer furniture produced, it has been established that this is a difficult application in the use of Spotted Gum timber.

2.6 Canberra School of Art - Product Outcomes
The following furniture prototypes were also produced by the Canberra School of Art designers, and provide experimental options. These options, offer some viable technical options for the production of furniture from Spotted Gum timber.

Figure 2.19: Table details designed and produced at the Canberra School of Art

This Spotted Gum indoor table features buffered and unconventional joints in the legs and top supports, in the traditional style. The buffering of the joint is a feature that I believe is a viable design option for improving the efficiency of Spotted Gum joints.

The buffering has been affected by placing an alternate material between two timber sections, to allow compression and movement of the timber without disruption of the joint. However, Metaform manufacturers found the idea of buffering in the way that it is applied in these instances, as an alternate joint mechanism too difficult to incorporate into their current production.

Figure 2.20: Indoor dining chair designed and produced at the Canberra School of Art

This indoor chair from a technical perspective could be very successful, as all the joints are buffered and fastened by mechanical fixtures.
This is another outdoor chair design; it features very thin timber sections and MDF buffers between the timber sections. The experimentally thin form of this chair proved it to be quite fragile over time.

This outdoor chair is very heavy due to the weight required for structural components in the cantilevered base. The joints here are large and interlocking, and although they are held with a mechanical fixing, the configuration could pose some problems through climate changes and transportation.

**Summary – Design challenges posed for the current investigation**

Through the analysis of technical issues encountered in prior furniture manufacturing and other research projects, several issues that needed to be addressed within this investigation.
Major problems

- Need for value adding to specific parts of the Queensland hardwood timber resource (particularly Spotted Gum)
- Import threatened, local furniture manufacturing industry

Extension: Manufacturer issues

- Technical problems with Queensland hardwood timbers
- Particular difficulties in the use of adhesives, and the success of the resultant glued furniture in service life
- Lack of market knowledge and direction
- Concern over gaining the quality of resource required
- Cost of the resource
- Adding to already high unit costs of the furniture

What strategies need to be put in place to counter these issues?

- Market integration and testing strategies

Due to a lack of market research and direction, a foreign market targeting strategy was implemented in this investigation.

*Appropriate product design parameters*

Other influential factors, established from this information now start to establish further design parameters in this investigation.

*How flat packed furniture can be advantageous in this investigation*

It was decided that due to manufacturer concerns over unit cost, particularly the extra cost which is added to an internationally transported product it would be best to incorporate a ‘flat packed’ element into the resultant design outcomes of this project.
A need to target high-end niche markets

The manufacturing group surveyed raised the concern that to become successful in large international markets they would not have the production capacities to fill large orders.

- This is due to the relatively high cost of the timber (Spotted Gum)
- The necessity of developing a new and alternative joining system to utilise Spotted Gum in furniture manufacture, is not likely to lower the unit cost of a product. The factories of the manufacturers surveyed in this investigation are set up to produce products in a certain way. Logically, this production particularly revolves around furniture produced from glued interlocking joints, as the most cost effective method of producing furniture joinery.
- The product must be integrated into high end niche markets to absorb the probable extra costs associated.

The challenge is to design flat packed indoor furniture, countering inherent difficulties encountered in the utilisation of Spotted Gum timber for high end niche market absorption.
Chapter 2 part 2
Literature Review: Market analysis for case study decisions

2.7 Introduction

This section of the thesis outlines the process undertaken to identify the major market case studies and further design led parameters fundamental to the investigation.

It was decided that due to a lack of market knowledge in the industry, products would be designed specifically for export market requirements, as a previously untried method of market integration within the scope of industry representatives involved in this investigation. The method implemented to achieve this aim required two products, designed for two international case study markets for comparative testing in those markets.

This created a need for two case study markets to be identified. Following this identification, various types of information on those markets needed to be gathered as important background steps in the design process.

2.8 How the initial international market analysis case studies were decided

From a broad analysis, the choice of countries for case study in this project must be narrowed down to two. The first step in defining two appropriate case study markets was to establish where Australian market research, government departments and Queensland furniture manufacturers are looking for their export opportunities.

In his Furniture Industry Structure Research Study, Ong (2001) stated that Australia is a high cost producer relative to many Asian countries. Hence its competitive advantage will lie in products that compete more on unique raw materials, design, quality and service rather than simply price.47 This means targeting export markets, which value these attributes. The market will therefore tend to be the more affluent

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47 Ong, C 2001, Furniture industry structure research survey, J.W. Gottstein Memorial Trust Fund, Melbourne, p. 2
countries of Europe, the USA and Japan and targeted affluent groups within these countries.48

A discussion paper released by the Queensland Department of State development (2002) investigated hardwood demand in Japan, South Korea, Taiwan and the United Kingdom as appropriate target destinations for the use of Queensland Hardwood timbers as an export product to these destinations. 49

This paper assesses these destinations with regard to potential for furniture export. It pointed out that most hardwood furniture exported to Japan from the USA manufactured offshore, then exported to the USA. It is suggested that re-exporting back to Japan could be advantageous for Australian manufacturers.

Furniture is recommended as an export product to South Korea, and strong recommendations are made that consumer popularity makes hardwood veneer furniture a potential target in South Korea.50

There is commercial opportunity to export furniture to Taiwan, however, the most likely areas of advantage would be semi-processed wood products, such as hardwood dimension lumber, hardwood veneer and hardwood plywood.51

The paper also indicates, that the furniture market in the UK has shown firm upward trends, coinciding with growth in the residential and commercial sectors. The UK is a net importer of furniture, and it is also recommended that semi-finished hardwood components may also find a place in this market.52

Austrade, a department of the Australian Government involved in foreign affairs and trade, does not provide extensive information with regard to global potential of furniture markets. However, it is recommended that Japan, Singapore and the USA

48 ibid. p. 26
49 Queensland Government 2002, ‘Discussion paper - Market research, the timber industry and hardwood demand in Japan, South Korea and Taiwan and the United Kingdom,’ State Development, Brisbane, p. 3
50 ibid. p. 7
51 ibid. p. 11
52 ibid. p. 15
would be useful export destinations for manufactures. It is recommended by Austrade that the best opportunities for Australian exporters of furniture to Japan are wooden and plastic furniture for domestic and office use. Demand for these products has increased or recovered in both quantity and value over the last five years.  

Austrade goes on to further recommend that the prolonged economic slowdown, which began a decade ago, is causing fundamental changes in Japanese business practice, which will ultimately have a positive impact on demand for Australian goods and services.

Austrade states that in the USA there are two distinct furniture markets office and domestic. The US residential furniture market has been a growing sector over the last years of the 1990s through to 2002. A slowdown in sales expected in 2003 due to reversionary reasons.

The main opportunities recommended in the Singaporean market are in dining and sitting room sets (particularly fabric and leather), followed by bedroom suites, individual pieces such as coffee tables and side tables, decorative tables and floor lighting.

The Queensland furniture manufacturing companies of Furnir, Janda, Tradway and Pegar all have experience in trade with Japan. Queensport Furniture has also had experience in the Japanese market, having exhibited hardwood furniture in Japan.

These export attempts have not always been successful and the manufacturers have various opinions on this market. However, they are all agreed that at one time this country has represented a desirable export option.

When initially interviewed in 2002, Tradway Furniture had experience in exporting timber furniture to Japan for seven years.  The company has now stopped all manufacturing operations and is focused on importing product. Paragon Furniture

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54 Discussion with Mr Timothy Cox, managing director, Tradway Furniture, 24 May 2002.
have also had experience in exporting reproduction timber furniture to Japan.\textsuperscript{55} Pegar furniture, manufacturers of upholstered furniture, export to Japan and New Zealand.\textsuperscript{56}

Furnir Furniture commissioned components to be produced in Korea, and exported to Japan and Singapore. Furnir have now stopped exports altogether, concentrating on the local market.\textsuperscript{57} Janda Furniture has also ceased their manufacturing operations in Australia, following initial contact with their management in 2002. At the time of that discussion they were exporting health care furniture to New Zealand and Hong Kong and some upholstered furniture to Japan.\textsuperscript{58}

\textsuperscript{55} Discussion with Mr Michael Uljarevic, owner of Paragon Furniture, 28 May 2002.
\textsuperscript{56} Discussion with Steven Peto, design manager Pegar Furniture, 26 May 2002.
\textsuperscript{57} Discussion with Mr Hanz Spitz, product design manager Furnir Furniture, 20 May 2002.
\textsuperscript{58} Discussion with Paul Reinhardt, managing director, Janda Furniture, 21 May 2002.
Major Market analysis

An analysis of the major world markets to identify appropriate case study markets for this project was required. The project aimed to determine appropriate markets for the export of products. It must be remembered that this was not a pure market analysis, rather a design-oriented one, therefore pure market research objectives do not apply to this case study selection.

The market-oriented information required is necessary to produce experimental designs and a comparison of these designs on the world market place, creating an analysis of design method that will assist them and other designers in designing products which have a greater probability of success in a world market.

A method of analysis was formulated through a design brainstorming method to determine which market was most appropriate for the case study application. These parameters were also used later in the process of the investigation to further investigate in more depth, the properties required for design for the two case study markets chosen.
2.9 **Major case study requirements: to design**

Major world markets included for further analysis, as a direct result of recommendations made in the above prominent market reports and the advice of exporters and Australia’s government export agency and Queensland manufacturers, are:
2.9.1 **Exemplification of global trends for case study selection.**

Requirements of the economy and its state in each country impact on spending trends in furniture consumption in those markets and often reflect on social behavioral aspects of the population.

The choices of case study markets for this project were required to exemplify global trends in social and demographic contexts. As the aim of this project was to find the best method of design for specific market sectors, strong trends in these areas meant that strong design analysis appropriate to these markets could be made.

In justification of decision making, with regard to case study choices, three main reports on industry and trend analysis, market research and export planning have been consulted and summarised.

In analysis and organisation of issues raised as part of these three reports, optimal parameters for case study requirements for “The design of indoor furniture for export market from Queensland hardwood timbers” were created.
Identification of global trends, market analysis and export requirements were the three main sources of information referenced.

First, Euromonitor’s, information on furniture and home furnishings retailing in leading international markets (2003), has provided definitions for determining what trends establish a market as world-leading. Secondly Ong (2001) in his furniture industry structure research study, gives his synopsis on future global furniture trends and style. Ong raises five major issues in furniture trends in materials, styles and function.

In social requirements, those destinations that are pushing trends on a global scale, due to demand and social progressions, will give most benefit in analysis in consideration of method and the potential use of findings to infiltrate other markets.

Also Austrades’ Guide to Successful Exporting (1989), whose criteria were partially evaluated in relation to this project earlier in the review, provided the practical manufacturing and exporting requirements that contributed to the evaluation of a case study market for this project.

The interesting elements of these reports are the criteria in which world markets are disseminated, to find the trends which dictate the attributes of each market. Below is a summary and analysis of knowledge requirements for case study markets, drawing on factors identified in these three references.

A great deal of information was generated through the analysis of these export markets which have not been included in this thesis. However, the information is documented and available through the CRCWI internal report, ‘Case study selection analysis, for the export of indoor furniture from Queensland hardwood timbers’ A summary of the decisions made as to appropriate case study markets are provided below.
2.10 Conclusion

The Japanese and German economies have been in decline, compared with expansion and growth in some other nations, which has affected spending in the furniture sector. However, it has been shown that consumers in these two countries will spend more on furniture per capita than in other areas of the world, even in declining markets.

- Germany is still the leading furniture consumer in Europe with 26% of the market share, while second furniture consumer Italy has a 16% share.\(^{59}\)

- The Japanese consumer will not hesitate to spend in the area of lifestyle, even in repressed economic times.\(^{60}\)

This steady consumption pattern proves that the population of these countries have an interest in ongoing consumption in the furniture area. This is an important aspect for Australian manufacturers, as the expense and effort it takes to establish a product in an export market should be considered a long term investment. Other countries whose economies are stronger at present, may not sustain the interest in expenditure in the furniture sector in more difficult economic times.

- Spending trends in Japan and Germany show that these destinations would be able to sustain furniture consumption patterns over long periods of time.

Due to practical constraints there was only time to design for the comparison of two markets. It quite difficult to differentiate between advantages in markets, but there are some strong factors that have contributed to decision-making. The factors outlined above indicated that for case study purposes it would be most advantageous to target Germany as a European case study nation. The USA, however, lies in a different western world region, is a market that has been in a strong economic period, and could potentially provide much advantage to Australian manufacturers.

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Therefore the countries chosen for case study analysis in this project were Germany and Japan.

Figure 2.25: Chart showing breakdown of region and country analysis

2.11 Summary

The following paragraphs provide discussion where by direct analysis and comparison of the two markets chosen for prototype development and market testing are assessed. This discussion is intended to give the reader further understanding into the choice of markets made, and provide a summary of this section of the literature review.

Trends:

Japan and Germany, being well developed and large world economies, are both leaders in consumption trends for their respective regions of the world and global trends as a whole. It is acknowledged particularly that through the medium of world
furniture fairs and inter-regional trade, trends in the furniture sector are passed quickly from country to country within regions and even on a global level. Although trends in these two countries are found to be rapidly changing due to economic and social factors, they contribute to leading these changes in the rest of the world.

**Branding through national reputation (Japan):**

Brand name establishment is an important spending trend in the furniture markets of countries with newly developing economies that are in boom periods, with new and expanding middle classes.61

Specific cultural requirements are evident in almost all Asian cultures identified as potential case study markets. However, markets are developing, and a good economy allows the population to have an interest in high end imported furniture for the first time, driving the boom sales in the furniture sector.62 It seems to be the general rule across most Asian countries that Europe and the USA produce furniture brands are synonymous with class, quality and status. The new middle class consumers of this region will purchase accordingly, to acquire new symbols of status in their homes.63

Japan has a leading economy and culture in the Asian region, and has evidently moved beyond this trend. It is noted that Japan has been through a stage where brand name of European and North American products was a vital status symbol. Countries such as China, South Korea and Taiwan are now experiencing that situation.64

The Japanese consumers will now place more emphasis on their own lifestyle requirements and the functional and aesthetic performance of products with regard to

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file://E:\euro%20stuff\euromoniter%203.htm

62 Ibid.

63 Ibid.

64 Euromonitor International 2003, *Furniture and home furnishings retailing in leading international markets (Japan February 2003)* 8.2 market background, viewed 6 October 2003. http://80-  
www.euromonitor.com.ezproxy.lib.swin.edu.au
their own unique lifestyle needs. Recent statistics would show that these elements are more consistently being proven to be the most important decision in the purchase of a high end imported furniture product by the Japanese consumer.65

It is highly probable that this trend is a result of the weakening of the Japanese economy in recent years. However, as pointed out, the weakening of the economy has not drastically affected spending trends of the Japanese consumer in lifestyle areas, which has proven advantageous to exporting countries as Japan has been dragged back to the rest of the world in terms of accessibility.66

**Economy (Japan):**

The weakening of the Japanese economy has allowed increasing amounts of imports into the country, driving the desires of the population to demand more variety of function and aesthetic in their product.67 It has also made world manufacturers take notice of the specific needs to the Japanese population. It is becoming more and more evident on the Japanese market that status is not sufficient and companies must design to meet consumers needs in order to compete.

This shift exemplifies the Japanese consumer as a world leader, exhibiting trends that will most likely in time become manifest in other Asian markets, and giving the Japanese consumer a share of leadership in trends that are taking place worldwide.

**Status (Japan):**

There is a subtle sense of status, where it is no longer in vogue to flaunt wealth by means of expensive brand name purchases displayed either on the person or in the home.68 The heating-up of world wide competition and the unique quality of what it

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65 Ibid.
66 Ibid.
67 Euromoniter International 2003, *Furniture and home furnishings retailing in leading international markets (Japan, February 2003)* 8.3 retail sales, viewed 7 October 2003. [file://E:\euro%20stuff\euromoniter%203.htm](file://E:\euro%20stuff\euromoniter%203.htm)
68 Ibid.
takes to compete on the extremely competitive world furniture market are other factors.

**Advantages for Australian manufacturers (Japan):**

There are several advantages in this market from the perspective of Australian Manufacture.

Japan, in terms of global trends and highs and lows of economy and the sustenance of the furniture market in good times and bad, must been seen as a stable consumer environment and suitable for long term relationship investments from Australian manufacturers. Japan can be considered as a gateway to Asia in terms of furniture markets and trends. Identifying how to enter this market through material use and specific design method can only be advantageous when applying similar theories to other Asian countries, as they begin to look for similar advantages in their product consumption as the Japanese have.

The Japanese consumer will demand high quality and Australian producers must be able to provide this to compete in any world market. The Japanese consumer will provide an excellent test on a world scale. The shift away from brand names from Europe and the USA gives unknown Australian manufacturers hope of competition in the high-end sector. This hope can be exemplified by the use of Australia’s unique raw material.

There has been considerable interest in the Japanese market from Queensland manufacturers to this point. Geographically, Japan is an advantageous market, as are other Asian markets given the relative closeness to Australia on a global scale.

**Technical considerations (Japan):**

There is great variation in climate in Japan, with furniture generally passing through tropical climates on route to, then experiencing a great variation in climatic conditions from potentially hot and humid to cold and dry. Furniture sent to this environment
will need to be able to withstand extremes, and requiring technical solutions that could be adapted to any of the worlds’ major regions.

**The consideration of Singapore:**

The other stand-out market in Asia for the reception of high-end furniture goods is Singapore. This would be a good market to direct export research to in the future, given what will be learnt thought the Japanese and German case studies. However, given the experience of Queensland furniture manufacturers in their targeting and understanding of the potential of the Japanese market, and the greater resource of information due to this, it would be of greater advantage to focus on the Japanese market at this stage.

**Lifestyle (Germany):**

In the wake of September 11 there has been a strong shift in the Western world to place more emphasis on home lifestyle and relaxation, away from the stresses of the work place. The notion of ‘homing’ or ‘cocooning’ is evident in all western cultures reviewed in this case study.69

The trend is extremely relevant to the German consumer, whose interest in life style issues seems to be incorporated to the function of the home and reflected prominently in consumption patterns such as the large per capita expenditure of Germans.

However, while there is a shift towards the home as an investment opportunity, issues such as levels of home ownership are other factors must be taken into consideration. In the USA and UK, The majority of the population own their own homes and are more likely to invest money in furnishings that improve the value of the home, such as built in kitchens and furniture, The majority of the population in Germany rent apartments and homes and have therefore more incentive to purchase furniture to

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complement their living spaces rather than increase the value of the building structure.\textsuperscript{70}

\textit{High end verses Low end furniture, demographic and timber preference (Germany):}

There is also a high popularity of low-end knock down furniture in most Western countries, with the exception of the USA. Younger consumers generally prefer to purchase cheaper furniture that can be changed frequently as fashions and trends change.\textsuperscript{71}

The major European nations generally have older average ages than many other areas of the world, and it is evident that the older generation will purchase assembled furniture.\textsuperscript{72} The potential in this area must be assessed, as in the UK and France it is well documented that there is a large preference towards traditional European timbers\textsuperscript{73}, and a vast degree of education would be required to convince a consumer of a higher target market to produce furniture produced from a non-traditional timber in a non-classical style.

While it must be assumed that the majority of high end timber furniture consumed in the German market is produced from European timber, there appears to be less rigidity in the requirement of classical designs for high end product and therefore the market is open to more modern and contemporary design, produced from various timbers.

\textsuperscript{70} Euromoniter International 2003, Introduction and definitions, furniture and home furnishings retailing, in leading international markets, viewed 27 February 2004. file://E:\euro\%20stuff\euromoniter%203.htm

\textsuperscript{71} Ibid.

\textsuperscript{72} Ibid.

\textsuperscript{73} Ibid.
Alternate markets, USA, UK and France:

This is also a concern with high end furniture in the USA, as large section sizes are not suitable for Queensland hardwood timbers due to their joining problems and their weight.

Although markets in the USA, UK and France must be considered to be large enough to sustain a niche of non traditional Australian product, it may be more difficult to identify criteria for this product from a case study perspective.

To aim at a market where I consider an alternate style of high end knock-down furniture (which is assembled by a distributor in that destination) has a greater chance of pre-market identification and success, gives manufacturers a greater chance of establishment and a transfer of knowledge can then take place in aiming at other leading markets.

Environmental Certification:

Environmental certification is an important marketing element in both Germany and the UK. In Germany in particular it affects a generally declining furniture sector; one of the areas of least decline is timber furniture due to the overriding environmental concerns of the German consumer. Furniture produced from certified plantation timber would be most advantageous in this market, and has the potential to spread into other world markets due to recognition gained in this one.

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Chapter 3

Method

Summary – Using Industrial design as a tool to assist the export aspirations of small to medium sized furniture manufacturers in Australia, using a trial of a market specific design research strategy.

3 Introduction

There are two areas that need to be defined and considered before a strategy can be developed in this investigation.

The first is to justify the need for the use of a designer in assisting small to medium sized manufacturing companies, such as those used as a focus group within this investigation, in their product development approach to export. The second is to justify a strategy of design research, where a design-led system for product integration into international markets is the focus.

In this investigation, there was a need to develop furniture for export market integration, and the method used to achieve this aim must provide:

- An appropriate formula for the development of products for export markets
- A means of experimentally testing how appropriate those products are for export markets
- A mechanism for translation of information gained through the experimental process to the advantage of the furniture and forestry industries.

3.1 How industrial design can provide an advantage in export market infiltration

In 2004, Sousa stated “It is a well acknowledged fact in business that increased globalisation of trade has led a growing number of firms to search beyond their traditional domestic markets and focus on export markets, not only to expand but to
ensure their survival.”

Queensland furniture manufacturers are in a changed position with regard to their traditional market shares due to the increased globalisation of trade in recent years.

Sousa goes on to suggest that, “As a result of the increased globalisation of trade, the role of exporting in firms activity has become increasingly important. Recognition of this is reflected in the fact that the area of export performance has been given increasing attention among academics and managers.”

Procter, Souchon and Cadogan consider that “Market orientation has become a hot topic in marketing academic spheres nearly a decade ago (1990s).” The identification of factors providing businesses with increased export market orientation, and therefore enhanced competitive prospects, has become an important factor to be identified in business and research and subsequently exploited by manufacturers as much as possible. In several instances, design has been identified as one of those factors.

A research report produced by the US Appalachian Regional Commission, aims to compare cluster industries in order to identify more successful exporting strategies. It is stated that in improving competitiveness, “Exports and competitiveness are intrinsically interconnected. Exporters must be globally competitive, and therefore actions that improve the performance of a company with respect, for example, to quality delivery, design or costs, improve its export capacity.”

The report goes on to state: “although design ranked highly among competitive factors, it is given little emphasis. Those that do may emphasise design for manufacturability but not the creative and aesthetic qualities of final product that are increasingly important when competing in global markets with nations noted for

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1 Sousa, C 2004, ‘Export performance measurement an evaluation of the empirical research in the literature,’ *Academy of Marketing Science Review (online)*, viewed 6 March 2004. p. 1

2 ibid.


design such as Denmark or Italy.” These results indicate that within the furniture industry, more emphasis needs to be placed on a more overall design emphasis, including form development for market integration, rather than technical development alone.

3.2 **Industrial designers and their relationship to industry and society**

The role of the modern industrial designer was born of the need for competitive advantage after the beginning of mass manufacture. The role of industrial design has changed as society and industry have changed through history. In “Designing for people,” Henry Dreyfuss suggested that “Industrial design, as practised today did not spring magically from prehistoric man’s devising of the cup, nor the flow from the crucible of the Depression thirties, it is a heritage of many people and many turning points in the evolution of modern society.”

Kellerman and Kellerman consider that “some of the most intense moments in design history have occurred when industry was hard pressed to sell its products, that is: Germany in the 20s, Britain and Italy immediately after the 2nd World War, Japan in the late fifties and early sixties and the US during the depression.”

Adapting with changes in society that brought about changes in the way products are developed and industrial designer involvement in product development in collaboration with industry. The way industry changed through the development of new technologies, new materials, material shortages and other social demands is important in understanding the adaptive role that industrial design must play, and will be tested in this investigation.

It has been identified previously in this thesis that the timber resource is one of the driving reasons behind the inception of the investigation. In recent years, there has been a significant reduction in the harvesting of state forests. This slowing of harvest

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5 ibid.
7 Kellerman, B & Kellerman, M n.d, ‘Design: An important competitive weapon,’ Southeast Missouri State University, Missouri, p. 2
has been due to environmental pressures for governments to lock up Northern and Central Queensland rainforests.8

This change in the position of material resource has altered the needs of the furniture manufacturing industry in Queensland. Given the properties (both good and bad) of the new desirable resource such as (Spotted Gum), it is appropriate to enlist industrial design skills to develop appropriate design solutions for the use of the new resource.

In recent times, increased globalisation has again changed the demands of consumers, and the roles of manufacturers, and designers have adapted to these new needs accordingly. Mark Delaney, an experienced UK industrial designer, in 2003 stated that “Increasing liberalisation, deregulation and privatisation have exposed UK companies to global competition and provided customers with a growing choice of products and services.” He went on to say that “This means that companies are finding that in the context of rapidly changing consumer tastes, they can no longer find a competitive advantage from simply reducing costs.”

The report “An Investigation into the Antecedents of Export Performance” reviewed studies that related price competitiveness with export performance. After analysis of these studies, it was concluded that “These findings provide some support for the view that price competitiveness should not be considered as the only or major determinant of export performance.”9

Mark Delaney goes on to state that, “To compete on a global scale, UK companies now have to leverage an advantage by creating and exploiting intangible intellectual assets such as brand name, knowledge bases, product related services and innovative responses to customer needs. These intellectual assets are not easy to copy or bypass. And of these intangible assets, design is a vital source of competitive advantage.”10

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The evident need for design involvement as a crucial advantage in approaching export markets has been established, collaborated by business interests and academics in marketing fields and designers.

It has been discussed that the unique properties of the Queensland hardwood timbers that are proposed to be advantageous to their export options, result in the problem that the material is not highly adaptive to the current manufacturing techniques of the furniture manufacturers. Given this, it is unlikely that products will be competing on a cost reduction basis alone.\(^\text{11}\)

### 3.3 Design Research

Design research is considered to have emerged as a recognisable discipline in the 1960s, initially marked by a conference on design methods at Imperial College, London in 1963.\(^\text{12}\) According to Rachel Cooper and Mike Press: “Design research and its emergence since the 1960s followed the recognition of the increasing complexity of design problems and the need to develop tools and methods”\(^\text{13}\)

Research is integral to any industrial design project in various manifestations according to the needs of the project at hand. The complexity of the design issues in this investigation goes beyond the role that an industrial designer would play in product development within a normal industry context. And therefore, the more extensive investigation that has taken place within the investigation validates an academic approach. “Academic research is open source; central to the academic approach is that research problems, methods and findings are all made fully transparent and accessible. This enables research to be built upon and supplied by others.”\(^\text{14}\)

**Complexity of issues, validating a design research approach**

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\(^\text{11}\) ibid.


\(^\text{13}\) Cooper, R & Press, M, op. cit.

\(^\text{14}\) ibid.
The problem of resource utilisation, not only affects the forestry and furniture manufacturing industries, but also scientific research organisations, and other government organisations in the state of Queensland. In this investigation, not only were the properties of the materials investigated in collaboration with forestry scientists, research conducted within the CRCWI into the environmental conditions in global timber transportation, was also accessed and contributed to the design decision-making process.

The need for the generation of market information in this investigation, with particular regard to furniture design in both industry and research contexts is important. This information was generated in such a way that all quantitative and qualitative market information was recorded and reported upon within the product development process.

The strategy implemented in the investigation generated independent information through the development of two products against which market preferences were gauged and further market information developed. The documentation of this information, both through the embodiments of the products themselves and in reports and findings generated throughout the design research process has provided information that can be built upon through further investigation in research and industry spheres.

The objectives of an industrial designer in the employment of industry would be to generally develop product within the boundaries of the needs of that manufacturers. In this investigation, the problem raised goes far beyond the needs of one manufacturer alone, affecting many within a specific geographical location in Queensland. Within a design research project, a process of research could be implemented to address the needs of a manufacturing community, rather than an isolated manufacturer.

3.4 How best to approach product design for export market infiltration, given the circumstances of this investigation
We have established the need for industrial design to be involved in the development of products for export markets. However, it is still to be determined what export-oriented design strategy would be best implemented. Also, a technique for testing of those products in export markets, is required for implementation in this investigation.

From a review of literature, it is apparent that there are some main themes of recommendation from both industry and design perspectives on the best way to approach the issue of design for export.

**Market specialisation or market adaptation**

- Where a product is developed specifically for, or adapted to meet, the more specialised needs of an export market.

**Market standardisation**

- Where a product, or product range is developed, distributed and promoted across various markets.

**Niche market targeting, as a specialised form of design contribution to export development**

The report “Opportunities for improving export performance and competitive advantage” discussed a study conducted into various industries to ascertain companies and industries most appropriate for export assistance. The study, undertaken through research and site visits, found that there are four different categories of companies based on their export outlook.15

Two of the categories, it was suggested, offer the most promising targets for export promotion. They were:

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Those firms with existing products appropriate for exporting often are already exporting or looking to increase export share. These companies are generally, but not all, larger firms. Interestingly, in this study it is mentioned that numerous firms in the household furniture cluster employ this technique.

The second category consists of firms that usually sell to other companies and have unique products or occupy special niches. Certain producers of industrial equipment and electronic components as well as many environmental technology firms fall into this category.\(^{16}\)

Although this study suggested that household furniture companies are exporting standardised products, it also generalises that they are larger firms. The second theory of product specialisation may be more relevant to Queensland furniture manufacturers, as small to medium size manufacturers (SMEs) This leads to the question, “Is there a relationship between design strategy and company size in the approach of export markets?” If so, which is more beneficial?

The report “The Role of International Design Orientation and Market Intelligence in the Export Performance of US Machine Tool (MT) Companies” looked at the role of product design in the export performance of US Manufacturing firms in the US machine tool industry. It reported that “recent evidence suggests that certain types of US machine tool producers have become adept at serving niche markets at the global level” as a significant factor in the increased export success of the industry. The report suggested that current employment in the MT sector is around 59,000 amounting to less than 1% of total industry employment at the national level. Clearly then, we are dealing with a relatively small sector that consists of mainly small firms.”\(^{17}\)

The report went on to state that: “MT producers that work closely with potential users are more likely to develop successful products than those that do not. Extending this logic to the international arena implies that close interaction with extant or potential

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\(^{16}\) ibid.

foreign customers might be as an important factor in export success.” 18 This theory was tested through an interview process, which resulted in companies who were interviewed being categorised into two groups, international and non-international firms which depended on various issues with regard to export within those firms.

Within the surveying process, qualitative impressions based on interview evidence concluded that: “A majority of the international respondents indicated a commitment to specialisation, in that a few of these firms export more than two product lines with less than four variants within each line. Aside from the economies of scale that flow from specialisation, interviews from the international group placed considerable emphasis upon avoiding competition by opting for niche markets.” In contrast, non-international respondents were more likely to emphasise product diversity that is: the ability to offer a full range of items within multiple product classes. 19

Another supporter of the development of design led products for niche market infiltration is the New Zealand organisation ‘Better by Design,’ which encourages business to utilise design for product establishment in a global niche by stating, “Design led businesses design their products for a tightly defined niche market. Because they see the world as their market, their niche is likely to be worth millions of dollars. Concentrating on a niche gives design greater focus. Customers in a niche market know exactly what they want and put great value on design enhancements that deliver it.” 20

### 3.5 Decision to target a niche market

So the question in this design research investigation is how to develop a design research strategy, which could encompass the argument of either a standardised product or range that can be promoted across various markets, or products adapted to the needs of niche markets. The main issue is how best to gain appropriate knowledge through the process of designing and testing the products developed. In answer to this,

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18 ibid. p. 169
19 ibid.
20 Better by Design 2005, Design led business standout customers prefer their products and services because they like to be different and better, viewed 6 march 2005. [www.betterbydesign.org.nz](http://www.betterbydesign.org.nz)
the needs of the manufacturers must be reconsidered. It is evident that the manufacturing industry requires:

- Further product development – particularly joining systems (utilising Spotted Gum timber)
- Export market information.

The needs of the manufacturers point towards a niche market target approach as the most viable, particularly in their status as SME’s. The potentially higher unit cost of the objects developed, due to material and labour expectations, needs to be countered. The use of design is a strong argument in the development of a product for a niche market.

Another issue that could be raised through the development of a standardised product and prove problematic to the manufacturers is from a production perspective. It is more likely that a standardised product would be one that attracts larger orders at a lower cost. A high-end niche product will most likely attract smaller orders at a higher cost, with the intention of placing less pressure on the production facilities of the companies.

By developing specialised products for export markets and testing them in those markets, there is the potential to generate market information, through background research required into those market parameters, and information generation from the testing of those products in the appropriate comparative environments.

*What is the best way to design a product for a targeted niche market?*

It is suggested by Ulrich and Eppinger in “Product design and development” that there are four types of product development projects which can be used in a product planning process.

*New product platforms*
Creation of a new family of products based on a new common platform, and addressing familiar markets and product categories.

*Derivatives of existing product platforms*
Extend an existing product platform to better address familiar markets with one or more new products.

*Incremental improvements to existing products*
These projects only involve adding or modifying some features of existing products to keep the product current and effective.

*Fundamentally new products*
These projects involve radically different product or production technologies and may help to address new and unfamiliar markets.\(^{21}\)

From a design research perspective, to approach these issues from a standardised product viewpoint could be difficult. A product could be developed, however, it would pose the problem of on what market basis would it be developed. The manufacturers are already adept at producing products for the domestic market and seek knowledge beyond this in the prospective development of new products for export.

It has been discussed and established, from a review of literature and past product design outcomes in previous chapters of this thesis, that new joining systems need to be generated as the next step of experimentation in the quest to find an appropriate method of application of the timber. This results in the need for the development of new products, therefore adapting an existing product to accommodate various export market suggestions seems inappropriate.

### 3.6 Further development of a user-oriented product design strategy, for use within this investigation

A user-driven design process as generated by Ulrich and Eppinger in “Product design and development,” is proposed to consist of the following phases:

- Identification of customer needs
- Establish target specifications
- Generative product concepts
- Select product concepts
- Test product concepts
- Set final specifications
- Plan downstream development.22

In the development of design outcomes for this research investigation, the design strategy implemented can be drawn from a user-driven product, and the industrial design process commonly implemented by designers in industry.

Figure 3.1: A map of an industrial design process, used for consumer product development for both user-driven and technology-driven products.23

The diagram above illustrates where industrial designers are usually involved in a commercial product development process. The diagram illustrates that in a user-

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22 Ulrich, K & Eppinger, S, op. cit. p. 162
23 Ulrich, K & Eppinger, S, op. cit. p. 226
driven product, a designer is used throughout the process from an early stage of identifying customer needs, to co-ordination with engineers, manufacturers and marketing when the product is finalised before manufacture.

Using a user-driven design process as a basis for product design, a strategy was developed in this investigation that addressed the more specific needs of the project with particular emphasis on the collation of background information in reference to both material and niche market specialisation.

3.7 The development of an appropriate investigation strategy

Prior to decisions being made on market development direction in this investigation, initial brainstorming led to an important charting of a strategy for product design for Queensland hardwood timbers for export markets. This early stage incorporated the background information required, with the major points of consideration within the design process for this particular issue being the market-led parameters of product type and form, and the potential for materials other than timber to be incorporated into the design outcome.

The engineering requirements of the products were also assessed, including the incorporation of flat-packing requirements for export, environmental conditions during shipping routes and manufacturing considerations, given the manufacturing facilities of the industry used as a case study. All aspects covered in this area, provided general consideration of the technical stability of the product.
Figure 3.2: Initial 'design strategy' chart, for the design investigation of export
Creation of a strategy for market comparison

The most appropriate strategy to be implemented in this investigation, would be one which generates appropriate information in order to design for the specific needs of chosen case study markets, and tests the format of this information generation, by comparing the products in their proposed markets and alternate markets accordingly, the strategy was re-generated accounting for this.

Figure 3.3: Second ‘design strategy’ chart, for the design investigation of export
The diagram above is the extension of first stage of strategy development, accommodating the decision to focus on niche market integration, as an export market integration strategy.

**Final strategy implemented for the design research investigation**

By testing designed outcomes in their proposed export markets, it was intended that information would be generated which would assist Queensland furniture manufacturing in reducing risk in developing a product for entering an export market.

One way of testing whether a product is appropriate for that market is by evaluating it in that market through a questioning process. A process of testing prototypes is commonly used as a part design strategies in the development of new user-driven products (or prototypes as a part of the design process).

The development of a strategy that tests a product (or prototype) in its intended market and compares it to the success of a second product in that market, which has been designed for a second market, will generate two types of information. This process will provide conclusions as to how appropriate the specific market target strategy has been, based on the merits of that product. It will also generate information on the needs of that market, providing a strong insight as to major influences in that market area.

When that first product is also tested in the second market, in comparison with the second product (which has been purpose-designed for the second market), it will provide a second analysis on the market specific strategy that has been applied, and upon the merits of the second product. This process will also generate further information on a second market and influences on that market.

Following this process, a comparison between the needs of the two case study markets could then also be created.

A strategy such as this, is beyond that usually developed by export-oriented manufacturers in the development and market testing of a product (or prototype) for
export. It is intended that this process will provide quantities of new information to
the Queensland furniture manufacturing industry, in regard to product development
for international market integration.

It would also provide a precedent, as a first investigation, testing the parameters of
design for export and market entry within the chosen manufacturing sphere with
purpose designed products with an experimental material. This process will also
provide a strategy that can be built upon, both in industry and research realms through
future projects.

*Final diagram of project method*
Figure 3.4: Final ‘design strategy’ chart, for the design investigation of export, showing product design and international comparison product testing process.
3.8 Strategy Stages

1. Background
2. Initial market investigation
3. Initial design stage
4. International markets testing
5. Redesign.

Description of strategy stages

Background (1)
Background issues have already been extensively discussed in previous chapters of this thesis.

3.8.1 Design-led market investigation (2)
Integration of required market and user knowledge into the design research strategy

<table>
<thead>
<tr>
<th>Product Development Activity</th>
<th>Technology-Driven</th>
<th>User-Driven</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification of Customer Needs</td>
<td>ID typically has no involvement.</td>
<td>ID works closely with marketing to identify customer needs. Industrial designers participate in focus groups or one-on-one customer interviews.</td>
</tr>
<tr>
<td>Concept Generation and Selection</td>
<td>ID works with marketing and engineering to assure that human factors and user-interface issues are addressed. Safety and maintenance issues are often of primary importance.</td>
<td>ID generates multiple concepts according to the industrial design process flow described earlier.</td>
</tr>
<tr>
<td>Concept Testing</td>
<td>ID helps engineering to create prototypes, which are shown to customers for feedback.</td>
<td>ID leads in the creation of models to be tested with customers by marketing.</td>
</tr>
<tr>
<td>System-Level Design</td>
<td>ID typically has little involvement.</td>
<td>ID narrows down the concepts and refines the most promising approaches.</td>
</tr>
<tr>
<td>Detail Design, Testing, and Refinement</td>
<td>ID is responsible for packaging the product once most of the engineering details have been addressed. ID receives product specifications and constraints from engineering and marketing.</td>
<td>ID selects a final concept, then coordinates with engineering, manufacturing, and marketing to finalize the design.</td>
</tr>
</tbody>
</table>
Availability of Market Research within the CRCWI

The table above shows a listing of stages in the development of a product, and the involvement of an industrial designer in the development of those products. In the ‘user-driven’ column on the left, it is projected that in the area of identification of customer needs, an industrial designer would work closely with marketing to identify those customer needs.

It was apparent from discussions with manufacturers undertaken at an early stage of the investigation that the lack of market knowledge and market integration is a large factor inhibiting investment in export and expansion into world markets.

At the time required by this investigation, there was not enough information available within the CRCWI or industry interests to assist in the specific market knowledge needs of this design research investigation. The comparative strategy implemented in this investigation, required specific case study market knowledge, therefore became the work of the design researcher to obtain this knowledge, in the pursuit of industry benefiting outcomes for the investigation.

3.8.2 Creating the appropriate market research required:

Quantitative Data collection

In the first instance, market research was collected in the traditional sense, where information was sought before the design generation process was undertaken. This quantitative information collection provided an overall contextual and statistical understanding of that market and some insight into its needs (summarised in chapter 5.)

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24 ibid. p. 227
This initial undertaking of quantitative information collection was conducted in two stages, first to determine case study appropriateness according to the needs of the research project. Second, to the specific requirements of a list of ‘design knowledge requirements,’ developed through a brainstorming process specifically for the design knowledge needs of foreign market investigation.

**Qualitative research investigations**

According to Maurice Biriotti, of the British Design Council: “there are generally three types of qualitative research inputs that can be identified as being part of the design process.”

Those are:

*Generative research* – Aims to unearth “nuggets” of consumer insight that can be fed into the design process at the early stages of concept generation to help arrive at new ideas or innovative approaches.

*Formative research* – Where consumer testing is used as a part of an interactive design process where customer feedback drives design modification.

*Evaluative research* – Seeks to evaluate the effectiveness of a particular piece of design, whether brand identity, packaging, retail design, advertising or communication. ²⁵

### 3.8.3 Generative research: Further market investigation - concept development

The Design Council (UK) suggests in regard to market research “that while the rigour of a statistical approach is a strong tool for evaluating what already exists, the creative process is often about that which does not exist yet and so cannot be quantified.”

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²⁵ Biriotti, M, op.cit.
First hand foreign market investigation becomes a design tool to be exploited in the generative stage of the design process. Two international research tours were taken within the case study markets determined for the investigation. The tours incorporated international furniture fairs and manufacturer and retailer investigation. Where these resources were available in order to establish market trends, these study tours also allowed a brief but important insight into the users culture.

In a recent research study concerning the role of international design orientation and market intelligence in the export performance of US machine tool companies previously discussed in this chapter, manufacturing companies were surveyed and categorised as to those with international focus and those without. There was found to be distinct contrasts between the two groups, not only in regard to business direction, including specific foreign market targeting and design involvement in the production process, but also in regard to a significant difference in the emphasis upon foreign travel and interaction with the end users within the internationally oriented and superior exporting companies.\(^{26}\)

Although limited first hand ‘user’ consumer knowledge gained by visiting the chosen markets made a relevant impact on the pre-research design phase. This knowledge ultimately the research outcomes.

### 3.8.4 Formative research: Market testing method and re-design phase

Specific market testing in the latter stages of the project provided market information that creates new comparative market knowledge and general market knowledge in two major export markets, projected to be of great value to Australian manufacturing interests.

The formative stage of the research in this investigation was contributed to directly by end users, by the collection of information provided by professionals in each intended foreign market, information was sought particularly from those employed in the areas of manufacture, retail and buying.

\(^{26}\) Mac Pherson, A, op. cit. p. 173
The final stage of this investigation involved a ‘re-design’ of the chairs designed for exhibition, mainly on the basis of the ‘new’ knowledge gained through the testing stage of the project. The re-design stage will assist designers and manufacturers, as it will clearly outline how knowledge gained from the overall project direction can be manifested in design outcomes, and be of direct assistance to other designers and manufacturers.

The investigation is using designed outcomes as case study objects to generate international market knowledge, which pertains specifically to Australian manufacturers, a local material resource, and its inherent technical problems in application. This knowledge can be translated into new design principals, which can in turn be employed by manufacturers to target market design with the intention of risk reduction in entering those markets, and take more confidence that the technical properties of the timber are better accommodated through the design process.

3.8.5 Evaluative research

An evaluative research process was conducted in the context of the comparative testing scheme used in this investigation. The testing process sought to evaluate each of the niche market designed chairs in the market for which it was designed and an alternate, non-targeted market.

This process was intended to establish the effectiveness of the chairs designed within their intended and unintended markets, which consequently will reflect on the appropriateness of the method used to develop the chairs.

Evaluating a niche market approach to export design between two markets will determine how important it is to design for a cultural niche, determining whether between major furniture markets, there is a cultural (or other variance) reflection in product acceptance.
3.9 Market/user knowledge requirements – Information collation process

This investigation does not intend to provide market research outcomes, rather market reflecting design outcomes. Therefore it is not relevant to focus research strategies on traditional market research formulations, however, the focus of information collection to fulfill this aspect of the project has been based on formulations of knowledge, developed through a brainstorming process required as a designer for approaching export markets.

Following identification of the case study markets for the investigation, a more specific market knowledge is needed to gain an in-depth understanding of these two markets, to be integrated into the product design process. Therefore the information required to design for a specific destination falls into categories as follows:

- Defining elements of each market that would be most likely exploited by furniture made from Queensland hardwood timbers.

- These elements can be defined by drawing on comparisons that can be made from market observations. The areas that have been determined for this comparison are listed below.

- Identification of market knowledge requirements, which can be applied to any global market.

The first step in pursuit of the market comparison created for this project was to identify from a design perspective what types of information, particularly market-oriented information, would be most valuable when designing a product for a specific export market.

*Brainstorming, project design issues*
Figure 3.6: An example of a brainstorming chart, identification of areas of market/user knowledge required

Through the use of diagrammatical brainstorming, all market knowledge requirements for a designer when designing for an export market were tabled and placed into a concise format. This format would be followed for information-finding directions when the two preferred target markets for comparison were identified.

After the brainstorming process was refined into sections, these requirements were approached and documented as generic requirements for furniture design, not particularly indoor furniture as has been specified for this project.

Figure 3.7: Abbreviated market knowledge requirement chart

Case study knowledge requirements for specific design for the export of timber furniture to various destinations have been identified. The topics identified in this chart are expanded upon below.

*Market trends for the import of timber furniture in particular destinations?*
• Current
• Past
• Projected future

Possible market/product type

• High or low end market, cost acceptability and market potential.
• Domestic or commercial
• Batch produced / one off specialised market areas
• Mass produced markets
• Acceptability of assembled/flat pack furniture in each category
• Where timber furniture is popular, accepted in each destination
• Potential areas for market expansion

Purchasing population age/spending trends

Population, increase, decline or stable in destination?
How will ages and influences of the population influence purchasing trends of timber furniture in that destination?

• i.e. aging population / population with low average age

Destinations wealth

What are the general economic and trade standing of the destination?
Spending trends is there a time of year where it is advantageous to promote in a destination?

Destinations product lifecycle evaluation

How often do they buy furniture and how much do they spend?
Will they have it repaired, buy replacement parts?
Projected increase/decrease in particular market areas, i.e.

- Increase of tourism promotion in a destination
- Property or investment boom in a particular destination

Large lifestyle interest in a particular destination/market segment in that destination.

Lifestyle and culture

Identification where lifestyle and culture will influence the purchase of timber product and therefore what attributes a design must have to be successfully introduced into that destination market, i.e:

- Traditions
  What is traditionally accepted and purchased?

- Influences from other cultures
  Are the destinations whose consumption is influenced by a different culture?

- Ceremonies
  Performed daily that influence furniture requirements in that destination

- Average sizes of living space

- Gender
  Does one gender influence the purchase of timber products/furniture in a particular destination

- Media
  i.e. Does a popular television lifestyle program influence the purchase in the destination

- Others
Aesthetic preferences (General) including visual analysis:

Preference for particular timber species
Colour, surface finishes, grains, imperfection acceptability
Style (what influence)
Fashion influence, how often it changes

Current exporters to market destinations

Who is exporting to these destinations and the description of their market shares?
What are the reasons exporters hold these particular market shares?

Local industry in destinations

What are they producing, product, timber, and aesthetic?
Their market share local industry hold in that destination?

How furniture is distributed/purchased in that destination?

- Large chains of stores/distributors
- Smaller individual stores/distributors
- Internet, television
- Are there many tradeshows held, and is it important to establish a reputation in a show in the particular destination or elsewhere?

Brand Name Establishment

Interest and need in marketing particular timbers and products in that destination.
Are new timbers readily accepted onto the market?
Is the establishment of a brand identity important in that destination?

Destination Environmental Considerations
What interior environmental conditions will be encountered by timber furniture exported from Australia:

- Air conditioning, heating
- Are there large differences between internal environments for domestic and commercial furniture in a destination?
- How often they are used, i.e. seasonal, how often in particular destination are indoor environments altered with air conditioning and heating, how often will the EMC of the timber be the natural indoor environment
- Is there a large market for cafés with indoor/outdoor environments?

Trade shows

Is there a particular international trade show which influences the style of furniture buyers purchase for a particular destination?

Production and transport conditions

- Conditions where the product is produced
- Factory environment
- Type of packaging
- Effects of different types of packaging on MC
- Packaging containers (Size and environment)
- Shipping routes (all environments included)

Standard requirements

- Safety
- Environmental/recycling
- Maintenance requirements
- Other
Taking these particular steps of information gathering will determine conclusions for the functional and aesthetic requirements of the products for each destination. It will also provide comparisons between the two markets, which will be used to justify the steps that have been taken to design the furniture pieces for each individual market area.

**Design stage (3)**

The central design component of the method has involved the design and prototyping of an indoor dining chair, produced from Spotted Gum timber, according to the market led design parameters of two case study markets (Japan and Germany). Stages of design development undertaken in the development of the final two chair designs were extensive and will be represented and discussed at a later stage of this thesis.

In addition to the design of two market-appropriate chairs, two dining tables were also developed to accompany each chair, creating representation of a suite. However, only the chairs were prototyped and these remain the major focus for all of the project analysis. Each of the two chairs was developed with the specific requirements of those markets selected for case study analysis as priority.

**International testing process (4)**

The testing stage of the method required that both the chairs be exhibited in each of the designated case study markets. The information required from discussions undertaken at the exhibition of the products would best be provided by exposure in a major international forum, such as the representative international furniture fair of that country.

**Re-design (5)**

The re-design component of the method used the information gathered in the testing stage and fed that information back into the product design process. Both of the case study chairs were re-evaluated in terms of their design and appropriateness to each market given the results of the testing process.
From the testing process, conclusions were drawn as to the success or otherwise of the market specific design method. These conclusions will be manifested in the re-designed chairs. Further explanation and discussion regarding the success of the method, what was learnt through the investigation process, and what would be appropriate action for the future was generated.
Chapter 4
Technical Concept Development

4 Initial design experimentation

This early design experimentation was undertaken with the objective of creating a ‘Brainstorming’ style of information collection, the resultant information being visual and technical solutions, creating stored technical design solutions to be visited later in the process.

The initial concept work undertaken did not include market parameters, and instead focussed on technical solutions. This concept development was undertaken with an intention to find a means to invent new joining systems for Queensland hardwood timber indoor furniture, and more applicable to the requirements of indoor furniture manufacturers, which could then be adapted to market desirable design solutions.

As soon as possible in the progression of this project, a design brief was conceived and concept work undertaken based on the degree of technical knowledge that had been gained through the initial investigation stage.

For the initial design brief developed: See Appendix 1

4.1 Experimental jointing ideas

At the commencement of the investigation, as appropriate information was collected in the scientific and manufacturing areas, the brainstorming of alternative joining methods that could be used with Queensland hardwood timber products was
Figure 4.1: Examination of existing ideas through the design development process, authors' drawings
The sketching above depicts ideas for the development of devices where joints can be created that interact with timber sections to lock them together in a type of system. This would allow for many configurations of horizontal and vertical sections, which could then be assembled into many furniture solutions.
Figure 4.3: Shapes for joint creation
Figure 4.4: Potential metal joiner shapes and further slotting mechanism investigation
A further idea involves slide-on mechanisms, fabricated from metal, to which timber sections are attached and again investigating a system approach to creating furniture without interlocking glued joints.

4.2 Initial concept development: Technical focus

None of the concept work produced at this stage was to be used as a direct outcome for the project. However, much of the technical detailing ideation and resolution produced in this stage of concept development was adapted to suit market led concept outcomes created later in the project. This section of development work is presented in chronological order, as various concepts were initiated and explored.

It became apparent very early on in the investigative process that one area of indoor furniture design, which poses very particular problems for furniture produced from Spotted Gum timber, is laminated boards in dining table tops.

This problem has a large impact on the viability of Spotted gum timber in an indoor furniture context, as dining furniture is almost always sold in a suite, and the aesthetic and form created through the production of a laminated table top, is considered by the manufacturers to be integral to the success of a suite of dining furniture.

Given this, it seemed appropriate to focus design investigation in the initial stages on both the issue of creating a laminated tabletop, and then relating and further exploring these experimental principles in the context of chair design.

Janda Furniture released a range of furniture produced from Spotted Gum, and placed it in the Australian market through their various distributors, however the range was later removed from the market, and production of Spotted gum furniture eventually discontinued due to the stability problems encountered.
Carl Eckelman in his report on ‘The Shrinking and Swelling of Wood and its Effect on Furniture’ stated that the dimensional changes that accompany the shrinking and swelling of wood are the major sources of both visual and structural problems in furniture. Shrinking and swelling occur as the wood changes in moisture content in response to daily as well as seasonal changes in the relative humidity of the atmosphere.²

Improper moisture content is also responsible for many gluing problems, with respect to initial gluing of the wood and also with respect to the development of internal stresses in glued parts which result from differential shrinkage and swelling of the parts glued together.³

One easily demonstrated effect of shrinkage and swelling on furniture joints is the movement of mitre joints on the edge of a table. When wood swells, mitre joints open as shown on the left of figure 4.6. When wood shrinks, mitre joints open as shown on the right.

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¹ Janda Furniture, op. cit.
² Eckelman, C, A n.d. ‘The shrinking and swelling of wood and its effect on furniture,’ Purdue University, West Lafayette, Indiana, p. 1
³ ibid. p. 10
The main systems of jointing that the Metaform manufacturers have utilised in their projects in general involved glued joints that fall under the definition of butt joints and interlocking joints.

A style of mitre jointing was used in some of the Spotted or Golden Gum ranges produced by Janda Furniture (pictured above). The choice of this style of joining system, poor grade and moisture content in the timber supply or following non-recommended procedure in production could have contributed to the failure of the product and other similar products in the range. The style of mitred corner joints used in the Janda tables has restricted shrinking and swelling of the table top boards resulting in unsightly rupture of the glue lines.

However, even in the cases where the product was not restricted around the edges, slip joints were are used and alternate grain directions in the laminated board used to avoid cupping and bowing as much as possible. There was is enough movement in the timber, through water movement, to affect the glue lines regardless of which adhesives were trialled by the manufacturers.

Another important factor in timber table top production is grain orientation. The diagram below displays how shrinking and swelling of wood can be responsible for shrunken glue lines, and cupping and bowing effects in timber table tops.

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4 ibid. p. 6
“a” shows how boards in a panel look after glue has first been applied
“b” shows how the wood swells when water is absorbed from the glue into the wood
“c” shows that if the panel is then sanded to remove these lines, it will at first take on a smooth appearance, however as the glue line area dries and the glue line shrinks, the panel will take on this appearance.\(^5\)

Boards should be laid with alternate growth ring orientation as in (a) not as in (b) By alternately reversing the orientation of the grain, the effects of growth ring orientation has on shrinkage in the tangential direction in backsawn boards can be minimized.\(^6\)

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\(^5\) Eckelman, C. A., op. cit. p. 8
\(^6\) ibid. p. 12
Figure 4.9: An example of unrestricted laminated tabletop produced by Tradway Furniture

The images above is of a butt jointed Spotted Gum table top, taken during a site visit to Tradway Furniture. The table design did not have mitered joint edging restricting lateral movement of the boards, however, the table was never placed into production due to movement of the laminated boards resulting in glue line problems.

The style of butt jointing utilised in the production of a timber tabletop from laminated backsawn boards with their high tangential movement, resulting problems in obtaining stable glue lines.

Figure 4.10: Experimental joining of Spotted Gum using a fiberglass adhesive

Tradway Furniture, as well as Janda Furniture went to great lengths to try to solve the problems that they were encountering in their Spotted Gum ranges, applying different commercially available adhesives, and following the recommended production guidelines as closely as possible.

The image above shows Spotted Gum sections that were adhered with fibreglass as an alternative to traditional adhesives. This sample was one within a range of samples
produced by Tradway Furniture in an attempt to find a more satisfactory bond for the laminated boards required to produce a traditional timber tabletop. Cox believed that this particular alternative would not prove a good adhesive, as there was not enough flexibility in the fibreglass to allow for movement in the timber, and splitting of the timber sections would result.7

Within the experimental design process of this investigation, alternate systems for buffering, using rubber strips between timber joints, particularly to act as buffers for the laminated boards in tabletops, are illustrated in the sketches below.
Figure 4.11: Experimental sketching for laminated timber tabletops

*Tension and buffering concept: Table*

The concept which follows works on the principle that the table will have an outer board around the outside, however, the corner joints of the outer boards which form a
square around the inner boards are held with an elastic cord, and buffered around the edges by rubber, or inserts of another material. This material and elastic fastening are then designed to move with and buffer the movement of the internal boards as they expand and contract, both in the altered environments of transportation and in service life.

Figure 4.12: Initial sketching investigating ideas for buffering between joints on the seat frame of a chair
Figure 4.13: Investigation sketching, looking at using springs and cables in concept development to provide flexibility in joints
Figure 4.14: Further investigations of buffering and springs
Figure 4.15: Incorporation of buffers and cables in the development of an experimental timber joint
Figure 4.16: Further refinement of table design
The top joint (where the legs meet the table) is of crucial importance in this design as it allows movement, i.e. is not a glued rigid joint. The flex in the joint is intended to
counteract the expansion and contraction of the laminated top boards without deterioration, generally resulting in gaps between sections and reducing structural qualities of the piece.

In this design the entire table is interlinked though the use of tension cables running though the leg and boarder section, meeting its diagonal partner in the same format.

Figure 4.19: Final detailing of the table design. Foam buffers between the boards of the table top

It was integrated into this stage of concept development that the legs of the table would consist of two parts, providing better stability for the table in general, and also creating an important element of the success of the top joint responsible for counteracting the movement of the laminated boards in the top.

The two legs would be rounded on the edge to roll against each other. This is important as the top joint is designed to move (i.e. expand and contract), and the rounded edges of the two sections of each table leg means that the sections will roll against each other rather than split. This results in the fact that in theory no unsightly
gap would occur between the legs when they are pushed in or out according to the movement of the top joint, moved by the laminated top boards.

**Chair**

A similar concept for the joinery of the table was then applied to the joinery of a chair. Buffering and tension were also applied to the joints in the design for this chair. This concept was designed to be a wooden framed structure with upholstered, or material seat and backrest.

Further experimental issues were explored through the design of this chair, including analysis of the strength of the ‘moving joint’ and what materials would be required. The stability and the strength of the product come into question because of this. It is likely that the base of the legs would not be held satisfactorily and therefore more components would be required.
In these initial concepts, the upholstering was designed to be wrapped around the frame of the seat, making the upholstery removable and washable. There is also potential to expose, through the fabric, some of the engineering detail in the product.
**Strengths and weaknesses**

The major problem with a concept such as this is that the system of buffering is experimental, and it is probable that it will add some labour time to the production, and pose problems for manufacturers not really equipped to deal with in their production set-ups.

This style of joinery could be readily adapted to a flat packed concept which is particularly important in export. Given the degree of flexibility calculated into the joint design, it would be unlikely that if the concept if structurally correct and refined the joint would encounter problems in its service life.

![Computer representation of proposed suites together](image)

**Further Refinement: Adding upholstery**

![Sketch of upholstery design](image)
Figure 4.23: Investigation, adding upholstered seat and back components to the chair design

Figure 4.24: Detailing of upholstered components
Figure 4.25: Detailed sketching for upholstered seat and joint
In the sketches and computer renderings illustrated above, the joinery has been refined to incorporate a fully upholstered seat base and backrest. The concept still relies heavily on buffering to fill the gaps, and tension to hold the joints in place, however it is taking a further step towards being a more commercially viable product in that a basis of joinery has been created, around which more standard requirements can be introduced.

4.3 Metal options: chairs and table
Through brainstorming sessions, and the creation of the initial design brief, the importance of combining other alternate materials with Spotted Gum in joining solutions was identified as viable and important.

In exploration of the theme of integrating other materials into the furniture joints to allow movement of the joints with the expansion and contraction of the timber, metal elements have been identified.

Table

Figure 4.28: Sketching looking at the use of metal for the development of a new joint
Figure 4.29: Metal and timber leg combination, concept development
Figure 4.30: Further development of a metal and cable concept
The idea behind this concept was to use laminated boards in the tabletop, and as discussed in the buffering and tension concept use joints with some flex in order to allow better expansion and contraction of the laminated boards.

In this concept, the timber to timber element is removed from the joint completely and the laminated boards now rest on a metal system, which also involves the use of a tension cable system to create its structure.

Experimenting with various metal leg configurations to provide a better structure to the table base, the metal legs of the table create a ‘U’ shape wedging the laminated boards between them, as the idea of using metal in this configuration is to allow flex in the legs of the table without being restrictive. The timber boards are then supported by a floating metal strip that is located but not fastened into the top of each side of the metal ‘U’ shape. The system is then joined by a cable running through the timber section, to the base then the tops of the legs.
Chairs

Figure 4.32: Using the same principals of joining as in the table, and applying them to the chairs

Sketching for chairs, incorporating the same system of structure developed for the table, into a system of structure for a matching chair.

Figure 4.33: Computer generated image projection
The above chairs have been developed using the same joining systems as the tables. However, due to the requirement of a backrest to be developed from the ‘u’ shaped metal sections, the laminated timber boards, which in this case are intended to make up the seat of the chair, are running horizontally between the ‘u’ rather than vertically as they are in the table.

This allows the same ‘spring’ expansion method to be utilised as in the table, but in the same step allows for a backrest to be created within the chair. As mentioned the fastening method is the same as in the table with the cable threaded through the timber, however, in the chair it is configured in a crossover ‘x’ configuration for added cross-bracing structure.

**Settings**

![Figure 4.34: Images of chairs and tables combined](image)

A general issue raised with this concept development is that the concept relies too heavily on the timber sections

![Figure 4.35: Experimentation with the timber table from the first ‘buffer and tension’ discussed with the metal chair, to gauge how the metal elements work with a timber dominated table](image)
4.4 Tube chairs and tables

Following on from the ‘metal’ chair and table concept, it was decided that a more refined use of alternate materials was required, while still encompassing the theories of expansion and contraction and buffering of joints that had been explored in previous concepts.
The tube chairs and tables were designed as an attempt to incorporate new joining mechanisms relying on metal components, which are designed to allow some expansion and contraction of the timber while still providing a structural furniture joint.

The design attributes are explained as follows:

- Metal supports at back, the internal supports are welded to the metal plate that runs under the timber. Supports are surrounded by rubber sections to act as a buffer as the timber moves.

- The legs are mechanically fastened in three different directions into the end timber section of the base. The end piece of timber is rigid as it is attached to the legs.

- The timber sections supported by the metal plate underneath and the dowels running though are able to expand and contract against the rubber buffer.

- All metal tubes are mechanically fastened to the timber sections they touch, i.e. backrest and legs.
Figure 4.37: Form development for the tube chairs
Figure 4.38: Skeletal view of chair showing joining mechanisms and skeletal exploded view of the ‘tube’ chair

*Exploded view of chair: explanation*

Dowels run though the seat to provide a structure. The dowels are glued into the large timber sections on each end of the base with an elastic glue.

Rubber sections are inserted into the seat base where the tubular supports for the backrest run through. This ensures that the metal supports do not obstruct the sliding movements of the timber.

There is a three way mechanical attachment to each leg. The moulding underneath is attached to the leg to make this structure possible. Timber sections are used for the base, with the rubber buffers in between. The outer boards are larger as they provide the attachment area for the legs. It would be most appropriate for the backrest to be bent from laminated sections.

The long tubular section provides connecting support for the backrest and legs. For assembly it will be threaded though the metal plate before being attached to the backrest and front leg.

Metal plates at the front and base of the chair for support, so the base segments can slide along it as the timber moves. These plates are recessed into each of the legs.
In assembly, the seat base will be inserted into the back rest, with the rubber applied around them before the legs and rest of the backrest are attached. Straight bars are attached between the front and back legs to provide support.

Figure 4.39: Computer rendered image of proposed chair design

**Tube Tables**
The table top is divided into four main sections with the two sections on each side attached to the legs and rigid. There is also a thicker board running through the centre with thinner boards between these three. In between each board is approximately 1mm of rubber or other flexible material.

The purpose of having this arrangement is that the boards on each end are rigid because they are fastened to the legs while the others are able to slide as the timber moves. The rubber buffers provide as low pressure on the structure as is possible.

The central boards are held with dowels which are run through the top boards. These dowels are glued into the two rigid end boards with elastic glue to provide some movement, while the rest are able to expand and contract around the dowel.

The metal plates running across the table at the ends between the table legs provide a support for the boards on the top, but apart from being recessed into the leg mouldings they are not attached so the top is able to slide along it as it expands and contracts.
The tubular metal supports running the length of the table on either side provide stability at the base of the four legs. They are held in the centre by a timber moulding which is screwed into the central board of the table. Inside this timber molding, the metal is run though a rubber casing, which allows each metal structure to move slightly with the expansion of the timber but not so far that the supporting metal plate at each end is pushed out of the leg on either side.

![Skeletal view of table detailing joining mechanisms](image)

Dowels are inserted between timber and rubber sections of table top. The dowels will be glued into the end boards with an elastic glue to allow some movements.

The legs are attached to the outside boards from three directions to provide maximum connection. The mouldings that are attached between the leg, the metal plate and top board make this possible. A steel plate which sits inside the leg moldings is not fastened apart from being wedged between the two legs to allow for the sliding movement of the top.

A rubber block is inserted into the moulded timber section. The metal of the tubular support will run though the rubber section, allowing the tubular some lateral movement. The tubular metal support is attached to the central board of the tabletop and attached to each of the legs to provide structural support.
Figure 4.42: Skeletal exploded view of table detailing joining mechanisms

Figure 4.43: The final design of the tube table, is shown, with the metal structure developed for the underside providing further ideas for the use of metal in expanding and contracting timber furniture joints
Expansion and contraction concept: tables

Working with similar principals to those explored in the ‘tube’ chairs and tables, a set of chairs and tables was derived from the technical principles. The following concepts, however, make less of an aesthetic statement by encompassing more regular furniture forms and more segmented components than the tube chair design.
Figure 4.44: Development for tube table
Figure 4.45: Potential joining mechanisms for the tube table, investigating central joining systems, which allow flex, in the expansion and contraction concept sketch development
Figure 4.46: Further detailing of joint attachment for table and chairs
Figure 4.47: Detailing of the expansion and contraction central joint arrangement
Utilising the same principle as applied in the tube table concept, in this concept the metal attachments running from the legs to the underside of the tabletop are broken down to four separate components joined and pivoted at a central point.

In theory this mechanism would allow a structural support for the legs of the table while allowing for flex as the board of the tabletop expand and contract.

The exploded view shows the joining mechanism between the legs and the table boards, either a flat strip, or as illustrated in the exploded view a ‘U’ shaped extrusion would run the length of each table end. The legs would then locate the metal strip or extrusion and the boards of the table top. This mechanism would allow the boards to slide along the length of the metal as they expand and contract without disrupting the join of the leg.

The leg would then be attached to the table by separate mechanical fasteners at the top and the metal sections below, providing adequate structure.
Figure 4.49: The importance of the table to leg joint

Figure 4.50: Proposed appearance of the table – Computer generated images
Further Expansion and Contraction: Chairs

The chair works on a similar principle to the table, with the joining mechanism for the base of the chair being derived from the joining of the table.
Figure 4.53: Looking at lower leg support mechanism, attachment, and allowance for expansion and contraction
Figure 4.54: Further concept generation of backrest attachment
Two different bracing forms were identified for the chair. The first follows the same principle as the table where the metal struts are attached directly below the seat. The second, depicted in the sketches above and the first computer rendering below show a slightly different format where the supporting arms are attached to a central rod, lowering the supporting mechanism and creating an alternate aesthetic structure.
The backrest of the chair is proposed to be made out of bent plywood which is slotted into the uprights of the back rest and mechanically held in place.
4.5 Creating a joinery system

This system of joinery, if successful, could be the type of system that is utilised by a manufacturer, to create a variety of products for different markets. The computer images generated below show that it would be a relatively simple process to restyle components, which are configured to then drop into the joining system. Different aesthetic appeal could then be created to suit different markets, without altering the system of joinery used in the production process.

4.6 Technical development, summary to this stage

When dealing with creating a joint with some movement for the expansion and contraction of the timber required, strength and stability issues are generally placed in a position of compromise.

At this point, it was decided that there were probably two ways to proceed with the experimentation of creating new joining systems. First, the timber-to-timber joints
which allow movement, i.e. where timber is touching to timber, but with the conditions following:

The main structure of the joint relies on a type of fastening other than adhesives (generally where two or more timber pieces are interlocking.) The joint is devised in such a way that if the timber moves, it is given an allowance for this movement, to avoid damaging the joint by splitting or gap making.

The second is to devise a joining system where the timber makes the bulk of the structure of the furniture, but is not directly joined to another timber section. There are other materials that provide the connecting sections to create the structure of the piece.
Chapter 5
Qualitative and quantitative market information analysis, Japan and Germany

5 Introduction

The following information has been gathered from various sources, including international study tours. This compilation of information provides a background understanding for the market led design parameters evident in the final product design outcomes for this investigation.

5.1 Japan: Market trends

Although Westernised in many ways, modern Japanese lifestyle is still a unique mix of tradition and technology, that is:

- Tradition, Western culture and new innovations all play a role in attracting the large competitive Japanese consumer industry

- One very popular and important theme on the Japanese market is the ‘East meets West’ theme

- Both foreign and Japanese companies such as IXC Cassina (Italy) and Kashiwa (Japan) have ranges (with this specific theme) on the market at present.

Figure 5.1: Dining furniture from IXC/Cassina, East by Eastwest

5.2 Contributing factors to the mix of modern consumer furniture options in Japan

Manufacturing traditions

- Precision, quality joinery and very fine finishing
- Consumer expectations

Competitive prices

- Traditional timbers used in homes, other buildings and furniture
- Size of homes and apartments of Japanese people

Cross influence of Eastern culture with Western culture

- Classic Scandinavian furniture
- Italian image of class and refinement

High end

- European luxury versus Japanese high craft tradition

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• Brand name is still an issue in the Japanese markets, however the fact that there are many competing influences and more complex consumer expectations than in other markets is an advantage, as it breeds an open-mindedness for Japanese to appreciate products that are designed to their desires.

• Those that make the effort to bring products to the Japanese market will certainly be given consideration if the product finds an area that will interest the Japanese consumer.

5.3 Destinations wealth / economy

• In terms of the import of furniture it is estimated to be the fourth largest market globally, after the USA, Germany and France.  

• From the recession onwards the Japanese furniture industry has been underpinned by two main factors, the overall economic situation and building activity.  

• This unfamiliar uncertainty of the national economy has impacted on price awareness of the Japanese consumer.

• The demand for quality has always been high and what has been traditionally regarded as lower end imports from Asian countries are increasing in quality and pushing towards the higher end markets.

• Although the Japanese economy has changed, it has not all been adverse for exporting countries. Since the collapse of the economic bubble, sources of most types of wooden furniture have also diversified.  

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4 ibid.
5 ibid.
5.4 Japanese furniture market - product origins

Imported
- Contemporary furniture: Italy, Scandinavia, Germany
- Reproduction furniture: UK, USA
- Various styles: China, other Asian countries

Local industry
- The domestic furniture industry in Japan is not large enough to meet the demand for furniture in the Japanese market, mostly due to high labour and material costs.
- Imports now account for approximately 50% of Japan’s top ten furniture retailers’ sales.
- As a result of this, many Japanese companies are producing offshore and importing directly back into Japan.6

5.5 Possible market/product types

- Research conducted by the US and foreign commercial service in 2001 indicates that over the long term, while the new housing market will be likely to decline, the re-modelling market is predicted to grow significantly, which would help the Japanese home furnishings market maintain its current market size.7
- This predicted stability, combined with changing attitudes of the Japanese consumer with regard to style and function, provides an indication that the

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6 Euromonitor International 2003, Furniture and home furnishings retailing in leading international markets (Japan February 2003) 8.2 market background, op. cit.
http://80-www.stat-usa.gov
Japanese market should be seriously considered by exporters despite the weakened economy.  

- It is recommended by Austrade that Japan is a country with good potential for Australian exporters to target in the following areas e.g. ‘the best opportunities for Australian exporters to Japan are in wooden and plastic furniture for domestic and home office use.’

5.6 Brand Name establishment

- In 1999, an article published by the US newspaper ‘Trade Winds Industry Weekly’ concluded that Westernization of Japanese consumer tastes creates strong import demands as the world’s third largest furniture importer.

- There has been a considerable promotional effort by US manufacturers to break into the Japanese market and as a result, the tradition and quality of U.S. furniture are highly recognised in Japan.

- The US commercial service advises that there are several areas where Japanese do not hesitate to spend their money despite the weak Japanese economy. One such area is the so-called home fashion market with lifestyle themes. U.S. Companies are advised to target high-end home fashion market segments to avoid price competition against Asian products. By creating a reputation of quality and style,

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8 ibid.
U.S. manufacturers have been able to compete for the high-end market share in Japan against other Asian exporters.\textsuperscript{11}

*How this effects Australian manufacturers:*

However, as the Japanese business culture continues its rapid change, so do its demands. The Marketing Guidebook for Major Imported Products produced by JETRO (Japan External Trade Organization) states:

\begin{quote}
“Today more consumers purchase furniture that fits with their lifestyles irrespective of brand label or country of origin. As a result many of imported products are original products developed through business partnerships with distributors in Japan, not upscale brand names”\textsuperscript{12}
\end{quote}

This changing trend is important to Australian manufacturers trying to break into the Japanese market. Australia has no national identity with regard to brand name, and Japanese consumers have little knowledge of Australian timbers, manufacturers have a greater chance of success tapping into the Japanese market now that the emphasis has been taken off the high end furniture being exclusively of European or American brand origin.

Barbara Marshall is a professional in the field of tracking trends in interior furnishings and furniture, who travels constantly attending trade shows and manufacturers around the world. Speaking at the Australian International Furniture Fair in February 2004, she indicated that trends for design and consumer purchasing in Japan, particularly within the area of style, are returning to traditional themes as a part of a worldwide trend. According to Marshall, furniture products that are contemporary and modern yet reflect traditional Japanese themes in their styling are an increasing aesthetic trend in the market place.


\textsuperscript{12} JETRO 2001, *JETRO Marketing Guidebook for Major Imported Products (Furniture section)*, Japan External Trade Organisation, Melbourne, pp.785-792.
5.7 Purchasing population age/spending trends:

- It is apparent that there are two distinct consumer groups in Japanese consumer society.

- Within the next decade, the generation of so-called “second baby boomers” (children of the first baby boomer generations) will reach their 30s. This means they will try to find their own housing, as they start their families. This generation of middle-aged Japanese consumer is the primary target market for lifestyle consumption.

- Early indicators of the needs of this emergent generation were forecast by US media, ‘Trade Winds Industry Weekly’ newspaper sounds a warning to American exporters commenting that consumer models are veering more and more towards a manifestation of a lifestyle in Japan that is becoming increasingly individualistic.

- Research conducted by Euromonitor in 2003 indicate that it is this generation of second baby boom Japanese consumers that are becoming more individualistic. They are no longer content to purchase furniture for practical reasons, but they are constantly looking to source brands and products that reflect their viewpoints, attitudes and beliefs. The concept generally thought to be influenced by the adoption of Western values.

5.8 Lifestyle and cultural

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13 Umeda, K, Dori, N, op. cit.
15 Euromonitor International 2003, *Furniture and home furnishings retailing in leading international markets (Japan February 2003)* 8.2 market background, op. cit.
• In any aspect of any contemporary Japanese furniture, consideration must be given to the hybridisation of function and style between Eastern and Western culture that exists in exclusive manifestation in Japan.

• Research conducted by Euromointer in 2003 found that an inclination towards Western style living is still considered by some as the most dominant trend in the furniture industry.

• As mentioned earlier, the majority of Japanese households now possess Western style dining suites solely or in addition to a traditional low dining table that entails sitting on the floor. 16

• This trend acceptance of the combined cultures shown by the consumer demographic, particularly in regard to sitting and dining furniture, culminate in a notable recent design trend commonly known as “Shinwayo,” a style that blends Eastern and Western designs. 17

5.9 Housing sizes

• In terms of size, Japanese homes are noted for being relatively small in contrast to those in Western countries. In 1998, per capita dwelling floor space for Japan was 32.8 square metres in comparison to the US, UK and France 60 square meters, 38 square metres and 37 square meters respectively. 18

• Economy, Western influence and consumption behavior have all contributed to dramatic changes in Japanese homes in the last few generations, however, many

16 Euromoniter International 2003, Furniture and home furnishings retailing in leading international markets (Japan February 2003) 8.2 market background, op. cit.
17 Euromoniter International 2003, Furniture and home furnishings retailing in leading international markets (Japan February 2003) 8.2 market background, op. cit.
18 ibid.
characteristics of Japan’s traditional wooden homes can be found in new homes and condominiums.\textsuperscript{19}

- Traditions such as the dimensional dictation of Tatami floor mats still provide dimensions in some modern Japanese architecture.\textsuperscript{20}

- The use of Tatami as a kind of chair, table and bed leads to economy of furniture, stored away in the fitted wall cupboard found in every room, and articles are removed as needed.\textsuperscript{21}

- A key recommendation of JETRO, for companies interested in exporting to Japan is that “furniture made in other countries does not match Japanese consumer preferences in terms of size, functionality and colour. Manufacturers need to develop more products that are suited to the small rooms in Japanese dwellings and to Tatami-covered floors and other aspects of traditional housing culture.”\textsuperscript{22}

**Apartments in Tokyo**

Through the contacts of ‘Better Homes,’ a Tokyo real estate office, several Tokyo apartments were accessed as a component of this research.

The rental amounts of the apartments visited ranged between A$2,000 and A$18,000 per month placing them in the very high-end range. Given the cost of these apartments, by Western standards the living spaces are still small. However, the average inner city Japanese would live in spaces even smaller.

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{19} Stonebridge Press, 2002, *Japanese homes and apartments*, viewed 10 March 2002, \url{www.stonebridge.com/ash/Pages/apartments.html}
\item \textsuperscript{20} Euromonitor International 2003, *Furniture and home furnishings retailing in leading international markets (Japan February 2003)* 8.2 market background, op. cit.
\item \textsuperscript{21} Yagi, K 1982, *A Japanese touch for your home*, Kodansha International LTD, Tokyo.
\item \textsuperscript{22} JETRO 2002, *Import procedures for specific products*, viewed 19 September 2003. \url{www.jetro.go.jp}
\end{itemize}
\end{footnotesize}
Figure 5.3: Japanese apartments 1-3

The apartment above is what is know as a ‘designer apartment’ called such because it is new, in a modern building and a popular part of Tokyo, the bathroom is directly to the left as you walk into the main room and is a capsule built into the wall. This apartment would be around A$2000 per month to rent.

Figure 5.4: Japanese apartments 1-2

The above apartment is also new and worth around A$2000 to rent in a very popular part of Tokyo. Image 1. shows the entrance and kitchen, there is a small bathroom directly opposite the kitchen. Photo number two is taken from the other end of the apartment facing the kitchen and shows the main room of the apartment in its entirety.
This apartment is a display apartment for this building and therefore furnished. The apartment is larger than those shown previously, has a small second bedroom/study, a main living room, master bedroom and bathroom. An apartment like this would cost around A$5000 to rent per month.

![Figure 5.6: Japanese Apartments 1-2 (3)](image)

A second display apartment in the same building is, less expensive as there are fewer rooms. The apartment is one long room, and the bedroom at the far end can be closed off with screens.

![Figure 5.7: Japanese apartments 1-3 (2)](image)

This apartment was also extremely expensive and in a popular part of town, slightly more spacious with a dining room, lounge room and bedrooms separate. The kitchen in this apartment is extremely large compared to others. A very expensive apartment at around A$5000 per month.
5.10 Aesthetic / functional preferences (General)

Brown in his book “Small Spaces” identifies adaptations that Japanese designers, architects, designers have made in order for lifestyle to function well in small living spaces. Brown states that “The lack of space the Japanese have contended with throughout their lifestyle history has led to innovations and inherent appreciation of small things and the maximisation of space.”

Koji Yagi, in his book “A Japanese touch for your home” also confirms these ideas of the adaptable lifestyle and the maximisation of space. In the Western house, the functions of the rooms, dining, living, and bed are clearly defined. In the traditional Japanese house, one room can have several functions. The function, size of a room is determined by usage, and since the needs change through the course of the day, one Japanese style room can act as several of its Western equivalents.

As stated by Brown in “Small Spaces,” “the usual furnishings for a regular Western room take up a lot of volume because they have legs or bases, backs, arms and often approach the ceiling, and more often they block the light, creating a zone of shadow from the waist level down.”

He goes on to state: “Modern lightweight, visually unobtrusive furniture is not a Japanese invention, but designers in Japan have added incentive to put it to good use, enough so that one might rightly consider their use as a basic principle.”

This aspect of the requirements of the Japanese home provides a very good argument for the use of Queensland hardwoods as timbers to be exported to Japan in the form of furniture. With their high strength properties, thinner sections of these timbers can be used as opposed to other timbers with lesser structural properties. This is one element that

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23 Brown, A, op. cit.
24 Yagi, K, op.cit.
26 ibid.
can be taken advantage of from a lifestyle perspective, that is: using Australian timbers in the Japanese market.

**Style**

There are many styles of furniture on the high-end Japanese market, however, they can be grouped into some main categories and characteristics defining these main scale are described below.

*Japanese traditional furniture*

- Furniture taking distinctive form and style.

- Function is derived from traditional Eastern dining methods such as the use of low tables and legless chairs used for traditional low dining.

- Styling reflects a modern interpretation of antique Japanese furniture style.

- The furniture market is mostly dominated by Western-style dining suites, however most stores will offer at least one or two designs for low tables and chairs. Sometimes these low tables are round, although it is rare to see a round Western scale table.
Japanese contemporary furniture

- Western style furniture that has been styled to fit a particularly Japanese aesthetic, using forms derived from Japanese traditional furniture and also other aesthetic elements of Japanese culture such as traditional architecture of homes and temples, Japanese ornaments and writing, and other pursuits.

- This style has been interpreted by modern Japanese designers/manufacturers to fit a market demand for Western furniture function. Main features of this style are simple forms using subtle angles and section shapes to add styling interest to minimal forms.
Figure 5.11: Furniture ranges retailed by Akita, Japan Original

Figure 5.12: Words From the Forest, Hida Sangyo. Photographs taken of Hida Sangyo furniture, at Fantas Maruto retailer, Fujisawa, Japan, 2004

Figure 5.13: The Baguette range from Hida Sangyo. Photographs taken of Hida Sangyo furniture, at Fantas Maruto retailer, Fujisawa, Japan, 2004

Figure 5.14: Furniture ranges by Kitutuki – Hida Sangyo

Japanese/European

30 Akita Meisho Co, Ltd. 2003, Akita furniture catalogue, Japan, promotion of current furniture range, Publicity brochure available from Akita Furniture (www.chuokai-akita.or.jp/kabazaiku/akimei)
31 Hida Sangyo Co. Ltd. 2004, Words from the forest, furniture range, op. cit.
The influence of classic Scandinavian design on the Japanese market is apparent when viewing product available in Japanese retail stores. However, not only are the reproduced products of designers sold in specialty Scandinavian stores, but it seems that in some cases the Scandinavian influence has hybridized with the Japanese contemporary to create a rather unique style such as the product sold at the Acuts store in the images below.

Figure 5.15: Acuts: a corner of the Tokyo retail store devoted to Scandinavian furniture

Figure 5.16: Furniture ranges produced by Kashiwa

Figure 5.17: Furniture ranges produced by Civil Furniture


33 Civil Japan Standard 2004, *Civil minimal interiors*, Japan, promotional brochure available from Civil Japan Standard ([www.jhomestyle.com](http://www.jhomestyle.com)).
High-end European contemporary

Direct imports from Italy/Germany/Scandinavia. High - middle end contemporary furniture.

Period reproduction furniture

Very popular in the high-end market, purchased exclusively by those who can afford and accommodate sizes of such furniture in their homes.

Oriental

Furniture imported from China and other parts of Asia which is Oriental in its styling, usually quite ornate and produced in dark timbers or stains, and quite different to the traditional or contemporary Japanese style of furniture. However, it holds some popular market share because it is of a particular style.

Other

- Japanese provincial
- Adaptability – modular, collapsible furniture
- Thick flat sections
- Designer pieces

34 Hida Sangyo Co. Ltd. 2004, Words from the forest, furniture range, op. cit.
Combinations

Size/Scale

- Fitting furniture in lifts during delivery can cause problems, because lifts in Japanese buildings are extremely small even in some of the more expensive apartments.

- Rectangular tables are available in various sizes with some standard dimensions per seating number.

- Many of the rectangular tables, particularly four seated tables were extendable.

Scale of dining settings – Rectangular
(All dimensions in mm)

2 person: Approx. Length 750 X Width 750

4 person/4 person extendable : Approx. Length – 1350 to 1600
X Approx. Width - 850 to 900

6-8 person tables:
Approx. Length 1950 X Width 1000
Heights for Western dining suites will vary Approx 700 to 725.
The retail price per table, (on the assumption that 1 Australian dollar equals 84 yen.)

Available length 1350 X 850  Height 710  Price Yen 119,700  A$ 1,425
Available length 1600 X 1000  Height 710  Price Yen 140,700  A$ 1,675
Available length 1800 X 1000  Height 710  Price Yen 145,950  A$ 1,737
Available length 1950 X 1000  Height 710  Price Yen 151,200  A$ 1,800

(All dimensions in millimeters)

As seen above, the information provided by the manufacturer in the promotional includes the distance between the table legs.

Available length 1600X850  Height 725  Price Yen 75,600  A$ 900.00
Available length 1800X850  Height 725  Price Yen 84,000  A$ 1000.00

(All dimensions in millimeters)
<table>
<thead>
<tr>
<th>Available Length</th>
<th>Height</th>
<th>Price Yen</th>
<th>A$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2250X785</td>
<td>740</td>
<td>672,000</td>
<td>A$ 8000</td>
</tr>
<tr>
<td>2800X1050</td>
<td>740</td>
<td>976,500</td>
<td>A$ 11,625</td>
</tr>
<tr>
<td>2250X1050</td>
<td>740</td>
<td>819,000</td>
<td>A$  9,750</td>
</tr>
</tbody>
</table>

(All dimensions in millimeters)

- Section sizes, in most cases seem to be quite thick, there is a chance that furniture with much thinner sections will be perceived as too weak if not designed in a way which is structurally convincing.

**Chair sizes**

Taking the average dimensions of five different styles of chairs from various manufacturers.

![Chair 1 2 3 4 5](image)

Figure 5.22: various chairs available on the Japanese market

1. Kashiwa (solid timber, manufactured in Japan)
   Images taken from Kashiwa catalogue 2004.\(^{38}\)
2. Kitutuki (solid timber, manufactured in Japan)
   Images taken from Kitutuki catalogue 2004.\(^{39}\)
3. Hida Sangyo (solid timber, manufactured in Japan)
   Images taken from Hida Sangyo catalogue 2004.\(^{40}\)
4. IXC/Cassina (veneer manufactured in other Asia)

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\(^{39}\) Hida Sangyo Co. Ltd. 2004, *Words from the forest, furniture range*, op. cit.
Images taken from IXC/Cassina catalogue 2004.\textsuperscript{41}

5. Civil Furniture (solid timber, manufactured in Japan)

Images taken from Civil Furniture catalogue 2004\textsuperscript{42}

<table>
<thead>
<tr>
<th>Width (mm)</th>
<th>Depth (mm)</th>
<th>Height (mm)</th>
<th>Seat Height (mm)</th>
<th>Arm Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. W515</td>
<td>D550</td>
<td>H81</td>
<td>SH430</td>
<td></td>
</tr>
<tr>
<td>2. W620</td>
<td>D550</td>
<td>H71</td>
<td>SH395</td>
<td>AH 645</td>
</tr>
<tr>
<td>3. W44</td>
<td>D495</td>
<td>H79</td>
<td>SH410</td>
<td>AH 610</td>
</tr>
<tr>
<td>4. W435</td>
<td>D525</td>
<td>H790</td>
<td>SH430</td>
<td></td>
</tr>
<tr>
<td>5. W515</td>
<td>D535</td>
<td>H930</td>
<td>SH439</td>
<td>AH 620</td>
</tr>
</tbody>
</table>

There is some variation in seat height, however they do not exceed 439mm

Retail Price Per Chair, on the approximate assumption that 1 Australian dollar equals 84 Japanese yen

<table>
<thead>
<tr>
<th></th>
<th>Yen</th>
<th>AUD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. With arms</td>
<td>37,800</td>
<td>450.00</td>
</tr>
<tr>
<td>With Arms</td>
<td>49,350</td>
<td>587.00</td>
</tr>
<tr>
<td>2. Without arms</td>
<td>46,200</td>
<td>550.00</td>
</tr>
<tr>
<td></td>
<td>35,799</td>
<td>426.00</td>
</tr>
<tr>
<td>With Arms</td>
<td>43,050</td>
<td>512.50</td>
</tr>
<tr>
<td>3. Without arms</td>
<td>23,100</td>
<td>275.00</td>
</tr>
<tr>
<td>With Arms</td>
<td>27,300</td>
<td>325.00</td>
</tr>
<tr>
<td>4. Without arms</td>
<td>34,000</td>
<td>404.00</td>
</tr>
</tbody>
</table>

Shapes of table other than rectangular

\textsuperscript{41} IXC Cassina Ltd. op. cit.
\textsuperscript{42} Civil Japan Standard 2004, op. cit.
5.11 Timbers

With regard to colours, there is not much variety in timbers to be seen on the Japanese market, e.g. Oak, Maple, Tamo for lighter colored timbers and Walnut for darker pieces and colour variation are the most common varieties.

With dark stained or veneered furniture, generally the customer has a choice between light and dark. In some pieces different coloured timber species are used in combination, creating a popular effect.

Examples of light thin sectioned furniture on display at Mays Furniture and a dark veneered two person table set available in a department store in Yokohama, display common colours and themes of furniture available in Tokyo.

Although there are apparently limited timbers available in the Japanese furniture market, there is a great desire within the upper end market for differentiation in product selection. At present, this trend is being capitalised upon by products produced from various combinations of materials such as veneers, metals and glass.

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43 Hida Sangyo Co. Ltd. 2004, *Words from the forest, furniture range*, op. cit.
This desire for difference could be a lucrative area to exploit the unique visual appeal of the Queensland hardwood timbers.

Other materials

The use of many other materials was popular in conjunction with timber furniture, a trend that is apparently on the increase, particularly in the higher end of the market where points of differentiation are desirable.

Extending tables

There are many different variations on extending tables across all styles of furniture, and above are a few examples.
Folding chairs

- The folding chairs displayed in retail stores were designed for around the home type sitting, and could be used as dining chairs, were the type of chairs that fit in the lower end of the market.

Use of defects as feature

- Although the majority of furniture on display is defect-free with a fine finish

- The range photographed below is made from Oak and displayed and promoted using the defects in the aged Oak resource it was produced from.
Production

Finishes

- Finish is extremely important in furniture exported to Japan. Japanese consumers are fussy about quality and will almost always feel the underside of tables and chairs to make sure they are finished to the same quality as the top.

- Popular finishes on timber furniture vary, and due to the variation and influences from various exporting countries the finish ranges in variations from high gloss to matt.

- On the more rustic Japanese style furniture, produced by Japanese manufacturers, the finish was matt and natural, however, the really fine and precise finish of the furniture gives a subtlety to the angles of the furniture and a sheen to the overall features.

- Finish should always be to the highest quality, and type of finish should be considered depending on the theme of the furniture that is achieved and appropriateness to the individual appeal of the timber used.

Other common features observed in Japanese furniture ranges

Figure 5.30: Baguette range: Hida Sangyo

Figure 5.31: Photograph taken at Fantas Maruto Furniture, Fujisawa

Products by current Japanese designers - From Adiec Modern

Figure 5.32: Dining suites by Masamichi Katayama

Figure 5.33: Furniture by Hisanobu Tsujimura

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45 Adiec Modern Furniture Distributor 2003, Adiec modern catalogue, Japan.
5.13 Distribution

- Distribution is having an increasingly apparent affect on the Japanese furniture retail market.

- The distribution market is quite fragmented with the top eight furniture retailers accounting for a combined market share of only 15% of total furniture and furnishing retail sales in 2001.46

- In response to the growth of superstores, smaller chains and independent operators were forced to target niche markets by specialising in order to survive.

Distribution channels

The following distribution channels are found:

- Large Japanese owned high-end furniture stores representing various manufacturers (imported and domestic) products under large umbrella brands.

IDC Kagu
Hattori

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file://E:\euro%20stuff\euromonitor%204.htm
- Department stores, representing ranges from various manufacturers, often lower end furniture.
- Smaller furniture stores representing one or two manufacturers, such as the ‘Hida’ manufacturers.
- Smaller low-end furniture representing a collection from various manufacturers, often less expensive imported products.
- Select stores – high end and designer pieces (often International companies such as Cassina or Actus)

5.14 Destination relations and forums

Austrade recommends that Australian companies "Invest for a longer term. Japan is a market where long term business planning and high turnover are important. Successful importers typically aim at creating long-term market credibility with their distributors and customers and are willing to bear deficits for the first few years."\(^47\)

The overseas exporter should conform and not expect short-term profits. “Be prepared to adapt the product. The Japanese market has a number of special requirements that often translate in to product modification. Major consumer product firms are aware of this because Japan is renowned for its exhaustive research into product suitability, and even coca cola changes its ingredients and taste when selling in Japan. Experience in industrial goods is similar.”\(^48\)

Trade shows

Trade show representation is an important form of manufacturer representation in Japan, e.g. the International Furniture Fair Tokyo.

\(^48\) ibid.
Shows such as this have proved a beneficial and essential forum for the promotion of furniture and furnishing retailer brands, while also providing an important vehicle for the exposure of private labels to the industry.\textsuperscript{49}

This type of exposure is particularly important for manufacturers in Australia to promote awareness of their product in the Japanese market. Vital business links can be established which will not only set up individual businesses with contacts, but promote awareness of Australian manufacturers in general.

5.15 Germany, Economy and Furniture: Market Trends

- Germany is the leading furniture consumer in Europe in 2001 with 26\% of the market share (i.e. Consumption = Production – Exports + Imports)\textsuperscript{50}

- The market is forecast to increase by 11.7\% over the review period (2002-2007) to reach 34 Billion Euros in 2007.

- This increase is not large, because domestic production decreased significantly in 2002/2003 and the market is not likely to recover in the near future. However, the general production will strengthen over the next few years and improve consumer confidence.\textsuperscript{51}

- Germany is one of the major markets for forest products in Europe.\textsuperscript{52} Between 1997 and 2001, sales on the wooden furniture sector in Germany increased

\textsuperscript{49} Euromonitor International 2003, \textit{Furniture and home furnishings retailing in leading international markets (Japan February 2003)} 8.2 market background, viewed 6 October 2003, op. cit.
\textsuperscript{51} Euromonitor International 2003, \textit{Major retail sectors}, 12.7 forecast furniture and home furnishing sales, viewed 9 October 2003. \url{file://E:/euromonitor.euro%20germany%2025.htm}
slightly in a declining market due to consumer preference, an area of change in the German market that will be expanded upon.53

5.16 Local industry

- Germany has a long tradition of furniture manufacturing and a strong furniture-manufacturing base.

- Through the recent depressed economic period and the decrease of the German market, strong exporting has done much to support local production, although the work force in the furniture sector in Germany is decreasing.54

- While production of high quality furniture tends to remain in Germany, that of low priced, mass-produced articles is being systematically moved abroad.55

- It would take some time and effort to establish a new species of timber in the European market. However, new materials and colours have been incorporated into timber furniture pieces, giving them a novelty.

- According to Dean Smith in his (CRCWI) internal report, new materials and colours could be an important means of product differentiation, as demonstrated at the Cologne International Furniture Fair in 2004.56

- This could pose problems in targeting the higher end of the market with over 45-year-old consumer who spend the most money on furniture purchases.

53 Euromonitor International 2003, *Household furniture in Germany (September 2003)* household furniture - share of market, viewed 9 October 2003. file://E:\euromoniter\euro%20germany%203.htm


55 ibid.

56 ibid.
• These consumers are more likely to purchase conservative designs and have a preference for traditional European timbers, than an assortment of material innovations and new foreign timber species.

5.17 Lifestyle and culture

• Germany is the largest net importer of furniture in the European Union and a diverse and potentially beneficial market for Australian manufacturers to break into.

• Sales in the wooden furniture sector have been generally higher than in other areas of furniture. This is due to an apparent increase in interest in environmental issues by the German consumer.

• The furniture industry in Germany has been largely affected by social changes. The advent of smaller families due to higher divorce rates and couples choosing not to have children, is now establishing a strong trend. Living areas are accordingly becoming smaller, requiring more flexible, movable and multifunctional furniture than previously.57

• The average age in Germany is increasing almost yearly; the increasing age of the population majority has tended to polarize the targeting of the German consumer.

• The high end producers are targeting the older generation (45+) who will generally buy less furniture but when they do purchase, they spend more in a higher end category, in assembled furniture.58

57 Euromonitor International 2003, Major retail sectors, 12.7 forecast furniture and home furnishing sales, op. cit.
• The younger demographic is generally targeted by the lower end of the industry. The popularity of ready-to-assemble furniture in this end of the market is already large and growing.  

• The diversity of style desired by the German consumer is reflected by the degree of furniture styles infiltrating the German market.

• An increasing want to reflect individuality in lifestyle choices is driving the need for this. Due to increasing levels of stress in the workplace, the home is now considered a sanctuary more than ever in German society.

• The general majority of the population in Germany are renting homes, particularly in more highly populated cities. In Berlin, 89% of the population live in rented apartments, and 60% of the overall population live in rented apartments in Germany.

• The high incidence of rental properties suggests that those renting the properties will not invest in the property itself rather the items that go in it.

• It is often assumed that the kitchen is not a formal dining area as a dining room and consumers looking to purchase a dining table and chairs for a kitchen area may be looking for something less formal.

• Those consumers are spending more of their free time in their homes, and investing more in dynamic industry purchases such as home entertainment systems. These changes are mirrored in the consumer preference in furniture and affiliated goods. The popularity of compact and mobile furniture, the need for the

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59 ibid.
60 ibid.
62 ibid.
integration of multifunctional aspects in furniture and space (e.g. turning a sofa into a bed,) kitchen furniture that can be moved around easily, or a bathroom that is also a place for relaxation are new concepts for the furniture industry.  

5.18 Market directions / styles

- Small niche consumer groups are evolving with distinctive identities and characteristics forcing these identities.

- The demand for diverse styles is reflected by the range of furniture displayed by various global manufacturers at the Cologne International Furniture Fair and largely indicative of annual furniture trends in Germany.

- Contemporary furniture on the German market ranges from classics, modern, modern classics, minimalist, industrial look, ethnic look, mixed interiors for instance western furniture with African art, Japanese or Asian interiors, interiors with high technology, and the Mexican look. Whatever the taste, consumers regard the decoration of their homes as an extremely personal and individual experience which reflects their own identity.  

5.19 Population and demographics

- Germany is the most populated nation in the European Union with approximately 82 million people, but is another country with a significantly aging general population.  

- The demographic and profile of the population has had a strong influence on the consumption of furniture and furnishings.

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63 Euromonitor International 2003, Major retail sectors: Germany 7.1 market background, consumer behavior and changes in demand, op. cit.
64 ibid.
65 Euromonitor International 2003, Major retail sectors: Germany 6.1 retailing overview economy and population, op. cit.
• Market research report 7.1 provided by Euromoniter concluded that consumers over 50 generally favour ready-to-use furniture as opposed to the 18-to-40 year age bracket who are more inclined to buy self-assemble furniture.\textsuperscript{66}

• The older consumers value expert advice and high quality service. The younger consumer value novel ideas and convenience, although they should be given the freedom to customise and individualise their ideas.\textsuperscript{67}

5.20 Distribution

• In spite of indications of large retail players controlling the furniture market, more innovative small and medium businesses will develop outlets based on diverse specialised themes, functions and product materials, which will be targeted at niche market groups.

• Specialisation is becoming a vital issue in the furniture sector. Catering to niche markets that were not previously targeted by the large sellers, is an effective strategy that the small and medium sellers are adopting. Specialisation of themes and functions are likely to be adopted by retailers in the furniture sector.\textsuperscript{68}

• This type of retail outlook provides positive news for trying to get furniture produced from Australian timbers into this market.

\textit{Destinations product lifecycle evaluation}

\textsuperscript{66} Euromoniter International 2003, \textit{Major retail sectors: Germany 7.1 market background, consumer behavior and changes in demand}, op. cit.
\textsuperscript{67} ibid.
\textsuperscript{68} Euromoniter International 2003, \textit{Major retail sectors: Germany 7.4 major retail sectors}, viewed 9 October 2003. file://E:euromoniter\euro\%20germany\%2026.htm
The lifecycle evaluation in this market fluctuates between two extremes, and the target of the high turnover of the lower end of the market (which represents the most value and overall product) is intended to be of fairly short and fashion-oriented lifespan.

The high end product, however, is generally patronised by the older consumer who makes generally fewer purchases although these products are consumed with greater quality and longevity in mind. Products aimed at this market must be produced with long life cycle in mind.

5.21 Trade shows: Cologne International Furniture Fair (CIFF)

Attending the Furniture Fair was an opportunity to assess furniture trends on a global scale.

As the CIFF is one of the largest furniture fairs in the world, there was a great diversity of furniture from all scopes of style and function, and from many exporting design nations as well as a strong representation from the host country.

The CIFF confirms that furniture needs must be distributed to anywhere there is a potential market need, and that could be anywhere in the world.

Furniture needs to be designed and constructed with high quality and with the potential to withstand any travel or environmental condition, and to compete with products from other countries producing high quality furniture.

Innovation is required to compete, in design and the use of material and promotion of products, and any edge is important with the quality of the material and style including possible innovation in combinations of materials.
Australia, although disadvantaged in terms of location in comparison to European companies, has unique timber resources and can push innovative designs and products into the market with a relatively clean slate on which to establish a reputation.

5.22 Representation

- The representation at the Fair was dominated by European manufacturers. There were many different companies representing the main countries e.g. Germany, Italy, Denmark, The Netherlands, Switzerland, and Austria.

- The second largest continental representation after Europe was from Asia, where Malaysian, Taiwanese and Thai companies were well represented.

5.23 Trend Evaluation - International Cologne Furniture Fair

Overall there were several themes of aesthetic trends that could be developed and related to possibilities for design outcomes for Queensland hardwoods to perform viably on the international market.

Some trends of potential assistance when designing from Queensland hardwoods, particularly in design areas that aid movement and non-glued joints in timber are as follows:

- Leaving openings between joints and showing the defects in the timber as a feature
- Metal joints and fasteners of many traditional and non-traditional variations, combining metal and timber (an extremely popular trend) could provide alternative fastening and jointing options
- Knock down joints where furniture can be flat packed for transport
• Producing designs in sections e.g. the popularity of fold out dining and office tables is something to consider for export to most markets
• Using other alternate materials such as elastics and plastic sections
• Strapping furniture together as a way of jointing
• Thin timber sections with external brackets incorporated into a design feature
• Utilising alternative traditional materials such as leather, wicker, plastic and upholstery to innovate new joints and timber forms

_Cologne International Furniture Fair: Points of Interest: Metal, joints, legs and fastenings_

• Metal elements combined with timber are an extremely popular trend at present, in all types of furniture.

![Figure 5.35: Photographs taken of products at Intraform, Bern Switzerland](http://www.e15.com/english/press/imm.html)

![Figure 5.36: Images taken from e15 catalogue 2003](http://www.e15.com/english/press/imm.html)

• In some cases, timber and metal has been combined with other materials for further successful combinations.

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Alternate materials, upholstery, molding sections

- Using non-traditional indoor materials with timber can assist with the creation of new jointing techniques. Materials that stretch, e.g. coloured elastic strips could possibly be adapted to create an aesthetic effect and joining alternative.

- There were also many examples of timber in combination with upholstery.

Natural timber defects, sizes and grains

- There were several examples of indoor tables where gaps were left in the tops as a design feature.

- The various tables were joined using different techniques, with some having metal or spacing materials between the gaps.

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70 ibid.
• This aesthetic provides great alternative possibilities for tabletops of timbers such as Spotted Gum that is difficult to join to create the traditional flush tabletop.

Figure 5.39: Image taken from Chairman Denmark Catalogue 2003

• In some examples of timber furniture exhibited, the defects in the timber were made in to a feature of the piece to create a rustic modern style.

• The style was used very effectively in many different examples, and it was also popular to show the natural features and color changes in timbers used.

Figure 5.40: Image taken from Draenert catalogue 2003

Figure 5.41: Images taken from e15 catalogue 2003

72 Chairman Denmark 2003, Chairman Denmark catalogue, Denmark, promotional brochure available from Chairman Denmark.
73 Draenert Studio 2003, Draenert furniture Catalogue, Germany, promotional Brochure available from Draenert Studio, (www.draenert.de)
74 e15, op. cit.
Thin forms, joints and sections, obvious fastening

- Thin, elegant and minimal designs appear to be a popular aesthetic with many manufacturers, and forms depicted here are both plywood and solid timber.

- This thin streamlined aesthetic is appropriate to design in Queensland hardwood timbers as thinner sections can be achieved with these timbers than most because of the high strength.

Figure 5.42: Image taken from Nils Holgar Moreman catalogue 2003\textsuperscript{75} and Schimidinger catalogue 2003\textsuperscript{76}

Alternative points of Interest

- A plywood table strapped to create a flat packed portable table that shows that strapping or flexible joining could be a viable alternative in the production of furniture from Queensland hardwoods.

Figure 5.43: Corner bench seating with displays of both indoor and outdoor alternatives, are a popular dining room accessory in Europe

Figure 5.44: Image taken from Die Holzschmiede brochure 2003

Figure 5.45: Image taken from Team 7 catalogue 2003. "Team 7" an Austrian manufacturer, is one of the largest solid wood furniture producers in Europe, it promotes the idea of style in every room

- Thin sections are achieved here in plywood, a possible aesthetic appropriate to Queensland hardwoods due to their strength. These plywood sections are also joined underneath with a metal L bracket where each leg joins the seat.

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77 Team 7 Naturlich Whonen 2003, Team 7 catalogue section, Austria, promotional brochure available from Team 7 Naturlich Whonen, (www.team7.at).
Mixing timbers

- There were examples of different types of timbers being used in the same collection or piece, and this type of aesthetic could provide techniques for using Queensland hardwoods in conjunction with a softer or more pliable timber or timber substitute.

Alternate/traditional materials

- In this example there are thin metal components between the sections of timber joining on the top and legs, with a laminated top.

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79 Calma Austria 2003, *Calma Austria catalogue*, Promotional brochure available from Calma Furniture.
5.24 European Manufacturers

- Designs are minimal and simple, using mostly European Oak and European Walnut. The furniture is minimal in design and exhibits defects in the timber, displaying a rustic and natural feel with the timber used.

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80 Chairman Denmark, ibid.
82 e15, op. cit.
This heavy large board (component) style furniture is not applicable to Queensland hardwood timbers, because it would be difficult to join them to create a satisfactory finish and the final product would be exceptionally heavy.

The furniture displayed above was produced as a special promotion by German company Draenert, a high-end producer.

Draenert was approached by the association for environment and nature protection (Baden-Wurttemberg, Germany) to join in the promotion of ‘red-core’ Beech and dedicated concepts to the material that would value the features of these trees.

The company has taken a very environmental tact in the promotion of this furniture going into a detailed description of the resource, and stating that the unusual colouring of the wood with its red centre means that it has not been considered as a high value timber and is often used as firewood.

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83 Draenert Studio, op. cit.
This Dranert furniture promotes the red streaks in this timber as unique, and it displayed in all aspects of modern minimally designed high end furniture. The use of curved components in the backrests is the beginning of a strong theme detected in the German furniture market.

The large producer keeps up with trends offered by other large producers, and supplies a large range and variety in their styles and timbers used in the furniture.

Their ranges include dark and light timbers and it is obviously left to customer to mix and match with what they choose to purchase.

Versatility in range is the most important aspect for this producer, tailoring to meet the lifestyle need of the consumer in both function and style is evident.

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84 Die Holzschmiede Massivholzmöbel, op. cit.
The examples shown above from Wasa furniture are representative of the different ranges that manufacturers provide in an attempt to cater for the varieties of furniture demanded by the market.

Modern and minimal styles are represented alongside more traditional and stylised forms using various types of timbers, in various thicknesses and finishes.

Upholstered seats, leather seats, and seats made from weaved elastic strips and cushions are all used with various styles of furniture and are often represented as different options for the same timber frame.

Aneri, an Austrian company, display similar themes but colours although along the same themes are various and optional. There is a subtle difference in the colour of the timber/veneer used and the colours of cushions that are displayed with the respective timbers.

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• There are also options in one two, or no armrest on the stand-alone chairs. These armrests appear to be adjustable by the consumer after purchase.

Figure 5.57: Images taken from Wooden Stories catalogue 200387

• Wooden Stories, timber furniture manufacturers based in Stuttgart, displays different colour combinations of timbers used in conjunction with each other.

Figure 5.58: Filippo Sibau & Co brochure 200388

• Italian company Filippo Sibau & Co promote the use of various timbers in use with leather and upholstery, variations in timbers used, armrests, and jointed curved sections to create backrests providing many options to the consumer.

87 Wooden Stories 2003, Wooden stories furniture catalogue, promotional brochure available from Wooden stories.
88 Filippo Sibau & Co, op. cit.
Differentiation on the market is important, and Dutch company Ansager have used a particular aesthetic with their furniture to promote themselves.

The solid laminated timber has been styled in various ways, but with particularly curved edges which gives this furniture a distinct appeal.

Traditional furniture in combination with modern forms in light timbers has cushioned seats.

Traditional upholstery and alternated in ply finishes

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89 Ansager Mobler International 2003, *Ansager furniture catalogue*, Denmark, publicity brochure available from Ansager Mobler International, ([www.ansager.dk](http://www.ansager.dk)).

90 Voglauer Mobel 2003, *Voglauer furniture*, Austria, promotional brochure available from Voglauer Mobel ([www.volauger.com](http://www.volauger.com)).
Chapter Summary 5.25

In summarizing this chapter, it is appropriate to point out the complexities that face a designer when attempting to develop a product in a market niche. The need to interpret diverse effects and make design decisions based on the plethora of information in a cultural and market sense is very difficult. Not only are the specifics of the particular cultures and resultant market influences to be investigated, but the countries influence on the region and countries around them and the rest of the world, and those on them must also be calculated.

The factors influencing the Japanese furniture market are shown in this chapter to be highly dictated by cultural and generational dynamics in Japan, and the change that has been undertaken in that country due to outside influences from the rest of the world, particularly Western culture.

The traditional, verses the uptake of new information and culture, the demand for style, in some instances brand name recognition, combined with the practical aspect of the lack of

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housing space in Japan has forced the hand of the consumer in a sense, their appreciation of Western, and particularly European style, has had to be hybridized to be practical to the Japanese living space. These factors leave the designer, whether from that culture or otherwise, with a difficult job in determining which product to develop and how to style it for the Japanese market.

Factors in demographic age groups and traditions in the furniture and timber manufacturing industries also influence the German furniture consumer, and create factors that the designer must address when designing for this niche market also.

The older generation in Germany are those who will spend more on furniture and buy pre-assembled high end furniture. It is suggested that their tastes are more conservative, that they will favor traditional German manufacturers and timbers. The younger generation of German consumers will be more open to take home and assemble furniture, being targeted by lower end marketers.

In considering these factors the designer, developing high end timber furniture for the German market must factoring in an understanding of the traditional styles and functional expectations of the older generation of the culture. The possible reluctance to appreciate a new timber and style of product on the market must be considered within the design process.
Chapter 6
Market led design development chapter

6 Introduction

Chapter 4 technical concept development, and chapter 5 qualitative and quantitative market information analysis Japan and Germany, were both important strategic steps in creating the final design outcomes for this investigation. Through the process of technical concept development, ideas were generated for experimental joining systems for the Spotted Gum timber in a flat-packed process.

There were three major design concepts worked upon in this section of the investigation, however only two of these concepts, and only the chair designs were developed to prototype stage for exhibition and will be discussed in this chapter.

To create an appropriate international comparison for this investigation, the products needed to be of a similar theme. Western style dining suites were of vast popularity in various styles and dominant in sales in both the Japanese and German market areas. It was decided that an alternative concept proposition for each of the market, in the same style (a Western scale dining chair) would be the most appropriate vehicle for creating the desired comparative market information desired through this investigation.

6.1 Summary, German market requirements

The mixture of styles and form available in the European market is extremely diverse. Further refinement of objectives needed to be undertaken to successfully design with market objectives in mind, however, a description of objectives in the following product design experimentations will be discussed.

One of the major advantages to be exploited in the German market is their appreciation of timber and timber products, particularly the environmental aspect, such as the potential of the Spotted Gum as a plantation resource.
Objectives:

- High end niche target (Timber product)
- To stand out as a high-end product
- Must be attractive as something unique and different in a diverse high-end market
- Product must be assembled for purchase
- Avoid association with lower-end market, ready-to-assemble products
- To fit into average to small home size, perhaps apartments
- Appeal to an affluent younger generation, as well as a traditional appeal for the older generation
- Exploit the use of timber as much as possible, it will be a popular feature of the German market
- with a preference in Germany for lighter-coloured timbers (such as the timbers native to the region) how can ‘light’ timber elements incorporated with Spotted gum
- There will be acceptance of various material combinations
- Quality requirements will be high
- Medium to large orders may be taken.

Technical reminders

- Exploit timber properties
- Flat pack for transportation
- Correct tolerances for climatic conditions of proposed market place
- Experimentation with a new joining mechanism.

6.2 Initial market focused concept development: Curved ply back chair

The initial concept development utilised the simple structure of a square base with an upholstered seat in this case. A method for clamping and buffering to create a square
chair base as dictated by preference and popularity in the German market was explored through further sketch work.

Figure 6.1: Basic and initial sketching for this ‘square base’ concept
Figure 6.2: Incorporating a diagonal metal structure in the traditional way to assist in holding the buffered metal to metal joint.
Figure 6.3: Further sketching, showing a more considered joint, and where a buffering material would be required.
Design experimentation devised ways of joining a curved backrest (another successful and popular market driven aspect) to a chair with this simple base structure.

The nature of the Spotted Gum timber required that alternatives for attaching the backrest beyond a second timber joint, either attached to the back leg or running from the main seat frame, were investigated.
Metal, Plywood

It has been discussed in previous chapters how important alternate materials will be in the production of chairs from Spotted Gum timber. The high-end German timber furniture market is receptive to alternate material use in combination with timber.
In this early phase of market concept development, plywood as a backrest was strongly investigated as an alternate to a solid timber backrest, which would pose difficulties in production.

This concept relies on a bent ply shell to provide the major structure of the backrest, this was an investigation to find a simple alternative for attachment of the backrest, avoiding glues and lamination. An advantage of this concept and the use of plywood as a main element in the backrest is that an alternative to timber can be used to create contrast and a ‘light’ colour appeal. However it was determined that the support structure required for this chair was over-engineered due to the alternate support mechanisms required, the concept work was discontinued.

A further issue in this concept is that it is not promoting or exploiting the valuable properties of the Spotted Gum timber, i.e. mainly its strength properties and visual appeal. While it is considered advantageous to incorporate ply and metal elements to create a unique appeal to the furniture, in this case the over-engineering detracts from the timber and fails to exploit its advantageous properties.
6.3 Further concept generation

A further concept, using the square based theme, with a ply backrest was investigated; however this concept endeavored to avoid the requirement a secondary support structure for the ply backrest.
Figure 6.10: Investigating various attachments for a backrest and lower leg bracing
Figure 6.11: Sketching, showing for development of the chair form and plywood sections in conjunction with the square timber frame
Rather than a curved backrest, as in the previous concept discussed a straight free-floating ply backrest was proposed. The seat base could also be created from matching ply to the backrest or an upholstered stretched leather effect.

This concept encountered the same negative aspects discussed in the previous concept. Where the strength and elegance of plywood would be exploited in the concept, it does nothing to promote the features of the timber. The structure of the seat, requiring a covering element of ply or upholstered leather, further hides the timber frame element of the base.
Perhaps the problem of such concepts is that they are taking popular aspects of market conformity and applying them too literally, without appropriate awareness of the properties of the major material of the investigation.

6.4 Germany Chair: Concept taken through to prototype

*Images of various influential chairs*

The diversity of style in the German market is a large issue in approaching product development. Modern styles are various and popular and striking a niche appeal requires specific qualities in a product. The unique and unusual properties of the furniture produced from Spotted gum timber will be evident. However, to balance the new appeal of the furniture, it was decided to subtly replicate some of the forms and visual elements of some popular traditional styles of European and Scandinavian furniture.

Figure 6.14: Teak and paper cord armchair by Peter Hvidt and Orla Molgaard-Nielson 1956 and Model no VN44 by Finn Juhl 1944

Figure 6.15: AX chair Peter Hvidt and Orla Molgaard-Nielson 1950
6.5 Initial concept development

Initial concept development explored the process of inventing an alternative joining system to accommodate material problems, while incorporating particular styling elements into the design process.

This intended relationship between traditional elements and forms, was intended to contrast with the unique timber properties and joining system to create a novel piece of furniture. The resultant piece, while presenting visual features that will be familiar with and popular with sections of the market, will also display a unique appeal, typical of Australian timber.

Early in the process, the pros and cons of designing a stacking chair for the German market were considered as a space saving element of addition to the chair. However, this was abandoned due to market and demographic appeal issues.
Figure 6.18: The early concept generation stage - an investigation between joining and form.
The curved and shaped turned sections, drawing on the theme set through various examples of popular timber furniture design.

Figure 6.19: The sketching above shows positioning of components to generate comfort and stability.
Figure 6.20: Chair forms dictated around the alternate mechanism for the joining system
Figure 6.21: Basic alternate styles are investigated, square or round, and the advantages and disadvantages of simple alternatives are weighed up.
Figure 6.22: Further attempts, various backrest attachment investigations.

Figure 6.23: Computer generated image of an initial chair concept in a preliminary stage of overall form development

6.6 Alternate bracing system

Investigation of alternate systems of bracing has been a continual theme throughout the investigation, however, the difficulty has been finding the balance between an appropriate solution to accommodate the following:
- Structural requirements of the furniture article in question - in this case a dining chair
- Addressing the adverse properties of the timber in question
- A system that can be dismantled for flat-packed transportation
- An elegant visual effect, complementing the inherent strength properties of the timber
- Of unique appeal in an already diverse market

In many of the design attempts undertaken in previous concepts discussed, one or more of the elements listed above has been sacrificed to conform more strongly in the other areas. This shows that all aspects must be treated with equal consequence to create a successful product.

Ideas such as these, particularly the idea of buffering between joints, is essential in producing a viable high-end furniture solution for production from Queensland Hardwood timbers. However, such ideas pose difficulties in manufacturing as encountered through the products developed by the Canberra School of Art.

Given the parameters and difficulties which arose through the proposal to use extra material in the joint to buffer the timber sections, a simplified alternate joining mechanism was developed for use in the German chair concept.
Figure 6.24: Further investigations, how to brace the timber in a visually and structurally pleasing way

The joining system revolves around being able to utilise a simple duplicated laser cut piece of metal, running between the four legs and one on top of the other, using hooks on each end while facing alternate directions to clamp the legs on each end. Using such a mechanism is simplified production and flat pack friendly method to give a buffered joint.
The following section of this chapter will provide an explanation of the development of this joining system and consequent chair.

Figure 6.25: Further sketching

Ideas of clipping and interlocking mechanisms to locate the metal sections as they cross over each other were considered, but rejected for a more simple method of pinning for location, on the basis that it would make the metal arm components far easier and more cost effective to produce.
The idea is that the metal arms act like spring-ended tongs, as they pivot on a central point and allow some expansion and contraction and movement as the timber moves (expands and contracts) while still providing a solid structural joint.

Some buffering to help the timber leg and metal hook locate may be required. However, it is envisaged that a simple sleeve type arrangement could be devised, which could be applied on assembly rather than an intricate buffering system involved in the joint production process.

Figure 6.26: It was decided to make the components so they could lock into place on assembly, rather than requiring the top of the leg to be detachable as depicted in the sketch above.
Various ideas for how the joint would be assembled were explored. If the ‘hook’ components were to slide on from the top, it would allow for easier assembly, but would create production difficulty in that a further component would need to be added to locate and secure the top section. If the arms were to clip together from the sides, the leg could be created from one timber part, which would be of greater advantage.
Figure 6.28: Considering various alternatives, using the computer to gauge various hook types, depths and forms of the arms

Figure 6.29: This mechanism has several advantages in theory
- Simple manufacture
- Appropriate for flat pack production
- Could be arranged to snap into place for assembly
- Is visually unobtrusive and provides a basic structure which can be built upon for the design of the chair without becoming a dominant visual feature, and must be incorporated into the more aesthetic elements of the design process from the start.

6.7 Attachment of seat

The seat of the chair sits upon the metal arm structure, creating a floating effect. The pins locating the seat also interact to add to the structure of the chair. The seat, produced from plywood, was then secured from the top to the bottom of the metal arm with a screw and nut arrangement at the bottom.

This format provides a secure attachment for the seat, while also providing an extra locating and fastening method for the metal arms.
Figure 6.30: Initial thoughts on seat location to provide better support in the bracing system
Figure 6.31: Front orthographic image showing the placement of seat pins, legs, metal arms and seat, sketching solutions to seat attachment, through the arms of the structural metal bars

6.8 Mock ups

Cardboard mockups were developed at approximately this stage of design development, to gauge how the joining mechanism would look and potentially act on
a basic frame. It was concluded from this process that the idea would be quite visually unobtrusive and generally pleasing if successful.

The basic frame allows for a chair aesthetic to be built around it, as can be seen from the cardboard modelling process. However, the model gives no indication as to the structural properties of the chair.

Figure 6.32: The exercise of producing this model from cardboard allowed some ideas on how the concept could be further developed

Even at this early stage, it was recognised that a secondary structure at the base of the chair would probably be required. Again the challenge was how to apply such a structure to gain strength while not restricting the movement of the timber entirely, rupturing joints and causing problems in the chair.

Figure 6.33: The seat is then located with pins securing the seat and metal arms through the one vertical mechanism
6.9 Metal arms

Incorporation of an exploitative form

With a structure in place, the rest of the chair could be worked on to create the next theme. An important aspect to keep in mind in the further development of the product was the exploitation of the strength properties and natural appeal of the timber in creating a new visually appealing product.
Previous design attempts showed that by incorporating various materials the main feature of the timber and the exploitation of its strength properties could be lost. It was an important priority of this concept development process that this did not happen.

The proposed joining mechanism allows for this because the clamping hooks which are located between a recessed part in the turned leg of the timber, allowing for any length above or below (leg or backrest section), an element that was missing in some previous design concepts.

6.10 Leg shape: form and function

A rounded and shaped style of leg was required for the chair, in keeping with the peasant chair theme. Deciding on the exact form of the leg was determined partially in the development of a certain aesthetic theme, and partly as a functional process to create the correct support mechanism for the chair.
In both the front and back legs a recessed part is required, routed into the shape of the leg to allow the metal arms components to be attached to the leg sections. Having timber sections above and below the area allows for the metal arms to be confined and supported within a certain section.
Figure 6.37: The use of tapers visually and physically reduce the weight of the chair
In the case of the front legs, a round flat section was used on the top of each front leg at different sizes to bring them to the same level, and as previously discussed to provide vertical security above and below for the metal hook section.

The tapering of the legs was used strategically (i.e. larger towards the top of the leg where the joint is) to provide a greater surface and stronger join where the metal interacts with the timber. This also allowed less thickness to be used on other sections of the timber where such a solid form is not required.

This is an important aspect in exploiting the strength properties of the timber by providing a fine leg section. It provides a visually pleasing cylindrical form, in keeping with the peasant chair theme, as a market target aspect of the chair.

Figure 6.38: Image of back left leg and back right leg together
The left and right legs were slightly offset from each other in vertically, although both reaching the same height, the recessed part of the legs where they are clasped by the metal arms requires a 5 mm height difference to accommodate the height difference in the legs.

*Experimental leg size*

An even finer leg section was trialled, as an experiment to see if the timbers’ strength could be exploited even further, and what effect this would have on the visual appeal of the chair.

![Figure 6.39: The visual effect of the finer taper can be seen visually in the orthographic drawings of the front legs shown above](image)

The base of the legs is 15 mm diameter compare with 21 mm diameter in the thicker version of the leg.
Bend back in leg

There was a bend required in the top of the backrest, which needed to be applied through a steam bending mechanism after the leg section had been turned to the correct dimensions.

Figure 6.40: The image above shows the bend required in the finer leg thickness. The bend is subtle but provides better ergonomic position for the back rest

6.11 Seat

The seat was developed to be produced from pressed plywood, which was required in this design because the form and strength required in the seat would be impossible to achieve from solid timber.
The plywood was also specified to be of a lighter colour, to contrast with the darker tones of the Spotted Gum legs, and providing the chair with more appeal. Also, the joining mechanism required does not require the strength and structure that a timber seat would provide, adding to the weight and bulky appearance of the chair.

The shape of the seat was developed to fit on top of the metal structure, hiding it almost completely except where the metal arms clasp the legs. The seat is 476mm long, with 446 mm at the front and tapered to 400 mm at the back, to provide a deep wide and curved sitting section.

Figure 6.41: Sketches detailing the development of the seat, in relation to the proportions determined through the rest of the chair
6.12 Backrest

The backrest, in a similar theme to the seat, was intended to be made from pressed plywood, attached to the legs of the chairs by simple mechanical fasteners. The objective of the backrest was that it was to be kept as simple as possible and complement themes taking shape in other parts of the chair.

Due to the bend at the top of the back leg, incorporated to provide more comfort as well as a better visual appearance, various designs were considered to provide the horizontal backrest between the two vertical back leg supports, within the area of the bent back leg section.
The final form chosen of two simple straight lines with curves in them were considered the most appropriate to the rest of the chair, being simple and effective in form and function.

Figure 6.43: Sketching for backrest development
Figure 6.44: Further development of the backrest form and function
6.13 Support struts

The supporting leg struts, although investigated in a traditional form, could not be treated in the same way of attachment, construction and production as in traditional chairs due to the properties of the timber and the flat-pack requirements of the chair.

The leg struts were therefore designed to be hooked at the ends, and attached by screws to the outside of the timber legs, resulting in a timber to timber attachment, held by mechanical fastener.
Figure 6.46: Orthographic views of the different size of the support struts required

Figure 6.47: Exploded view of chair showing components required, including support struts and mechanical fasteners
6.14 Proportions, derived from peasant chair

The proportions of the Germany chair were developed in consideration of similar chairs of the same genre, to conforms with European market expectations for the scale of such styled chairs.

Figure 6.48: Dimensions of a Fritz Hansen produced peasant chair
6.15 Final concept generation: computer generated renderings

Figure 6.49: The final concept of the Germany chair. The sections shown in this concept development, are the ‘finer’ of the two sizes that were generated for investigation.

The chair has a ‘light’ appeal and draws upon the theme of traditional European furniture previously discussed. However, it is unique due to the strength properties of the Spotted Gum timber.

Figure 6.50: For setting reference, the German chair has been attached to the final expansion and contraction table.

6.16 Using knowledge of timber movement to create appropriate tolerances

The spreadsheet below was provided by Mr Gary Hopewell of the DPI &F.
This spreadsheet was specifically developed by Mr Hopewell to project the movement of Spotted Gum timber through various climatic changes. The spreadsheet works by estimating the degrees of movement expected within the component size of timber is altered within the width and thickness columns, and various projected moisture contents are taken into account.

An equation for conversion of outdoor equilibrium moisture (EMC) content to indoor EMC is also provided.

Finally the equation for converting relative humidity and timber into EMC was used.

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<th>movement</th>
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Enter component width in B2 and thickness in C2
Enter outdoor EMC value in C11

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This spreadsheet was very useful as predictions as to the highest extremes of environment could be made and then accounted for through the tolerances allowed between some of the joining aspects of the chair.

_Tolerances required_

Four cities from various parts of Germany were selected Hamburg, Dresden, Munich and Frankfurt. The average EMC per year in each city was calculated, as well as possible extreme EMCs per season that could be encountered.

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<tr>
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<tr>
<td><strong>Extremes</strong></td>
<td><strong>Month</strong></td>
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<tr>
<td><strong>High =</strong></td>
<td>Jan</td>
</tr>
<tr>
<td><strong>Low =</strong></td>
<td>May</td>
</tr>
</tbody>
</table>
### Japanese Chair: Concept taken through to prototype

Major factors and objectives, in designing a dining chair for the Japanese market were as follows:

- Exploiting a high end niche market
- Targeting younger affluent, lifestyle driven consuming market
- Appreciating of lifestyle products
- Accepting alternate material use, such as metal or plywood in incorporation with timber in the products
- Accepting alternate style presented due to timber requirements
- Accepting a new timber species as a point of difference is likely in the younger age group
- Differentiating from other products is important
- Relating to current themes and identities is important
- Carefully considering product size is required
- Consider small apartment living
- Noting that consumers may be brand/country of origin conscious although not as much as consumers in more emergent economies in Asia
- Establishing an Australian reputation for furniture is important
- Expecting extremely high quality
- Desiring product to give value for money
- Expecting high end products to be assembled for purchase

Technical reminders are:

- Exploit timber properties
- Flat-pack for transportation
- Correct tolerances for climatic conditions of proposed market place
- Experimentation with a new joining mechanism.

6.18 Summary of concept

The new joining system in the Japanese chair concept was a direct derivative of one of the concepts explored in Chapter 5. Technical concept development. The ‘expansion and contraction’ tables and chairs concept were given further consideration through the Japanese chair concept generation.

One of the main features of the ‘expansion and contraction’ concept was a proposed joining mechanism incorporating laminated timber sections for the seat component, and testing of the success of laminated Spotted gum boards in both table and chair formats. This proposition and design development will be discussed further in this chapter.

The second point of discussion for the Japanese chair is the evolution of shape and form of the chair. Primarily the chair was sculpted around the joining system. Elements of detail applied were derived from technical functions to accommodate visual appeal and appropriateness to the market direction specified, mainly simplicity derived from traditional Japanese form.

6.19 Japanese designers, Western-style furniture

An interesting point of reference for design for the Japanese market is investigation of furniture designs developed by Japanese designers that often signify an inherent relationship to the aesthetic subtleties of the culture.

It is not the intention to mimic Japanese furniture in this investigation, rather to find a unique appeal through the use of native Australian timbers in conjunction with a ‘Japanese’ style. However, investigation of these forms allows further insights into the visual zone of the culture.
Figure 6.53: Chairs designed by Katsu Masumoto Design Studio 1979

Figure 6.54: Torii shaped chair designed by Keisuke Nakamura 1976 and Cattail chair, by Katsuo Masumoto design Studio

Figure 6.55: Armchair by Sohri Yanagi 1979 and chair (Hapi) by Ternaki Ouhashi 1979

1 Nihon, I & Dezaina, K 1981, To live with lights, interior designs in Japan, Rikuyosha, Tokyo.
2 ibid.
3 ibid.
4 ibid.
The visual appeal of the products depicted above are derived from many visual elements of the Japanese culture.

- Geometric forms
- Organic forms
- Combinations of both.

An overall simplicity of form and structure, with effective but subtle detailing, is an underlying feature of the concepts.

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5 ibid.
6 Kita, T 2001, Toshiyuki Kita the soul of design, Amus Arts Press, Tokyo.
A similar visual appeal is found in chairs designed by Toshiyuki Kita.

6.20 Visual objectives of the chair

Visually, the objectives of the chair were to create a light elegant object, reflecting aesthetic principles of Japanese style, and exploiting the strength properties of the timber. This would produce an object that is simple stylistically and works well visually as a streamlined overall piece. The challenge is that the new joining system must be incorporated, and the chair is able to be flat-packed for transportation.

Visual Literature Review: Japan
Figure 6.58: Visual review of Japanese interiors, exteriors furniture and other objects
Aesthetic direction

The compilation of imagery above was conducted at an early stage of the market focused concept development process.

The images composed show the style and level of detailing commonly found in traditional Japanese homes, and the objects in those homes. The predominant use of timber as a building material both internally and externally in homes and in furniture is shown.

It is acknowledged in the previous market analysis chapter that in new apartment buildings, found particularly in cities such as Tokyo, timber is conspicuously absent. However, timber and its traditional use in homes is a strong identity point for Japanese people, and traditional forms derived from timber application in homes generate strong identities with an overall Japanese style or aesthetic.

The Japanese consumer, existing in an environment where they are often subjected to traditional forms, can become an influential factor that is exploited in this “Japanese” aspect of the design investigation. The combination of the experimental joining methods, and unusual visual appeal of the Australian eucalypt timber provides the point of differentiation to other products on the market.

It is intended that references to traditional Japanese timber forms, combined with unique aspects of design and material, will appeal to the Japanese consumer.

Figure 6.59: The images represented above are types of traditional Japanese joinery. 7

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The detailing and artistry in the joinery, the unusual and decorative use of shape is indicative of the way Japanese treat timber, which is translated into their furniture design.

6.21 Expansion and contraction concept

The expansion and contraction concept was derived from the idea of the secondary location of the four legs (of a chair or a table) with a secondary material at a lower point on the legs, beyond the primary top joint attaching the flat plane or surface to the legs.

Figure 6.60: Exploded sketch of ‘Expansion and Contraction’ concept

Figure 6.61: Expansion and contraction concept chair
As seen in the images above, the primary joint between the seat and leg of this concept is held by an extrusion running the length of the seat, and nesting in an appropriately routed-out front of the seat. This metal extrusion is located into the legs, which are then fastened by a secondary fastening into the seat timber. The legs of the chair are then supported at a lower point by the metal structure, reaching out to the legs from its fastening at the base of the seat.

In theory, this concept allows the expansion and contraction of the laminated boards of the seat structure, and some movement is also accommodated in the legs through the flexible structure of the metal support mechanism. This mechanism has been re-evaluated for the Japan chair.

6.22 Initial concept development
Figure 6.62: Square and geometric shapes can be worked with to create a softer and more stylised appeal

**Component explanations: Seat to leg joint**

The initial ‘expansion and contraction’ joint needed to be re-evaluated for use in the Japanese chair. There were unresolved issues with the seat-to-leg joint proposed in the ‘expansion and contraction’ concept. The way the joint was structured, by using an external extrusion, strength was of concern if the extrusion was pushing the legs out
with the movement of the seat, and one additional fastening mechanism may not have been enough to secure it.

The use of a visible extrusion to hold the seat together is not ideal, while the process of routing slots into the seat sections is labour intensive. A process of refinement was undertaken to strengthen the joint and create a better visually pleasing effect.

Figure 6.63: Re-development of major joint in expansion and contraction process
Initially, ideas were gathered on where the joint was fastened in two directions instead of using an external extrusion, and a solid round metal rod was substituted, running through the timber to hide the connection.

Figure 6.64: Initial joint analysis sketching

The final method that was used for this joint involved pinning the legs to the seat structure by running a rod directly through the seat section. This is important, as it is
non-visual and an improvement on the external extrusion working the same way. It is also important as expansion and contraction of the timber is countered, using the same principle as in the original expansion and contraction concept.

Figure 6.65: Three dimensional diagram showing leg and rod insertion and two dimensional section of the same

The advantage of having one rod running straight through the seat and leg section with no joinery from a second direction is that it allows expansion and contraction of the timber, within a controlled limit, i.e. contained within the length of the rod.
Figure 6.66: Sketch showing the front view of the seat, the rod and threaded ends pinning the chair seat and leg components together

6.23 Rubber section detail

The rod running lengthways through the timber sections in the chair seat allows for some expansion and contraction within the limitations of its length. However, the rod still pins (due to its threaded fastener) the timber at either end and restricts its movement beyond the two end points. This restriction is inevitable, as there needs to be some restriction (fastening) of the timber to create the joint.

As an additional intended design improvement to decrease the problem of movement of restricted timber sections in a furniture joint, it was conjectured that adding a small rubber stopper into the space between the end fastener of the rod and the timber would allow for some flexing and reduce the tension on the chair joint.
Figure 6.67: Sketching above shows initially sketched ideas of this concept

The re-evaluation of this joint resulted in the idea of having a single steel rod running between the legs and seat section at the front and the back of the seat.
Figure 6.68: Assembly of the legs sections would be quiet-straight forward, the legs inserted, the rod pushed through and fastened

Figure 6.69: The rod would then be secured by a threaded cap on each end, providing the containment for the seat board and securing the legs between the boards

6.24 Shape of seat

The requirements for the seat were fairly straight-forward, given the experimental fastening and its impact on laminated timber sections. The front and back of the chair,
horizontally between the two sets of legs required alignment, so that the rod could run through all sections. This was also dictated by the direction of the timber grain, and accounted for the lateral movement of the timber along the length of the rod.

Figure 6.70: Sketching of seat shape illustrating timber and joining constraints
The shape of the seat from above showing timber sections, used in the seat were kept thin to reduce movement as much as possible. The use of short thin sections also creates a design that utilises short sections of timber, which could be useful in the use of fast grown plantation timbers.
*Leg seat joint detail*

The corner of the seat sections creates an interesting visual detail. The shape is partially determined by the placement of the joining sections, however, this was used as a styling element to create a subtle decorative form.
The shape of the seat where the legs are run through at the back to create the backrest located at the front was developed into a point of visual detailing, adding a subtle decorative element to the seat.

The form of this joint section was also partially derived from the structural requirements of the joint. The top of the leg section and the seat section needed to be aligned to allow for the supporting rod to pass through both.

### 6.25 Lower leg support: Metal arms

The metal arm format, integral to the ‘expansion and contraction’ concept, have been refined and re-developed for use in the Japanese chair concept. The metal arms are required to provide structure to the lower chair legs, improving the strength and
stability of the chair without restricting the movement of the timber seat sections, and allowing flexing in the legs and through the seat joint.

Figure 6.75: A sketch showing development ideas for the attachment between the legs (requiring a flush face) and the metal bracing system.

The flat “front” face of the joint in both the seat section and the leg, was dictated by the need for a flat front on the leg, which was accommodated in the form of a flat taper.

**Why a curved metal structure at the base?**

The structure of the metal bracing on the expansion and contraction concept, as the technical forerunner to the principles applied in this concept, used straight arms to attach the metal struts between the seat base and the legs of the chair.
In the Japanese chair concept, these struts were curved up (as shown in the computer-generated image directly above). This curved effect was created in an attempt to make a less obvious and more elegant form, in keeping with the refined and visually simple theme proposed for the chair.

The curved form of the metal also contrasts with the more geometric sections of the chair. This style of contrast between curved and flat elements is often used in Japanese style design.
The image directly above shows how a flat face was required at the front of the leg to allow for a flush finish between the fastener of the metal base structure and the leg surface on the front and back legs.

The legs were to be produced from a turned section of timber, creating a round cylinder tapering towards the base. A flat section was then machined flat on the front face, and rotated to face out at a 45° angle, to accommodate the needs join between the legs.

**Detail of metal fastener**

The metal fastener was required to locate the arms of the support struts, and provide an easy mechanism for assembly and disassembly. As the top section was required to anchor the fastener through the timber, it was decided that it would be best if the structure could then be fastened from underneath. This aspect would allow for the chair to be turned upside down for assembly, and the mechanism fastened and tightened while upside down.

The mechanism was created as a round form as a clean visual effect, and if viewed from the base as a round metal cylinder with the arm struts reaching out at 45° to the front and back of the seat, attaching to the legs.

The fastener and struts have been specified as stainless steel for strength and visual effect.
Figure 6.78: Sketches showing the interaction between the metal arms and their fixing to the base of the timber seat
Figure 6.79: Developmental sketching of metal fastening for the metal arm components of the chair, considering strength of hold and assembly and the final solution.
Figure 6.80: Sketches depicting the final form of the metal arm to seat attaching mechanism
6.26 Legs, front and back

The leg shapes, particularly the front legs and lower part of the back legs, were derived from the need for a flat front face to accommodate the fastener required for the metal struts.

Importantly, a round section was required to be inserted into the seat to create the seat to leg joint. This suggested that the easiest form of production for the leg would be turning, to achieve the stepped-in round section at the top.
Therefore the whole leg was created as a turned section with a taper at the base, as can be seen in the computer generated image of the front leg shown above. A section was then planed off the front, creating a flat taper to best accommodate the metal fastener.

Figure 6.82: Sketches depicting initial development of leg shape for the Japanese chair
Visually the leg shape is fine, with the tapered end providing interesting detail and the effect of the chair lessening in volume and weight as it moves towards its anchor on the floor. The taper in the front provides a second angle on the leg and a second level of detail.

These aspects combine well to provide the simple visual details intended in the theme of the Japanese chair.
Back Legs

To best exploit the strength properties of the Spotted Gum timber, and at the same time contribute to the elegance and simplicity intended in the chair, the back leg and upper backrest support sections were created from one piece.

6.27 Backrest

The backrest plays an important role in the design of the Japanese chair. As the theme of the chair revolved around simplicity and simple detail, the backrest needed to fit this theme while adding an element of appreciation to the chair design.
Attaching the backrest to the back legs was intended to be applied through a simple mechanism, such as mechanical fasteners.
At an early stage, before the form of the backleg had been considered and attaching a curved backrest section to a flat back leg, it was conjectured that a buffer between the two timber sections would be required.

The angle of the back legs was developed (as seen in the sketch above) to accommodate the attachment of the backrest section to the back leg of the chair.
Figure 6.87: Consideration of fastening, and computer generated images, investigating backrest form and attachment
The final form of the backrest was considered to best suit the chair in terms of finding a balance between simplicity and eastern decoration.

The subtle curves in the form invoke an Eastern appeal, while the form is unobtrusive and complements the overall theme of the chair. The backrest form was intended to be cut from a single section of timber.

Figure 6.88: An orthographic view of the backrest component, showing the curved form, intended to add comfort and appeal of comfort to the chair

6.28 Scale

The proportions and scale of the Japanese chair were an important consideration. As discussed in the previous chapters, this was due to the vastly smaller size of Japanese houses and particularly apartments in comparison with most other countries. The proportions of the Japanese chair would be slightly smaller than those used in western countries.
Figure 6.89: Sketched proportions of the Japanese chair

Exploded view

Figure 6.90: Computer generated image showing chair components including metal arms, leg and seat sections
6.29 Assembly

Assembly of the Japanese chair works in four stages:

1. Fitting the legs into the seat section
2. Inserting the rods through the leg and seat sections and fastening
3. Attaching the lower leg bracing (metal arms)
4. Attaching the backrest.
6.30 **Japanese table**

In addition to the development of the Japanese chair, a ‘Japanese table’ was also developed. The principles behind the design of the tables were exactly those applied in the chair adapted to a table format. The table was developed so consumers could gain an understanding of the Japanese chair in a ‘suite context.’
Figure 6.92: Computer generated image: Two to four person table
Two sizes of the table were developed, as the flexibility of the joining system allowed the basic principles to be adapted easily not only to the table design but also to varying scales of tables.

6.31 Final form of Japanese chair

The final form of the Japanese chair achieves the aim of simplicity through minimal detailing in form.
Figure 6.94: Final computer rendered image, Japanese chair

Figure 6.95: Japanese dining with rectangular table

Figure 6.96: Japanese dining chair with square table

6.32 Tolerance explanation: Japanese chair

Tolerances were calculated for the Japanese chair, using the same spreadsheet, created by Mr Gary Hopewell, of the DPI&F (as was conducted for the German chair). However, in this instances, Japanese cities, Sapporo, Tokyo, Fukuoka and Sendai were used to gauge extreme EMCs’ on which to base tolerance calculation for the Japanese chair. An example for Sapporo is given below.
### Country: Japan
### City: Sapporo

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<th>Feb</th>
<th>Mar</th>
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<th>July</th>
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<th>Sept</th>
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<tr>
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<tr>
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<td>63</td>
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<td>77</td>
<td>71</td>
<td>67</td>
<td>66</td>
<td>68</td>
</tr>
</tbody>
</table>

- **Yearly Average Temp.:** 10
- **Yearly Average RH.:** 68
- Yearly Average (EMC): Outdoor = 13, Indoor = 11

**Extremes**

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<th>RH</th>
<th>Indoor EMC</th>
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</tr>
<tr>
<td><strong>Extreme RH</strong></td>
<td>High</td>
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<td></td>
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Figure 6.97: Movement extremes for Sapporo, Japan

### 6.33 Chapter Summary

As discussed in the introduction, this chapter undertakes the task of explaining how the market and cultural research previously undertaken has been applied in a design application, to direct decisions made in the furniture design process for both the German and Japanese markets.

In attempting to achieve this, a summary has been given of market and cultural attributes before discussion on influential elements of the design process is
undertaken. In addition to aesthetic decision discussion, technical requirements of the given design requirements have been refined into coherence with the function and aesthetic requirements of the market led design decisions.

Much of the development in this chapter has been illustrated through sketch work and the attempts to annotate the sketch work and discuss the process through which the designer has worked give insight into the aesthetic and technical decisions given throughout the design process.

Analysis of earlier market led designs, which were not taken through to the prototype stage are an important aspect of this chapter, as the pieces which are analyzed as to their positive and negative attributes create the stepping stones of knowledge and analysis that led to the final design outcomes.
Chapter 7
Prototype making process: Japanese and German chair

7 Introduction

This chapter will discuss the components that were produced, how they were produced and the assembly of the chairs designed (i.e. the two preferred concepts as outlined in the previous chapter) for exhibition. Difficulties were encountered with the design in the prototyping process and in some instances parts of the chairs were redesigned for better performance.

Ideally, the prototypes created for this investigation would have been developed in conjunction with one or several Queensland furniture manufacturers. However, time constraints and logistical difficulties made this preferred option an impossibility. As a result, the components required were sourced from appropriate manufacturers in Victoria. The chairs were assembled and finished in the Swinburne Faculty of Design workshop.

The first chair prototyped in this investigation was the German chair, and exhibited in Australia at the Cooroy Contemporary Furniture Exhibition of which the DPI&F were a primary sponsor. Producing a prototype of the German chair in the relevant materials highlighted several problems in the concept of this chair, and served as an important learning process for following prototype development. The German chair was re-developed and re-prototyped and the Japan chair prototyped for Exhibition at the IFFT 2004.

7.1 German chair (1): Legs
All turned leg components were produced by Karem Woodcraft, wood turners. The major part of each leg was turned in one section, and the recessed section then required some hand finishing to create an appropriate flat edge to accommodate the metal bracing system. As discussed in the previous design chapter, two different section sizes of leg for the German chair were trialled.

7.2 Bending process

As there were such a small quantity of bent components, and the bend required was fairly subtle from a standard section of timber, it was decided the bending could be conducted through a fairly simple set up in the Swinburne workshop.
Figure 7.3: Annotations on the sketch describes the layout

- Water container
- Steam generator/Cleaner
- Hose to transport steam
- Metal tube (chamber for holding steam around the timber)
- End boards, to contain the chamber
- Cut-away view
- Holders for the timber section.

Figure 7.4: A side section of the chamber used for steaming

The timber sections were placed into the metal cylinder. The end blocks were then clamped into place to prevent excessive steam and heat loss. The steamer nozzle was then placed into a custom-made hole in the top of the tube, and steam pumped in. The nozzle was lined up with the section of the timber where the bend would take place, allowing it to gain the greatest amount of heat and moisture saturation.
Steaming process used - splitting and finishing

In some pieces, (where the highest pressure on the wood fibers occur) some splitting of the timber occurred. This did not happen in all pieces. Several factors could have contributed to these splits, e.g. the steam flow being inconsistent, or interruptions if the steam was halted due to workshop breaks.

As a rule of thumb, a 25 mm by 25 mm section of timber should be steamed for at least one hour to provide an appropriate result for steaming. The thickest section on the thickest German chair leg was a circular section with a diameter of 30 mm which should be steamed for at least one and a half hours approximately.

Figure 7.5: The steamed piece of timber was then placed in an appropriately angled former

Figure 7.6: Photograph of chair legs in a drying rack
Figure 7.7: Where splitting occurred, and the leg sections were required for use, the splits were filled, with off the shelf timber filler and photograph showing working with filler on splits in the bent leg section

7.3 Metal arms

Figure 7.8: Warping encountered in initial metal arms

Problems were encountered on the metal arms for the prototype. The sections were laser cut from stainless steel, and the fine dimensions required created problems as the heat from the laser warped and bowed the metal. This problem made the arms difficult to use, as they had to be manipulated into alignment on assembly.

A second batch of arms were requested, however, the first batch were used for the first German chair as the prototype was required for the Cooroy Contemporary Furniture Exhibition as mentioned in the introductory section of this chapter.
Between the seat and metal arms, there was an issue with having the seat angled properly when located on top of the arms.

A connector from Hafele was used as the main fastener, with the threaded screw locating into a custom end. This fitting can be seen in two representations in the photograph above.

The first shows how the end of the fitting presses into the metal arm, representing what would be viewed from underneath the chair. Above it is the mechanism, and the components that were used to support the seat. This arrangement caused some difficulty in assembly as the components were separate and difficult to align. If the chair was to go into production, a simplified arrangement would need to be developed, such as an angled rubber stopper.

### 7.4 Seat and backrest

The plywood components were produced by David Emery, a furniture designer-maker located at Kyneton, Victoria.

The ply elements were produced by 9-ply 1 mm veneer section with a Tasmanian Oak fiddleback finish veneer, which created a striking striped effect across the seat top. For the small scale production requirements of this prototype, a base mould was created and a vacuum suction used to pull and hold the components down around the mould. The same process was used for the seat and backrest components. The components were then cut to size, sanded and finished.

The Tasmanian Oak veneer is light in colour, creating a contrast with the Spotted Gum timber sections.
Figure 7.10: The fiddleback detail can be seen in the seat top. Circular sections on all corners were cut as a secondary process, allowing the seat to be slotted over the top of the chair frame for assembly.

Figure 7.11: The image above shows the subtle curve of the seat surface, and the screw ends are countersunk into the seat top, creating a flush finish with the seat surface.

Figure 7.12: Machining the plywood seat and the process for drilling and countersinking the holes in the top of the seat required for fastening.

Figure 7.13: The backrest made from 9-ply 1 mm Tasmanian Oak veneer with a regular finish.
Figure 7.14: From above, both the bend in the back leg and backrest can be viewed

Figure 7.15: As a finishing effect, the ply backrest struts were detailed to curl around the timber leg. This also worked to create a structural parameter, guiding the back legs between two points at the top of the chair

Figure 7.16: The effect of the curling backrest and the subtle curves in the backrest struts and back rest, as seen from behind

7.5 Leg bracing components

The leg bracing components were designed with a hook end to be attached to the outside of the chair legs, following the theme of the “hooked” metal components at the top of the joint.
However, due to a misunderstanding between the drawings sent and component producer, the parts were sent minus the hooks. Consequently, pilot holes were drilled in the legs, and for the case of this first particular prototype was sent to the Cooroy Contemporary Furniture Exhibition in Queensland assembled.

![Images of the turned components that were used for supporting leg struts in the German chair](image1)

**7.6 Assembly**

The assembly of the chair was quite straight forward, however there were further difficulties due to the warping of the original set of metal arms in the laser cutting process, as was mentioned earlier.

![The image above show two stages of the assembly process.](image2)
Figure 7.19: The images above show the screws being located and pressed into place

**Finishing**

Figure 7.20: The leg and plywood components were sanded before oiling and waxing

7.7 The first prototype of the German chair

Figure 7.21: The first prototype of the German chair
Issues raised from the development of this prototype were that it was not structurally sound, and conjectured reasons were:

- Warping in arms not locating the legs correctly
- Leg bracing beneath not appropriate (specifically as a flat pack product)
- Section sizes giving a look of fragility

Figure 7.22: Further photographs of the first chair, views from behind, and below

**Cooroy Butter Factory, Contemporary Furniture Exhibition**

Figure 7.23: The German chair on display at the Cooroy Contemporary Furniture Exhibition

This chair was exhibited as a part of the Cooroy Butter Factory’s Contemporary Furniture Exhibition that is held annually in Cooroy, in the Noosa Hinterlands, in Queensland. The Exhibitions opening night was sponsored by the Department of Primary Industries and Fisheries.

7.8 **Re-evaluation of German chair prototype**
After exhibiting at Cooroy, it was realised that the German chair would need some re-development before it was exhibited in Tokyo. The two major problems which had been identified with the first German chair prototype were the metal arms, which provide the seat to leg joint of the chair, and the supporting rungs below them.

There was limited time before the Tokyo exhibition to re-develop the chair, therefore existing components (such as the turned leg components) were used where possible. It was important to retain the form of the chair, due to market parameters that had been identified as important in the design development process.

It was apparent that by doubling the width of the arm from 5 mm to 10 mm that the problem of warping was resolved, and the quality of the second batch of arms was far superior. However, when the new arms were tested on the chair model, they did little to improve the structural properties of the chair.

![Figure 7.24: A comparative photograph of the first two sets of metal arms](image)

The problem was identified as being related to the hooked end joint. The overlapping effect of the arms meant that the two hooks could not wrap around the leg at the same level, as each hook was offset vertically by the thickness of the metal arm (5 mm).

This was causing two problems. On each leg there was a gap on one side where the top hook was located, and the legs were inclined to tilt towards this unsupported area. Also, the difficulties in getting a precise diameter on the recessed section of the timber leg was not accounted for. Due to difficulties encountered in getting the correct dimension on the leg, the hook did not always bite into the timber and provide a snug fit as intended.
The metal arms were not thick enough to provide adequate structure, and the hook end was not flexible enough to adjust with the movements in the timber as intended.

7.9 Metal bracing re-development

The legs of the chair had already been produced; it would be too difficult to have them re-made with a wider recessed section before the Tokyo Exhibition, so another joining mechanism was needed to improve the joint quality of the German chair.

The issues encountered in the previous prototypes led to the conclusion that the area which secured the top of the leg, needed to fill the entire recessed section of the timber leg, to give better bite and structure. It must be adjustable in a more refined way than the ‘hook’ concept, to better allow for the expansion and contraction of the timber.
The idea of ‘filling’ the entire recessed section of the leg component vertically, which had been recessed to accommodate the ‘hook sections of the original arm design was the aim of the re-development. Filling the recess will disallow much of the movement that was causing structural problems in the initial German chair prototype.
Figure 7.26: Investigation of interlocking clamping components
Figure 7.27: Further exploration of interlocking bracing
Figure 7.28: After some preliminary sketching, the idea for the re-fabrication of the metal component was refined using computer layout programs.

One of the issues that arose at this stage was how to hold the screws and end nuts that locate the seat. A solution was kinking the metal around the diameter of the nut, at the appropriate points along the length of the arms from the centre, creating a pincer effect between the two arms and clamping the nut in position. When in place, this will not only hold the nut but give more room between the two arms for the tightening process that needed to be available for adjustment around the timber leg.

Figure 7.29: Computer generated images of the new metal joining mechanism.
The computer-generated images above show the final design, the interlocking arms, the locating nut, position and kink in the arms to accommodate the locating nut, and the secondary screw and nut combinations running horizontally between each clamping end for each four legs. This importantly allows the clamping ends to be tightened in around the shrinking timber.

The production of the arms was going to take longer than the timeframe left for the chair. Therefore a compromise in design was reached and the prototype fabricated in-house at the Swinburne workshop. The design remained identical, with the exception of the interlocking parts in the centre, where a ring was substituted and the arms welded to the sides.

Figure 7.30: Refined bracing form
The final metal prototype, produced from mild steel strips, bent and welded into shape, the “c” shapes on the ends of the arms were turned from solid steel rod and welded onto the arm end. The prototype needed to be welded at several points, and after the welds were filed back, the structure was then polished clean for exhibition.

![Figure 7.31: Photograph, of final metal bracing form](image)

Figure 7.31: Photograph, of final metal bracing form

The photographs above show the components used to tighten the metal arms around the chair legs and locate the seat.

![Figure 7.32: Photographs of components used to tighten the metal arms around the chair legs and locate the seat](image)

Figure 7.32: Photographs of components used to tighten the metal arms around the chair legs and locate the seat

A view of the seat from underneath and Image of the metal joining component, with seat lowered on top.

![Figure 7.33: A view of the seat from underneath and Image of the metal joining component, with seat lowered on top](image)

Figure 7.33: A view of the seat from underneath and Image of the metal joining component, with seat lowered on top

7.10 **Lower bracing**

It was mentioned earlier in the chapter that there were difficulties encountered in the design and production of the lower leg bracing struts. There was insufficient communication between designer and manufacturer, and the struts consequently were incorrect and glued into place for the first German chair prototype.
From the difficulties encountered in the production process of these parts, and the realisation on analysis that the initial concept for their attachment was not have best solution, a new lower bracing method was investigated.

Figure 7.34: The computer-generated image above shows early concept development involving a crossing structure underneath the chair.
The idea of using a ply or metal interlocking brace underneath the chair was suggested. It was investigated as it could be potentially made from two materials that were already featured in the chair. It could add another decorative element to the chair and potentially improve the structure.

![Figure 7.35: Orthographic views of the new lower bracing development](image)

The ply wood leg components were also produced by David Emery in Kyneton using Tasmanian Oak 9 ply 1 mm veneer. Slots were then cut into the arms to allow them to be interlocking.

![Figure 7.36: Photographs showing the final components and assembly for the lower bracing](image)

![Figure 7.37: Computer generated images: the new look German chair](image)
Figure 7.38: Computer generated image, viewed from the underside showing new joining and bracing development

Thicker leg components were used for the prototype.

Figure 7.39: Photographs of the ‘thicker leg components (front and back) which were used in the development of the German chair for Tokyo

**Final Chair for Exhibition in Tokyo**

Figure 7.40: Photographs of final German chair for exhibition in Tokyo
7.11 Japanese chair prototype

Fewer issues were encountered with the prototyping of the Japanese Chair than with the German chair. There were two sets of parts required for the Japanese chair, those made from timber and those made from stainless steel metal.

John McLennan, a furniture designer and maker, with factory and studio ‘Makers on Mair’ in Ballarat, Victoria, produced the timber components of the Japanese chair. Feedback from Mr. McLennan was very valuable in ascertaining the appropriateness of the chair design and the difficulties in production.

![Figure 7.41: The components required for the Japanese chair are shown in the photograph above](image)

7.12 Legs

![Figure 7.42: The leg components of the Japanese chair](image)

The leg components were turned with sections planed on one face of the lower leg half and two faces of the upper back rest half. Mr McLennan raised the issue that it
was difficult to plane the surfaces right to the edges of where the leg interlocks with the seat as indicated in the drawings, as it is difficult to get a good finish on the edge.

This issue was solved by finishing the tapers lower from the central position than was first anticipated.

![Figure 7.43: The front legs are the same as the lower section of the back leg. The holes for the locating arms, front and back, can be seen drilled into the front leg sections in this image](image)

**7.13 Seat**

![Figure 7.44: Laminated seat of the Japanese chair](image)

The seat, as discussed in the design chapter, was made up of laminated sections, with a gradual curve to create comfort. The laminating of the sections worked successfully structurally and visually in the Japanese chair prototype.

Although adhesives were avoided in the main joints in both the chairs, a laminated butt jointed seat was created for the Japanese chair. The adhesive recommended by AV Syntec for edge to edge gluing, e.g. tabletops, where the glue line creep is likely
to be result in visual problems, is AV203, modified urea formaldehyde, and this was used in the prototypes. The experimental theory behind the use of laminates sections was explained in the previous market oriented design chapter.

![Image](image1.png)

Figure 7.45: Another problem with the seat design is that the rod needs to run right through the seat, creating a difficult drilling depth in production.

The initial design specifications were for the segments of the seat to be cut and drilled separately. However, precision caused a problem here, because the precise alignment of the holes proved difficult as the tolerance allowed for the metal rod was small.

![Image](image2.png)

Figure 7.46: Detail of the chair: the top shows where the rod is inserted and held with threaded screws on each end.

### 7.14 Backrest

The backrest component (in a similar way to the seat component) worked well structurally and visually in the Japanese chair. However due to the grain direction that needed to be worked to cut the component from the timber, it was difficult to create in a production sense.

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The short grain direction on the ends also made attachment of the backrest sections to the back legs quite difficult.

Figure 7.47: The backrest, with the short grain sections towards the ends seen in the photograph.

Figure 7.48: Visually the form and attachment of the backrest works well with the chair, leaving several options for re-evaluation of the part to better suit the material and production requirements.

Figure 7.49: The curve in the backrest component from the flat ends of the backrest sitting against the tapered flat face of the back legs worked well, a feature to be exploited in the re-evaluation of the chair.

Figure 7.50: Stainless steel fastening component.
The stainless steel component that gathers and fastens the arms underneath the chair. (Gathering component) shows:

- The top section is the screw that is fed through the seat top
- The large centre section has circles drilled out to allow for the metal arms to slide into place within the component and become located
- The third section screws into place at the bottom, fixing the entire arrangement.

Figure 7.51: The rods that are inserted through the seat and leg sections of the Japanese chair create the main seat to leg joint

Figure 7.52: The arm struts which locate between the legs and central joining point under the center of the seat

An upside down view of the chair with the metal components assembled underneath, shows that the assembly of the chair was straight-forward. The top screw of the ‘gathering component’ is threaded through the seat, the chair then turned upside down, the arms gathered in from their position in the legs to the channels allocated in
the second part of the ‘gathering component’, and the third part of the ‘gathering component’ then screwed into place, securing the arrangement.

The sections in the gathering component where the arms were gathered and contained were deliberately not to the full depth of the arm diameter, so that the mechanism could be ‘tightened up,’ pressing the arms into the underside timber of the laminated seat.

This idea was not successful; the timber was too hard to press into, reducing the area for the third ‘gathering component’ part to screw into. In addition, the joint between the metal arms and timber legs was too loose, allowing the legs to slip backwards and forwards lightly on the timber legs.

*Chair for Exhibition in Tokyo*

![Figure 7.53: The final Japanese chair for exhibition in Tokyo](image-url)
7.15 Chapter summary

The prototyping of the chairs was a learning aspect of the project, particularly in the area of the technical performance of the timber when processed, and the testing of the technical aspects of the designs for their practical success or otherwise.

The opportunity to exhibit the German chair in Queensland before it was taken to overseas exhibitions was also a valuable step in the refinement of the products and therefore the project. The Cooroy exhibition offered the opportunity for public display and therefore consumer feedback on particularly technical but also aesthetic aspects of the design.

As in the previous design development chapters, the production process detailed in this chapter was displayed through sketching, computer generated images and finally photographs. This imagery, combined with the written annotations is intended to divulge the thought processes and assessment of problems found by the designer to the reader in the most transparent manner possible.

This chapter also allows the chairs to be seen for the first time in the actual incarnation of the physical products, and therefore they can be seen and assessed as such. This was very beneficial in gauging the strengths and weaknesses of each design.
Chapter 8
Exhibiting process, Tokyo and Milan

8 The Method: Testing

Appropriate pre-design market information had been created as a prelude to the design of the Japanese and German chairs. Exhibition of the chairs, in or as close to the appropriate markets as possible, would provide information the success or otherwise of the chairs designed, in their intended markets.

Furthermore, the exhibition process would a new contribution to knowledge through:

- Overall evaluation of the two chairs placed into each market
- Comparison of the positive and negative qualities of the two chairs
- Appropriateness of the chairs for each of the markets, and if inappropriate could they be altered to make them appropriate?
- Information on each of the markets in which the chairs were exhibited
- Opportunity to gain privileged knowledge with regard to the design of the two chairs that can be documented and further extended into other design opportunities
- Value of following a market-specific design strategy, and what was achieved from the process
- Testing of new processes in design, and market appreciation research in the furniture and forestry industries in Queensland
- What could be improved to make the process of market-specific design better, or identification of a more appropriate procedure?

*It is important to note that the analysis in this chapter contains raw data only and no further statistical interpretation has been attempted. This is the case because it was deemed more important to gather opinions and interpret them from the point of view of a designer and therefore determine what the outcomes could contribute through design interpretation to industry.*
The data included in this chapter should give an indication of trends (for design knowledge) not a statistical conclusion from a market research perspective.

8.1 Exhibition process

As international exhibitions are difficult and expensive to undertake, I was fortunate to have the Japanese and German chairs represented in International Furniture Fairs in Tokyo, Japan and Milan, Italy. Ideally, the second choice of exhibition for the chairs would have been Germany. However, as the opportunity arose to exhibit the chairs in a European city and to complete the proposed method, the merits of the Milan Furniture Fair, one of the largest in Europe, were gratefully accepted.

In this section of the thesis, the exhibitions, their circumstances and qualities will be discussed. Also the information generating process that was undertaken, and why information-seeking discussions were held will be explained.

An explanation of results from the information gathering process will be represented in tables and graphs of each discussion question and area of interest. Finally, an analysis of that data and what it means in terms of design and the project method will be presented.

8.2 How the information collected has been treated

It has been discussed in the method segment of this thesis why specific markets have been targeted for design development, rather than a global market approach, the parameters of comparison created by the qualities of the chairs, each designed for a specific market. The comparison of these qualities provides the insight as to the appropriateness of each design for its intended market.

The information generated through the exhibiting process undertaken in this investigation is qualitative design information. To explain this, key market factors have been integrated into the design of two chairs, which were then being tested as to market preference. The aim was to establish successes and failures in the market
information and design development process of the chairs, and as a final stage of the method, re-design the chairs on the basis of the privileged information learnt.

In this chapter, it will become apparent that the results of the surveying process have been quantified to establish the qualitative information required for the re-design of the chairs.

**8.3 Cultural differences: what must be taken into account?**

In the collation of the qualitative information desired as a result of this testing process, some allowance for cultural differences must still be taken into account.

According to Jim Miller, businesses considering launching new multi-country products should note that, “Different political and economic conditions come into play, as well as cultural differences that may influence consumers’ responses to the new initiative, or the way that they talk to researchers about it.”¹

Miller believes that it is important to interpret what consumers tell us in the context of their demographic profile. For example, he states that “respondents with a higher degree of education overstate to a lesser degree than those with fewer years of experience. Likewise we have observed dramatic country to country differences in the way that consumers evaluate new product initiatives, that is an overall level of overstatement is unique to each culture which must be taken into account when determining chances for success in different countries.”²

These discussions are relevant to Simulated Market Tests (STMs) where quantities data is collected and recommended, with an error range of + or – 20% due to cultural differences and tendencies to overstate. In this investigation, it is difficult to gauge cultural difference, or give it an error rating due to the nature of the information sought (i.e. re-design information, rather than market entry information) and the multicultural representation at the Milan Furniture Fair.

² ibid. p.
However the points for analysis in this testing scenario were the appropriateness and design features on the chair. These were carefully approached, especially where seeking negative aspects of feedback, in the best attempt to gauge an honest response and gain the most value from those questioned.

Throughout this chapter, comparative difficulties between the demographics of attendees at the two furniture fairs are discussed wherever possible.

8.4 The exhibitions: International Furniture Fair Tokyo

The International Furniture Fair Tokyo (IFFT) has been held annually for the last 25 years. The Fair is primarily business-oriented, with Japanese interests including manufacturers, local distributors and importing and exporting companies attending either with the intention of buying new pieces of furniture to distribute from their retailing outlets, or to gain ideas, make contacts and keep up to date with industry developments.

The IFFT was deliberately chosen as a place of exhibition for this investigation because of its direct links to the desires of those in the Japanese furniture industry. For the purpose of the project, it was imperative to get the opinions of this particular group of people, to establish the best grounds for market viability of the products tested.

Due to limited time and language restrictions, the discussion topics were kept quite short and questions asked pertained to issues of the required comparisons and marketability of the specifically designed products and timber. The IFFT 2004 ran for four days from 24 to 27 of November. The first two days are for industry interests and the third and fourth for industry, the general public and students.

8.5 Salone Satellite: Isaloni, Milan Furniture Fair

The Salone Satellite Exhibition an (extension of the Isaloni) often referred to as the Milan Furniture Fair (MFF,) ran between 13 and 18 April 2005. The Salone Satellite
is the second international venue where the Japanese chair and German chair were exhibited.

The Milan Furniture Fair is one of the biggest and most renowned furniture fairs in the world, where exhibitors representing various countries, particularly leading Italian furniture manufacturers, display their products to an international audience.

The Salone Satellite is an event of the Isaloni, MFF, located in a separate pavilion within the main fairgrounds, giving a unique and important display of the work of young designers. The organizers describe the Salone Satellite, as the “planet of youth and creative vision and the point of encounter between today’s most important manufacturers and promising young designers.”

Exhibiting in the Salone Satellite were over two hundred designers and twenty-four design schools. Swinburne University of Technology, National Institute of design was invited to exhibit at the Salone Satellite in 2005, and this opportunity was taken by the design school.

8.6 Important differences: The varying contexts of International Furniture Fairs

The Salone Satellite is a vastly different context of exhibition to the International Furniture Fair Tokyo. The IFFT was purpose selected as an exhibition appropriate to this investigation. Funding to stage an exhibition of the Japanese and German chair prototypes at the IFFT was sought and received for this purpose.

The IFFT was chosen as the most appropriate exhibition for this investigation, because it is a commercial furniture fair, and attendees of that fair would be furniture buyers and distributors that would supply the most appropriate response to the chairs for the needs of this investigation.

Ideally, the second point of exhibition for the investigation would have been in Germany. However, to undertake an international exhibition requires a vast deal of work and expense. Due to timing and funding, it became apparent that an exhibition

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3 Anon. 2005, Isaloni Catalogo generale 13/18.04.05, (Milan Furniture Fair catalogue,) Milan, Italy.
in Germany was not an option. As the National Institute of Design had been invited to exhibit at the Salone Satellite in Italy, the opportunity was taken to exhibit the two chairs in an international and more importantly European market context.

8.7 Immediate comparisons: Tokyo and Milan

The IFFT is a trade show where Japanese buyers and distributors attend to purchase products and do business in a serious context. The Isaloni/MFF is also a trade fair for buyers and distributors. However, the Salone Satellite as an extension of the Isaloni is a more experimental environment. It is a requirement of products exhibited in the Salone Satellite that they are not in production, i.e. they are in the initial prototype stages of development.

The most important difference to realise beyond the general contexts of the two exhibitions is the type of attendees they attract. Manufacturers do visit the Salone Satellite, however, the vast amount of interest that it generates is from the global design community.

Although the context and attendees of the Salone Satellite were quite different to that of the IFFT, this further surveying process was valuable in finding a preference between the two chairs for the European, if not specifically German market. Further differences can be found between the Japanese and European markets, by virtue of the more specific details of the responses gathered in the ‘positive and negative’ elements of the chairs.

8.8 Japan: International Furniture Fair Tokyo
Figure 8.1: CRC Wood Innovations stand at the IFFT

Figure 8.2: The CRC Wood Innovations stand during business hours at the IFFT
8.9 Who was targeted for information?

As the IFFT is a business oriented fair, the main patrons of the event were buyers, manufacturers, designers, importers and exporters, and furniture retailers. Those who passed through the IFFT in the first two days were generally limited in time and attending the IFFT with particular objectives. In the second two days, students and the general public also attended.
There were few people attending the fair who were confident in speaking English, so the vast majority of the surveying was done through a Japanese translator. As the majority of attendees had limited time, it was often difficult to engage their conversation for very long. However, very successful discussion was undertaken and research results were achieved in satisfactory quantities.

8.10 Discussion

The nature of trade shows, as the name would suggest is to sell and trade. However, companies often use trade shows as a means of gaining feedback on new products. The information required is generally gathered by manufacturers or those presenting the product through informal discussions. Generally those attending the show will not stop at a stand if there is nothing of interest to them on that stand.

A series of questions was developed, to be integrated into discussion with those who showed an interest and came onto the stand, and notes on the responses to these questions were taken. This process was devised to give the most succinct feedback that could be used to analyse the design theories posed in the research project.

In Tokyo, the discussion was mostly undertaken through verbal questioning by our translator and in some instances by myself and other colleagues attending the stand. The questions were as follows:

*Consumer discussion questions for International Furniture Fair Tokyo, November 2004.*

1. **Age**
   - Occupation
   - Nationality
   - Gender
2. **Which dining chair do you like better and why?**
3. **What do you like or dislike about either or both of the chairs?**
4. **Would either of the chairs be suitable for Japanese homes? Why or why not?**
5. How much money would you expect to pay for either one of the chairs?
6. Do you like or dislike the timber used in the chairs, and why?

and Other suggestions made through the course of the questioning

It was imperative to know why people had reactions and opinions on the products that they did, by asking consumers to give a numbered rating as to appropriateness. It was considered that further explanations into reasoning and issues would not have been explored. It was surmised that it was more likely to extract these opinions in conversation where people were more relaxed, rather than the formality of a written survey.

It was decided that informal verbal discussion would be the most appropriate way of providing the required information, rather than attendees being asked to write answers to questions. To ask people to fill in a survey while they have limited time to see exhibits in a trade fair would most probably lead to people declining the survey, particularly those buyers and distributors who attend trade fairs on a purely business basis.

8.11 Questions were asked for the following reasons

1. Age
   Occupation
   Nationality
   Gender

The occupation and nationality of the person surveyed was obviously very important. As would be expected, the vast majority of those surveyed were Japanese. The age of the people surveyed was also deemed as important for demographic comparison.

Due to the approximate recording of age and gender, some breakdown of preferences could be established between different age groups and gender preferences.
It must be considered that persons involved in the furniture industry again will have different requirements and expectations than those of the general public. Distinctions between directional advice given by experts in their respective fields and generally interested parties will be made where possible.

2. *Which dining chair do you like better and why?*

Which chair do you like better and why is the first and most obvious question for the market comparison requirements. Those surveyed were left deliberately ignorant about which chair was designed for which market.

A first impression as to preference was taken, which was then followed up with and enquiry as to why that was the preferred chair.

The feedback on this first and candid analysis was important to the overall preference information gathered.

3. *What do you like or dislike about either or both of the chairs?*

Understandably this was a more ambiguous question but important to draw out opinion on the less desirable as well as more successful elements of the preferred or non-preferred chairs.

Asking people what they didn’t like about the chair when they were more at ease was important, because of the fact that people were not always willing to volunteer negative information, due to politeness.

Finding the negative elements of the designs was important information to be obtained for the re-design phase of the project.

4. *Would either of the chairs be suitable for the Japanese? Why or why not?*

The chairs designed for this project were not specifically designed with a space-saving intention. This design decision was based on the assumption that most of the
higher end chair products in the Japanese market do not have features such as folding and stacking, and also there were already other prerequisite design challenges with the unusual technical elements of the timber and the flat-packing requirement for export.

Areas such as design appropriateness, colour of timber, other materials and size of products are all considered in this question.

The sizing of the chairs also came into concern in these questions. The chair designed for the Japanese market was deliberately scaled smaller that the chair designed for the German market, and thus had an inherent advantage in this sense.

5. How much money would you expect to pay for either one of the chairs? (Would you buy these chairs)

It was appropriate to ask this question to gain an understanding of the value that consumers placed on the products and where the product sits in the market.

As the products were designed to be flat packed for export, a form of furniture more common to lower end furniture although not such a popular option in Japan, it was interesting to see whether the furniture had avoided this category.

This pricing of the product would also be very dependant on branding and promotion, a point that was reiterated though the surveying process.

Do you like or dislike the timber used in the chairs, and why?

As the particular timber was Queensland Spotted Gum, the target timber of the project for various reasons and used to produce both chairs, many of the structural and aesthetic elements of the chair were based on its unique properties.

Gaining feedback on the perceived acceptability was appropriate information to provide to Australian manufacturers who may potentially use the timber in production.
It also opened up discussions as to what preference the Japanese consumers have concerning timber, which is relevant information to those companies considering Japan as an export opportunity.

8.12 Question 1: Analysis of results

**Overall statistics**

<table>
<thead>
<tr>
<th>Nationality</th>
<th>No. of people</th>
<th>Percentage of people by general nationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese</td>
<td>53</td>
<td>97%</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>55</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.1: Overall statistics (Tokyo), nationality

<table>
<thead>
<tr>
<th>Gender</th>
<th>No. of People</th>
<th>Percentage of each gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>32</td>
<td>59%</td>
</tr>
<tr>
<td>Female</td>
<td>23</td>
<td>41%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>55</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.2: Overall statistics (Tokyo), gender

**Work groups**

<table>
<thead>
<tr>
<th>People in the work groups</th>
<th>People</th>
<th>Percentage of people per work group.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buyers/Importers/Exporters/Retailers - professional</td>
<td>17</td>
<td>31%</td>
</tr>
<tr>
<td>Designers/Architects Professional</td>
<td>11</td>
<td>20%</td>
</tr>
<tr>
<td>Manufacturers - Professional</td>
<td>9</td>
<td>16%</td>
</tr>
<tr>
<td>Students/General public - Others</td>
<td>18</td>
<td>33%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>55</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.3: Overall statistics, people in work groups (Tokyo)

<table>
<thead>
<tr>
<th>Professionals vs. non-professionals surveyed</th>
<th>No. of people</th>
<th>Percentage of professionals vs. non professionals</th>
</tr>
</thead>
</table>


Professionals | 35 | 65%
---|---|---
Non Professionals | 20 | 35%
TOTAL | 55 | 100%

Table 8.4: Overall statistics, professionals vs. non professionals (Tokyo)

<table>
<thead>
<tr>
<th>Professionals per gender (Male)</th>
<th>No. of people</th>
<th>Percentage of male professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>29</td>
<td>91%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>32</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.5: Overall statistics, professionals: Male gender (Tokyo)

<table>
<thead>
<tr>
<th>Professionals per gender (Female)</th>
<th>No. of people</th>
<th>Percentage of female professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>8</td>
<td>35%</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
<td>65%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.6: Overall statistics, professionals: Female gender (Tokyo)

**Overall preferences**

<table>
<thead>
<tr>
<th>Overall Preferences</th>
<th>People</th>
<th>Percentage preference per chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred the German Chair</td>
<td>27</td>
<td>49 %</td>
</tr>
<tr>
<td>Preferred the Japan chair</td>
<td>18</td>
<td>33 %</td>
</tr>
<tr>
<td>Did not offer and opinion</td>
<td>10</td>
<td>18 %</td>
</tr>
</tbody>
</table>

Table 8.7: Overall preferences (Tokyo)

**Gender preferences**

<table>
<thead>
<tr>
<th>Gender overall preferences</th>
<th>No. of people preference for German</th>
<th>% preference for German chair</th>
<th>No. of people preference for Japan chair</th>
<th>% preference for Japan Chair</th>
<th>No. of people not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
</table>

---

---
<table>
<thead>
<tr>
<th>Chair</th>
<th>Female overall</th>
<th>13</th>
<th>24%</th>
<th>10</th>
<th>18%</th>
<th>0</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male overall</td>
<td>15</td>
<td>27%</td>
<td>7</td>
<td>12.5%</td>
<td>10</td>
<td>18%</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.8: Overall gender preferences (Tokyo)

<table>
<thead>
<tr>
<th>Female preferences/professionals vs. Others</th>
<th>No. of people preference for German chair</th>
<th>% Preferences for German chair</th>
<th>People preference for Japan chair</th>
<th>% Preferences for Japan chair</th>
<th>People not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>5</td>
<td>22%</td>
<td>3</td>
<td>13%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Others</td>
<td>7</td>
<td>30%</td>
<td>8</td>
<td>35%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 8.9: Female gender preferences (Tokyo)

<table>
<thead>
<tr>
<th>Male preferences/professionals vs. Others</th>
<th>No. of people preference for German chair</th>
<th>% preferences for German chair</th>
<th>No. of people preference for Japan chair</th>
<th>% preferences for Japan chair</th>
<th>No. of people not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>13</td>
<td>41%</td>
<td>6</td>
<td>19%</td>
<td>10</td>
<td>31%</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>6%</td>
<td>1</td>
<td>3%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 8.10: Male gender preferences (Tokyo)

**Analysis**

- Almost 60% of those whose opinions were sought were male the vast majority of people spoken with were Japanese.
The largest group of people were those falling into the category of professional males, from the main groups categorised above of the 29 people spoken with, professional males accounted for 53%.

The number of professional males far outnumbered those males attending the furniture fair on an unofficial basis, with 29 professional males as opposed to only 3 in the other category. There was less discrepancy between the female groups, with eight attending on official business, and 15 female visitors falling into the other category.

This statistic is important, as the buyers and distributors whose opinions on the products are particularly sought, are in the professional category.

All groups involved in discussions preferred the German chair to the Japanese chair, with the exception of women in the ‘other’ category who preferred the Japanese chair. There was a very close comparison to those who preferred the German chair (8 to 7 preferences respectively.)

This is fairly conclusive that the German chair would be the more popular of the chairs if placed on the market at that time.

While the Japan chair itself was not unpopular, 16% more of those who offered an opinion preferred the German chair for various reasons.

None of the women engaged in discussion declined to make a preference on either of the chairs, while 31% of males spoken with did not offer an opinion on either of the chairs (for various reasons).

Thirteen professional males preferred the German, giving it the largest preference within the gender and work group designations with 29% of all those who offered an opinion on either of the chairs.
Although people were categorised into various gender and work group segments, this categorising did not seem to make a great deal of difference to the preferences given. Preferences between the two chairs remained fairly consistent throughout the various categories. This was different to what I expected as I thought the results would vary with the demographics.

**Age group preferences**

Ages were approximated into very general groups. Age groups were estimated to see if there was any age group bias towards one or the other of the chairs.

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>People Preference for German Chair</th>
<th>% Preference for German chair</th>
<th>Preference for Japanese chair</th>
<th>% People for Japanese chair</th>
<th>Not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>20 to 39</strong></td>
<td>15</td>
<td>27%</td>
<td>10</td>
<td>18%</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td><strong>40 to 50</strong></td>
<td>8</td>
<td>14.5%</td>
<td>6</td>
<td>11%</td>
<td>5</td>
<td>9%</td>
</tr>
<tr>
<td><strong>60+</strong></td>
<td>4</td>
<td>7%</td>
<td>2</td>
<td>4%</td>
<td>3</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

Table 8.11: Age group preferences (Tokyo)

<table>
<thead>
<tr>
<th>Age groups</th>
<th>People</th>
<th>Percentage of each age group</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 to 39 Year Olds</td>
<td>27</td>
<td>49%</td>
</tr>
<tr>
<td>40 to 59 Year Olds</td>
<td>19</td>
<td>34%</td>
</tr>
<tr>
<td>60+ Year Olds</td>
<td>9</td>
<td>17%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>55</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 8.12: Proportions of age groups (Tokyo)
Table 8.13: Proportions of age group chair preferences (Tokyo)

<table>
<thead>
<tr>
<th>group</th>
<th>Percentage of overall comments</th>
<th>Percentage of overall comments: Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>German Chair</td>
<td>56%</td>
<td>45%</td>
</tr>
<tr>
<td>Japan Chair</td>
<td>37%</td>
<td>22%</td>
</tr>
<tr>
<td>No opinion</td>
<td>7%</td>
<td>33%</td>
</tr>
</tbody>
</table>

**Analysis**

- In all age groups, the German chair was preferred, with the largest discrepancy being in the oldest age group category (approximately 60+ age group). From that age group alone, 23% of those asked who offered a preference preferred the German Chair. However, this was the smallest category of those who held discussion, representing only 17% of the group.

- The next highest discrepancy was in the largest age group, representing 49% of the discussions held (approximately 20 to 39 age group.) 19% more of those who offered an opinion preferred the German to the Japanese chair.

- The smallest discrepancy was in the middle age group of approximately 40-59 age group

Although there are slight differences in totals, all age groups showed a general preferences towards the German chair.

At this stage, age group preferences are not making a varying impact on overall preferences.

### 8.13 Question 2: Elements of both chairs, positive and negative

<table>
<thead>
<tr>
<th>Japanese chair: positive elements</th>
<th>Percentage of comments made on each issue</th>
<th>Percentage of overall comments: Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal bracing</td>
<td>(5)</td>
<td>6%</td>
</tr>
<tr>
<td>Simplicity of design</td>
<td>(6)</td>
<td>7%</td>
</tr>
</tbody>
</table>
Table 8.14: Positive comments on the Japanese chair in Tokyo

Other comments included:

- Simple lines and detailing
- Metal detailing
- Combination of wood and metal

<table>
<thead>
<tr>
<th>Other</th>
<th>(3)</th>
<th>21%</th>
<th>4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td>14 Comments - 100%</td>
<td>17% of comments given</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.15: Negative comments on the Japanese chair in Tokyo

* number is given in brackets

Other comments included:

- Preference for no metal
- Lack of detailing
- Lack of backrest
- Backrest appears weak
- Not “user friendly” in appearance.
Other comments included:

- Looks safer
- Like the lighter veneered elements

### German chair: negative elements

<table>
<thead>
<tr>
<th>German chair: negative elements</th>
<th>Percentage of comments made on each issue</th>
<th>Percentage of overall comments: question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength and safety issues</td>
<td>(9) 47%</td>
<td>11%</td>
</tr>
<tr>
<td>External fastenings</td>
<td>(4) 21%</td>
<td>5%</td>
</tr>
<tr>
<td>Backrest</td>
<td>(2) 11%</td>
<td>2.5%</td>
</tr>
<tr>
<td>other</td>
<td>(4) 21%</td>
<td>5%</td>
</tr>
<tr>
<td>Totals</td>
<td>(19) comments –100%</td>
<td>23.5% of total comments</td>
</tr>
</tbody>
</table>

Table 8.17: Negative comments on the German chair in Tokyo

Other comments included:

- Appears to be child safe
- Needs more refinement
- Preference for no metal

**Analysis**

- Reasons for the popularity or otherwise of the chairs became quite apparent through this further analysis
• Discussion on each of the chairs was fairly evenly split with 46% on the Japanese chair and 54% on the German chair. The German chair again provided greater interest.

• It is interesting to note that the majority of references made to the chairs pointed out elements of detailing that those surveyed liked or disliked about the chairs.

• Overall styling problems were not the largest issues of discussion, but were generally smaller details that led to comments on the chairs. However, the discussion of detail was generally associated with an aesthetic preference that detail in question provided.

Discussion on Japanese chair

Positive

• The most appreciated comment with regard to the Japanese chair was the overall simplicity of design.

• The second most appreciated elements of the Japan chair were those of the metal bracing on the legs (at 36%). This element was obviously appreciated as a feature of the design by many people.

• The combination of wood and metal was also commented on appreciatively.

Negative

• The strength and safety issues, with particular reference to the thin section sizes of the timber and in some cases the non-traditional joining techniques were by far the largest criticism of the two chairs. There were 47% and 29% of negative comments about the German and Japanese chair respectively focused on this issue, creating the two largest categories of dislike.
• The Japanese chair was further criticized for its lack of decorative substance and refinement

• The metal bracing was commented on by some as a negative feature, although the element of the metal bracing which was particularly disliked was the way the metal was externally fastened onto the legs.

• The use of metal screws on the backrest also falls into this category, making it the second largest issue raised.

• The issue of the lack of decorative substance was raised, but only in a small proportion (8%) of the overall negative comments made on the chair.

Discussion on German chair

Positive

• The decorative elements on the German chair, mainly the cross-over bracing underneath was a big feature that drew interest to the German chair. This element was different and caught people's attention. About 54% of positive comments to the German chair were made on this element.

• The German chair was perceived by some of those who were surveyed to have more appeal of comfort, being more inviting to sit on although no one surveyed actually sat on it.

• The angled back leg contributed to the appreciation of comfort of the chair, this factor was commented upon individually by some.

Negative

• Strength and safety issues again topped the list of comments made, this time in regard to the German chair.
• The issue of the appearance of strength and structure of the chairs, which is particularly related to the section sizes of the legs, will need to be seriously evaluated in the re-design section of the project.

• The external fastenings on the chairs, such as screws attaching the backrests to the upright legs, and with particular reference to the metal joinery through the legs of the Japanese chair, received the second largest group of negative comments for both of the chairs.

• A dislike for the backrest of the German chair was the only other area to raise multiple comments.

Other analysis: why was the German chair more popular?

The feedback taken showed that several issues could be considered in this result:

The Japanese are influenced by European design; Italian brands command respect and high prices. Scandinavian timber furniture is also extremely popular in the Japanese high-end market, and the Scandinavian styling and blonde wood has set precedence in Japan for foreign high-end furniture.

The German chair, with its aesthetic elements drawing on the traditional European peasant chair is perhaps more reminiscent of the European style of furniture and therefore more popular. However this was never consciously mentioned as a reason by those surveyed.

As mentioned earlier, the majority of the reasons for which the German chair was better appreciated came back to detailing.

The chairs had different joining systems, with the German having far less exposed metal than the Japanese chair. The German chair also had lighter veneered elements in combination with the darker and more unfamiliar Spotted Gum timber. The Japanese chair was produced from just the Spotted Gum and metal, while both the designs were
unique, the Japan chair through its use of metal was perhaps set apart as different again.

These features all contributed to the preference for the German chair, and the ply bracing on the German chair was far more appreciated and less controversial than the metal bracing on the Japan chair.

The light colour of the timber veneer on the German chair also had an effect on popularity. Many of the Japanese surveyed mentioned that they liked lighter timbers, again the influence of European furniture and timbers.

The bend in the back legs to create more slope on the backrest was commented upon as the reason for the appearance of greater comfort. This element was omitted from the Japanese chair in striving to keep the simple and compact lines of the chair intact. The inviting and comfortable appearance was one raised as a desirable feature in several surveys, and is obviously a very important element for the Japanese consumer.

The Japanese chair was interesting in that those who did appreciate it, liked it for its simplicity and simple elegant lines. This was one of the major intentions of appeal when this chair was designed for the Japanese market. It is fair to say that this was appreciated, however, it was out shadowed by other design elements present in the German chair.

The main problem of perception with this chair was its lack of detail and refinements, leading to a perception of less comfort. Changes are required for this chair, however, the changes lie in the detailing, while maintaining the overall simplicity of the form, such as a slight bend in the backrest, and perhaps refinement of the seat to suggest more comfort.

As the metal element of this chair was intended to suggest a contemporary feel, rather than a traditional timber appeal, it would perhaps be interesting to investigate this market further through various materials which can be explored within this chair design.
8.14 Question 3: Suitability of chairs for the Japanese home

<table>
<thead>
<tr>
<th>Are the chairs appropriate for Japanese homes?</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive responses</td>
<td>14</td>
</tr>
<tr>
<td>Negative responses</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 8.18: Positive and negative comments on the suitability of the chairs to Japanese homes

<table>
<thead>
<tr>
<th>Responses specific to the appropriateness of each chair</th>
<th>Number of responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan chair</td>
<td>2</td>
</tr>
<tr>
<td>German chair</td>
<td>1</td>
</tr>
<tr>
<td>Generally commenting on both</td>
<td>14</td>
</tr>
</tbody>
</table>

Table 8.19: Responses specific to each chair

This question was responded to with a reason or condition for appropriateness or inappropriateness. The reasons for agreement or otherwise are as follows:

Suitable

Yes – for the high-end apartment market
Yes – would prefer German chair in own home. More timber elements
Yes – would need to be convinced on the safety aspect
Yes – better for Japanese houses, too large for apartments
Yes - Japanese chair better size for Japanese homes and apartments
Yes – if there were sold in suites (and other changes indicated) were made
Yes – because of their simple designs
Yes – in sets with tables
Yes - the Japanese chair is a good size
Yes – because of their aesthetic lightness
Yes – would be good for new homes i.e. contemporary and modern apartments
Yes – success would depend upon the marketing of the product
Yes – good match for modern homes
Yes – chairs are unique and would be desirable, the Japanese consumer will desire this.

Non suitable

No – a preference for lighter coloured wood
No – modern apartments, timber furniture is not appropriate
No – customers will worry about safety because of fine sections.

Analysis

- Generally a very positive response was given here, however, without exception comments were made as to why or why not the furniture was appropriate for Japanese homes. These comments must be given equal consideration to the statistics themselves as the reasons bring out more issues.

- There is a link with answers to question 5 regarding the suitability of the Spotted Gum timber. Whether or not timber furniture in general is suitable to peoples’ homes is important in relation to this question.

- Sizing is also a factor in this question, as the Japanese chair was smaller in all proportions and comments were made as to the size appropriateness for Japanese apartments.

- Generally the comparative appropriateness of both chairs in Japanese homes, rather than the individual chairs, was discussed as both the designs were unique and different using the same timber. However, references to individual features of the chairs were made.

- The general consensus was that this style of furniture would be good for contemporary homes. This would imply that this style of furniture would be competing more with furniture made from materials other than timber, as
timber is generally used for more traditional styles. One person surveyed commented that timber furniture is not appropriate for modern apartments.

- The use of metal and plywood in both chairs but particularly of the Japanese chair, would create a case to promote this furniture into these areas.

- The high-end market exists more in the cities than in the suburbs.

- Timber furniture is not preferred in modern apartments generally; this was generally explained to be because materials used in modern apartments which are usually metal, concrete etc. More traditional houses have elements of wood and are more suitable for timber furniture. Also, the more traditional styles of timber furniture are inappropriate and too large for use in apartments.

- It was mentioned on several occasions that success would depend on who promoted these products and how they were promoted. This aspect will always remain important for unique and contemporary products.

8.15 Question 4: How much would you expect to pay?

Price estimates: Japanese chair

<table>
<thead>
<tr>
<th>Overall statistics: Japanese chair</th>
<th>Price estimates retail: AUD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most expensive estimate</td>
<td>1200</td>
</tr>
<tr>
<td>Least expensive estimate</td>
<td>240</td>
</tr>
<tr>
<td>Average*</td>
<td>443</td>
</tr>
</tbody>
</table>

Table 8.20: Price estimates, overall statistics Japanese chair

* Average price estimate taken without the highest estimate of A$1200 included

Breakdown per person
Table 8.21: Breakdown per person, Japanese chair

<table>
<thead>
<tr>
<th>Yen: Per Japanese Chair retail</th>
<th>AUD$: Per Japan Chair retail</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td>376</td>
</tr>
<tr>
<td>32,000</td>
<td>400</td>
</tr>
<tr>
<td>48,000</td>
<td>600</td>
</tr>
<tr>
<td>19,200</td>
<td>240</td>
</tr>
<tr>
<td>30,000</td>
<td>376</td>
</tr>
<tr>
<td>48,000</td>
<td>600</td>
</tr>
<tr>
<td>31,520</td>
<td>394</td>
</tr>
<tr>
<td>20,000</td>
<td>250</td>
</tr>
<tr>
<td>25,600</td>
<td>320</td>
</tr>
<tr>
<td>45,160</td>
<td>677</td>
</tr>
<tr>
<td>96,000</td>
<td>1200</td>
</tr>
<tr>
<td>20,000</td>
<td>250</td>
</tr>
<tr>
<td>32,000</td>
<td>400</td>
</tr>
<tr>
<td>36,000</td>
<td>450</td>
</tr>
<tr>
<td>70,160</td>
<td>877</td>
</tr>
</tbody>
</table>

*German chair*

**Overall statistics:**
- German chair

<table>
<thead>
<tr>
<th>Price estimates : Per German chair AUD$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most expensive estimate</td>
</tr>
<tr>
<td>Least expensive estimate</td>
</tr>
<tr>
<td>Average*</td>
</tr>
</tbody>
</table>

* Average price estimate taken without the highest estimate of 1200 included

Table 8.22: Price estimates, overall statistics German chair

*Breakdown per chair*

<table>
<thead>
<tr>
<th>Yen: Per German</th>
<th>AUD$: Per</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 8.23: Breakdown per person, German chair

<table>
<thead>
<tr>
<th>Chair</th>
<th>German Chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>30,000</td>
<td>376</td>
</tr>
<tr>
<td>32,000</td>
<td>400</td>
</tr>
<tr>
<td>48,000</td>
<td>600</td>
</tr>
<tr>
<td>30,000</td>
<td>376</td>
</tr>
<tr>
<td>58,000</td>
<td>727</td>
</tr>
<tr>
<td>21,040</td>
<td>263</td>
</tr>
<tr>
<td>20,000</td>
<td>250</td>
</tr>
<tr>
<td>25,600</td>
<td>320</td>
</tr>
<tr>
<td>45,160</td>
<td>677</td>
</tr>
<tr>
<td>96,000</td>
<td>1200*</td>
</tr>
<tr>
<td>20,000</td>
<td>250</td>
</tr>
<tr>
<td>32,000</td>
<td>400</td>
</tr>
<tr>
<td>36,000</td>
<td>450</td>
</tr>
<tr>
<td>70,160</td>
<td>877</td>
</tr>
</tbody>
</table>

Analysis

This question showed a promising response as both chairs fell into a cost range that places them at the higher end of the market. The prices that the chairs would attract would again depend very much on the way they were promoted and who they were promoted by.

It was pleasing to note that consumers understood the chairs to be positioned in the more affluent end of the market, given the ‘flat packed’ elements and unconventional joining in the designs which may reduce the perception of their quality.

8.16 Question 5: Appreciation of the Spotted Gum timber

<table>
<thead>
<tr>
<th>Like/dislike the timber used in the chairs</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive comments</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.24: Positive and negative comments made on each chair

| Negative comments | 7 |

Figure 8.6: Chart showing percentages of positive and negative comments

**Liked reasons**

- appropriate timber for Japanese homes
- good because, expensive resource: Pushes up market value
- timber has a unique appeal, high-end bracket
- would need explanation to be sold
- color and appeal
- thinks that there is room for new timbers on the Japanese market
- likes the timber, but has a preference for something lighter
- likes the timber very much, would buy the products
- likes the aesthetic of the timber however prefers dark timbers
- likes the timber however the Japanese like lighter timbers

**Disliked reasons**

- didn’t like color variation
- preference for lighter timbers
- non-appropriate timber for Japanese homes
- the timber is too heavy for dining furniture
- the timber should be used for outdoor furniture
- didn’t like, too dark
- didn’t like, too much variation

**Analysis**

- Enquiries were about the timber and where it can be purchased, showing that there was particular interest.

- There were several people surveyed who did not like this timber, this is not surprising as the types of timbers on the Japanese market are fairly traditional and consumers are very used to them and their properties.

- The fact that those surveyed had a preference for lighter timbers and did not like the color variation in the Spotted Gum, a property which is quite common in that timber. This aspect does not make it the most suited material to the Japanese market, however the ‘difference’ factor and appeal will still appeal to a niche, as was proven through the surveying.

- However, there were still several positive responses to the material outweighing the disliking opinions. The unique appeal of the timber was appreciated however most stipulated that how the timber was treated, in a similar way to how the design of the products are treated through marketing and promotion will have a great impact on its popularity and success.

- Color matching would have to be an important aspect of production in furniture sent to Japan from these timbers.

**Question: Other suggestions**

Other useful suggestions that came from surveying process
8.17 Other comments made on the Japanese market

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>3</td>
</tr>
<tr>
<td>Negative</td>
<td>1</td>
</tr>
<tr>
<td>Neutral</td>
<td>4</td>
</tr>
<tr>
<td>Comments</td>
<td>8</td>
</tr>
</tbody>
</table>

- The high-end market is more specific to Tokyo, and other areas in Japan bring have lesser price ranges.
- Branding and marketing of the product are important and can add vast influence to a product in the market place
- The products are appropriate for the high-end market
- These designs are appropriate to the Japanese market because of their simplicity
- Unfamiliar timbers are difficult to sell, and brand must be established.
- Products should be displayed and promoted in sets

Other comments made on Strength and certification

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>0</td>
</tr>
<tr>
<td>Negative</td>
<td>3</td>
</tr>
</tbody>
</table>
• It is not appropriate to display something that cannot be sat on.
• Much better to have the product tested before exhibiting
• Because designs look stronger, (although they may not always be) that will impress the customer, e.g. bracing element on the German chair
• Belief that even with the safety guarantee for the product, customers will question the use of thin sections.

Other comments made on past experience

<table>
<thead>
<tr>
<th></th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1</td>
</tr>
<tr>
<td>Comments</td>
<td>1</td>
</tr>
</tbody>
</table>

• Buyers who had a poor experience with buying Australian products presumably would not buy them again.

Other comments made on Women and children

<table>
<thead>
<tr>
<th></th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>2</td>
</tr>
<tr>
<td>Comments</td>
<td>2</td>
</tr>
</tbody>
</table>

• Women make decisions when purchasing for the home
• Importance of child safety.

Material

<table>
<thead>
<tr>
<th></th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>1</td>
</tr>
<tr>
<td>Positive</td>
<td>1</td>
</tr>
<tr>
<td>Comments</td>
<td>2</td>
</tr>
</tbody>
</table>

• Preference for solid wood furniture
• Proof of interest in material, regardless of design

**Design**

<table>
<thead>
<tr>
<th>Neutral</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>3</td>
</tr>
<tr>
<td>Comments</td>
<td>4</td>
</tr>
</tbody>
</table>

• Interest in the unusual joinery created unique product
• The concepts are good, displaying the important structural elements.
• Comfort is the main thing required for dining furniture
• The designs are appreciated because they are universal

8.18 **Salone Satellite: Isalone, Milan Furniture Fair**

![Image of Swinburne University – Faculty of Design, CRC Wood Innovations stand](image)

Figure 8.8: Overview of the Swinburne University – Faculty of Design, CRC Wood Innovations stand, exhibited at the Saloni Satellite Exhibition, Milan Furniture Fair 2005
8.19 Who was targeted for discussion?

It would be expected that conducting an information-gathering process in Japan and repeating it in Europe would provide many variables, which is considered normal when making a comparison between two countries in separate regions of the world as
has been previously discussed. However, in the case of the process undertaken for this investigation, it is not only the cultural differences between Japan and Italy being accounted for, but also the differences between the two exhibitions must be considered.

With the feedback-gathering process undertaken during the Salone Satellite, all those with whom discussion was held were in some form of design profession e.g. practicing industrial designers, furniture designer makers, design professors and lecturers, architects and students of various design disciplines. There was a notable absence of buyers, distributors and manufacturers surveyed at the Salone Satellite, people but these professions contributed a large proportion of those surveyed in Tokyo.

It is expected that designers would talk about products in a different way to buyers and distributors, however, a comparison of preference between the two chairs was easily established, and elements ‘liked and disliked’ about the chairs raised many issues for discussion. These aspects are easily comparable with information derived from those surveyed in Tokyo. While there may be fewer comparisons made between the two international surveys with regard to particular professions, the opinions made on the product preference and detailing still provide valuable comparisons on the whole.

In addition to the different professions involved in discussions held in the two countries, the country of origin of those surveyed also provided a large discrepancy in comparison to the IFFT. While the vast majority of those surveyed at the IFFT were Japanese, the origins of those surveyed in Milan were more international, mostly originating from various countries in Europe.

As mentioned earlier, it must be considered that the information gathered from surveying at the Salone Satellite is of a multi-cultural European perspective, rather than Italian or German or more single-cultural perspective.

This factor makes a single cultural comparison with Japan impossible, however, it is far from being a disadvantage in the overall perspective of the investigation. As the
European market is closely related geographically and competitively between leading manufacturing countries for sales, the results of this exhibition provide an insight into the diverse and dynamic European market as a whole.

8.20 Discussion held

It was mentioned in the Introduction that the atmosphere and general style of the Salone Satellite is different to that of most international furniture fairs. The survey was less formal than the one undertaken in Japan, as all of those surveyed spoke English and the information-gathering process undertaken without the assistance of translators.

As the format for discussion generally had been set by the process undertaken at the IFFT, the information-gathering process undertaken in Milan was similar. However, due to differences in style of the exhibitions, the discussion was adapted accordingly. The discussions were undertaken in far more casual rather than questioning manner. As most of the contributors were involved in some aspect of the design field, most were happy to hold an informal discussion in regard to the design merits of the chairs.


1. **Age**
   
   **Gender**
   
   **Occupation**
   
   **Nationality**

2. **What was aspect was liked/disliked about each or one of the chairs?**

3. **Any comments on the timber?**

The discussion was directed in these areas for following reasons:

1. **Age**
The reasons here are similar to those used for the IFFT. As with the IFFT, an approximate recording of age and gender providing some breakdown of preferences between different age groups and gender as a result.

In the case of Salone Satellite, profession and nationality hold particular significance. It has been mentioned that without exception, all those surveyed in Milan were involved in the design profession. As those surveyed were of various cultural origins, this in itself provides an interesting comparison, within the context of Milan alone, and a Japanese-European comparison.

2. **What aspect was disliked about either or each of the chairs?**

Same as for IFFT

3. **Discussion on any particular timber or design aspects.**

As explained earlier, this question was slightly different in that more informal discussions were held regarding the design of the chairs and the timber and its properties used in the designs.

However, while gaining the Japanese perspective on the timber, as mentioned previously those surveyed were from various cultural backgrounds, and would probably have a more varied timber appreciation.

Gaining a ‘European’ response to the timber provides valuable information for Australian manufacturers.

8.21 **Question 1: Result analysis**
### Nationality

<table>
<thead>
<tr>
<th>Nationality</th>
<th>No. of people</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>England</td>
<td>(5)</td>
<td>12</td>
</tr>
<tr>
<td>Ireland</td>
<td>(3)</td>
<td>7.5</td>
</tr>
<tr>
<td>Iceland</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>Singapore</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>France</td>
<td>(5)</td>
<td>12</td>
</tr>
<tr>
<td>Swiss</td>
<td>(3)</td>
<td>7.5</td>
</tr>
<tr>
<td>Italy</td>
<td>(9)</td>
<td>22</td>
</tr>
<tr>
<td>Slovenia</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>Sweden</td>
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<td>5</td>
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<td>Hungary</td>
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<td>Austria</td>
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<td>5</td>
</tr>
<tr>
<td>Germany</td>
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<td>12</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>(1)</td>
<td>2.5</td>
</tr>
<tr>
<td>Total</td>
<td>(41)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.25: Overall statistics (Milan), nationality/country

### Regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of Discussions</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>(9)</td>
<td>22</td>
</tr>
<tr>
<td>Other Europe</td>
<td>(19)</td>
<td>46</td>
</tr>
<tr>
<td>Scandinavia</td>
<td>(3)</td>
<td>7.5</td>
</tr>
<tr>
<td>UK + Ireland</td>
<td>(8)</td>
<td>19.5</td>
</tr>
<tr>
<td>Other</td>
<td>(2)</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 8.26: Overall statistics (Milan), nationality/region

### Gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>People</th>
<th>Percentage of each gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>(24)</td>
<td>58.5</td>
</tr>
<tr>
<td>Female</td>
<td>(17)</td>
<td>41.5</td>
</tr>
</tbody>
</table>
Table 8.27: Overall statistics (Milan), gender

**Work groups**

<table>
<thead>
<tr>
<th>People in the work groups</th>
<th>People</th>
<th>Percentage of people per work group.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design professions</td>
<td>(26)</td>
<td>63.5</td>
</tr>
<tr>
<td>Design Students</td>
<td>(13)</td>
<td>31.5</td>
</tr>
<tr>
<td>Other</td>
<td>(2)</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>(41)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.28: Overall statistics, people in work groups (Milan)

<table>
<thead>
<tr>
<th>Professionals vs. students surveyed</th>
<th>People</th>
<th>Percentage of professionals vs. non professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>(26)</td>
<td>63.5%</td>
</tr>
<tr>
<td>Non Professionals</td>
<td>(15)</td>
<td>36.5%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>(41)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.29: Professionals versus students surveyed (Milan)

<table>
<thead>
<tr>
<th>Professionals per Gender (Male)</th>
<th>People</th>
<th>Percentage of male professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>(19)</td>
<td>77 %</td>
</tr>
<tr>
<td>Other</td>
<td>(5)</td>
<td>23 %</td>
</tr>
<tr>
<td>TOTAL</td>
<td>(24)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.30: Professionals per gender males (Milan)

<table>
<thead>
<tr>
<th>Professionals per Gender (Female)</th>
<th>People</th>
<th>Percentage of female professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professionals</td>
<td>7</td>
<td>46%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>54%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>17</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.31: Professionals per gender females (Milan)
### Overall preferences

<table>
<thead>
<tr>
<th>Overall Preferences</th>
<th>People</th>
<th>Percentage preference per chair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred the German Chair</td>
<td>23</td>
<td>56%</td>
</tr>
<tr>
<td>Preferred the Japan chair</td>
<td>15</td>
<td>36.5%</td>
</tr>
<tr>
<td>Did not offer an opinion</td>
<td>3</td>
<td>7.5%</td>
</tr>
</tbody>
</table>

Table 8.32: Overall preferences (Milan)

### Gender preferences

<table>
<thead>
<tr>
<th>Gender overall preferences</th>
<th>People preference for German Chair</th>
<th>% preference for German chair</th>
<th>People preference for Japanese chair</th>
<th>% preference for Japanese Chair</th>
<th>People not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female overall</td>
<td>10</td>
<td>24.5%</td>
<td>6</td>
<td>14.5%</td>
<td>1</td>
<td>2.5%</td>
</tr>
<tr>
<td>Male overall</td>
<td>13</td>
<td>31.5%</td>
<td>9</td>
<td>22%</td>
<td>2</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 8.33: Overall gender preferences (Milan)

### Female preferences/professionals vs. Others

<table>
<thead>
<tr>
<th>Female preferences/professionals vs. Others</th>
<th>People preference for Japanese chair</th>
<th>% preferences for Japanese chair</th>
<th>People preference for German chair</th>
<th>% preferences for German chair</th>
<th>People not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>3</td>
<td>18%</td>
<td>4</td>
<td>23%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>18%</td>
<td>6</td>
<td>35%</td>
<td>1</td>
<td>6%</td>
</tr>
</tbody>
</table>

Table 8.34: Female work group preferences (Milan)
In Milan there were marginally more males than females consulted, and 58.5% of those who held discussions were male.

As discussed in the introduction to this section, it is difficult to make judgments on national preferences in Milan due to the fact that such a broad range of nationalities was represented.

A relatively small number of Italians were involved in discussion (22% of those surveyed), but this was the largest representation from a single country.

Five Germans (those from the intended market for the German chair) were surveyed, accounting for 12% of the overall numbers.

The totals for individual countries were too small to be considered individually, reiterating the theme that Milan must be judged as an international exhibition.

As the vast majority of those surveyed were from mainland Europe, Scandinavia and the UK, this combination will form the majority group for reference in discussion.

Table 8.35: Male work group preferences (Milan)

<table>
<thead>
<tr>
<th>Male preferences/ professionals vs. Others</th>
<th>People preference for German chair</th>
<th>% preferences for German chair</th>
<th>People preference for Japanese chair</th>
<th>% preferences for Japanese chair</th>
<th>People not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>10</td>
<td>41.5%</td>
<td>7</td>
<td>30%</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>12.5%</td>
<td>2</td>
<td>8%</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

Analysis
• The largest work group amongst those involved in discussions were those in the category of professional males (of various design professions) Nineteen people were consulted within this category, accounting for a total 46% of discussions held.

• Representation between work groups was comparatively even for women, with 7 women from the professional grouping represented, and 10 from the non professional. There was more of a discrepancy in the work group status of the male representatives, with 19 from the professional category outweighing the five from the non-professional category.

• All groups of gender and work group in Milan showed a preference for the German chair.

• With 19.5% more from those discussions where opinion of preference was offered, the preference was for the German chair.

• Only three people, (two men and one woman) did not offer a preference when asked on either of the chairs, when asked.

There was a younger representation of students in Milan than Tokyo. The students attending the furniture fair in Tokyo, were generally university students enrolled in a design degree. In general, the attendees of the Milan Furniture Fair were younger, and this difference was represented by the age group categories, differing to those allocated in Tokyo.

The students at the Milan Furniture Fair were in some instances high school students, looking at the Fair as potential background towards a degree and career in design.

The fact that the Swinburne stand was in a row of University stands, exhibiting to primarily attract student attention, meant that some pre-design students were involved in discussions.
<table>
<thead>
<tr>
<th>Age groups</th>
<th>People</th>
<th>Percentage of each age group surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teens</td>
<td>4</td>
<td>10%</td>
</tr>
<tr>
<td>20’s – 30’s</td>
<td>19</td>
<td>46%</td>
</tr>
<tr>
<td>30’s – 40’s</td>
<td>12</td>
<td>29%</td>
</tr>
<tr>
<td>40’s Plus</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 8.36: Age groups, general (Milan)

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>People preference for German Chair</th>
<th>% preference for German chair</th>
<th>preference for Japanese chair</th>
<th>% people for Japanese chair</th>
<th>Not offering an opinion</th>
<th>% Not offering an opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teens</td>
<td>2</td>
<td>5%</td>
<td>2</td>
<td>5%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>20’s-30’s</td>
<td>11</td>
<td>27%</td>
<td>6</td>
<td>14.5%</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>30’s –40’s</td>
<td>7</td>
<td>17%</td>
<td>5</td>
<td>12%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>40’s Plus</td>
<td>3</td>
<td>7%</td>
<td>2</td>
<td>5%</td>
<td>1</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

Table 8.37: Age group, preferences overall (Milan)

<table>
<thead>
<tr>
<th>Age group Preference of people per age group</th>
<th>Teens</th>
<th>20-30 year olds</th>
<th>30-40 year olds</th>
<th>40+ year olds</th>
</tr>
</thead>
<tbody>
<tr>
<td>German Chair</td>
<td>50%</td>
<td>58.5%</td>
<td>58.5%</td>
<td>50%</td>
</tr>
<tr>
<td>Japan Chair</td>
<td>50%</td>
<td>31.5%</td>
<td>41.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>No opinion</td>
<td>0%</td>
<td>10%</td>
<td>0%</td>
<td>16.5%</td>
</tr>
</tbody>
</table>

Table 8.38: Age group, preferences per age group (Milan)

- The teen category was small with preferences for the chairs equal
• The group of approximately 20-30 year old people showed the highest discrepancy between those offering a preference between the two chairs, with 26% more preferring the German chair.

This was an indication that the chair is definitely appealing for the younger group of those surveyed.

• The approximate 30 - 40 and 41 - plus age groups were relatively even showing a 17 and 16.5% preference for the German chair from those who offered an opinion.

### 8.22 Question 2: Elements of both chairs, positive and negative

<table>
<thead>
<tr>
<th>Japanese chair: Positive elements</th>
<th>Percentage of Comments made on each issue</th>
<th>Percentage of overall comments: within Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple/fine lines in the structure of the chair</td>
<td>(9) 45%</td>
<td>10.5</td>
</tr>
<tr>
<td>Works well as an overall piece</td>
<td>(4) 20%</td>
<td>4.5</td>
</tr>
<tr>
<td>‘Light’ quality and appeal</td>
<td>(2) 10%</td>
<td>2.5</td>
</tr>
<tr>
<td>Laminated timber seat</td>
<td>(2) 10%</td>
<td>2.5</td>
</tr>
<tr>
<td>Other</td>
<td>(3) 15%</td>
<td>3.5</td>
</tr>
<tr>
<td>Totals</td>
<td>(20) Comments - 100%</td>
<td>23% of comments given</td>
</tr>
</tbody>
</table>

Table 8.39: Japanese chair, positive elements (Milan)

Other comments included:

• Better use of timber
• The metal bracing components underneath
• Detail of the backrest.

<table>
<thead>
<tr>
<th>Japanese chair: Negative</th>
<th>Percentage of comments</th>
<th>Percentage of overall</th>
</tr>
</thead>
</table>


### Japanese chair, negative elements (Milan)

<table>
<thead>
<tr>
<th>Elements</th>
<th>Made on each issue</th>
<th>Comments: Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not sturdy appeal in structure</td>
<td>(4) 24%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Not visually interesting</td>
<td>(6) 35%</td>
<td>7%</td>
</tr>
<tr>
<td>Metal fasteners</td>
<td>(3) 18%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Too small</td>
<td>(2) 11.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Other</td>
<td>(2) 11.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>(17) Comments –100%</td>
<td>20% of comments given</td>
</tr>
</tbody>
</table>

Other comments included:

- Not convinced on flat pack potential
- Too thin in the backrest.

### German chair: Positive elements (Milan)

<table>
<thead>
<tr>
<th>Elements</th>
<th>Percentage of comments made on each issue</th>
<th>Percentage of overall comments: Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bent ply bracing as decorative/structural feature</td>
<td>(8) 22%</td>
<td>9%</td>
</tr>
<tr>
<td>Other detailing decorative elements</td>
<td>(6) 17%</td>
<td>7%</td>
</tr>
<tr>
<td>Bigger and more comfortable</td>
<td>(4) 11%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Finer sections</td>
<td>(4) 11%</td>
<td>4.5%</td>
</tr>
<tr>
<td>More interesting</td>
<td>(4) 11%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Contrast between ply sections and timber</td>
<td>(4) 11%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Other</td>
<td>(6) 17%</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>36 Comments – 100%</td>
<td>41% of total comments</td>
</tr>
</tbody>
</table>

Other comments included:
• Appropriate for various homes X2
• Bends in the Back legs X2
• Floating seat detail
• More sturdy less light weight

<table>
<thead>
<tr>
<th>German chair: Negative elements</th>
<th>Percentage of comments made on each issue</th>
<th>Percentage of overall comments: Question 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor proportions: looks too sectioned</td>
<td>(4) 28.75%</td>
<td>4.5 %</td>
</tr>
<tr>
<td>Top half not refined enough</td>
<td>(2) 14.25%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Gaps between joins on legs</td>
<td>(2) 14.25%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Poor structure</td>
<td>(2) 14.25%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Exposed screws</td>
<td>(2) 14.25%</td>
<td>2.3%</td>
</tr>
<tr>
<td>other</td>
<td>(2) 14.25%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Totals comments –100%</td>
<td>16 % of total comments</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.42: German chair, negative elements (Milan)

Other comments include:

• Dislike of ply detail
• Not appropriate to home (Sweden)

Analysis

Discussion on Japanese chair

Comments on the simplicity and fine lines of the chair dominated those made on the appreciated elements of the Japan chair, and 45% of the positive comments made in regard to this chair were regarding this point.
This indicates an appreciation of the chair as an overall piece, its ambition of simple ‘Japanese style’ design seems to have been recognised. The second highest level of comment made regarding this chair referred to its light visual appeal.

These aspects of the chair design have certainly appealed to a degree of those attending the Milan Furniture Fair. Most of the discussion in this area focused on the overall theme and appeal of the chair, rather than specific aspects.

Although appreciated for its design intention in creating a simple light chair, it can only be concluded that this is not the style most highly appreciated by those attending the furniture fair.

About 23% of comments made on both the Japanese and German chairs, were made on the positive aspects of the Japan chair, with 10.5% of all comments made acknowledging the lightness and simple appeal of the chair. It was interesting, that 35% of negative comments made on the Japanese chair were directed at the fact that it was not visually interesting.

This is in direct contrast to the comments on appreciated elements on the Japanese chair, this indicating that there is a definite variation in opinion on this point. It raises the question of whether more detail could be added to the Japanese chair to make it more visually interesting, while keeping its streamlined visual appeal.

The 24% of negative comments made on the Japan chair were directed towards the structure of the chair, with those that made these comments believing that the chair did not appear sound structurally.

Again, it must be conjectured as to whether the components or some elements of the chair can be made thicker, without losing the light visual appeal of the chair which was so appreciated.

Comments showed that 18% of negative comments were directed towards a dislike of the metal structure and fasteners. However, the metal elements of the chairs were not commented on much individually as a positive aspect of the chair. Those who
appreciated the Japan chair, considered the metal elements as a successful integration into the form of the chair.

**Discussion on German chair**

Appreciated elements of the German chair were primarily the detailing structural element on the base (i.e. ply arms), with 22% of comments made on positive aspects of the German chair, closely followed by other decorative elements on 17%. In contrast to the Japanese chair, the greater level of visual detail on the German chair was well appreciated.

The size of the German chair was mentioned in a positive sense, and the more generous proportions of the German chair, were appreciated over the smaller ones of the Japan chair. Scale of the chairs was not mentioned in any other sense, logically indicating that the proportions of the Japan chair would also need to be scaled up for sale in the European market.

A comment of ‘more interesting’ is closely linked to comments on the higher ranking better visual detail.

The contrast between the ply (Tasmanian Oak) and timber (Spotted Gum) added another appreciated and interesting element to the German chair.

The proportions of the German chair were criticized, with the placement of the bracket bracing in relation to the seat and the backrest making the chair appear too segmented and disjointed, and not flowing as an overall piece. Such comments attracted 28.8% of the negative comments made regarding the German chair.

Other comments include: simplicity of the backrest, not enough detail in relation to the rest of the chair, and the joining of the ply bracing brackets onto the legs in both alignment and fastening. These are small details, easy to alter and not too inherent in the chair design.

Other concerns were raised in the area of structural integrity.
8.23 Question 3: Response to “Spotted Gum” timber

The following comments were made:

- Like the timbers and the colour contrasts
- Interesting
- Large interest in the properties of the timber
- Interested in the timbers used, colours and contrasts
- Unusual and eye catching, liked the colour variation
- Timber is warm and unusual looking
- Interesting timber on both, are striking
- The timber looks unusual
- Interested in the timber, and the increased strength properties.

8.24 Comparisons Between Tokyo and Milan

Nationality
It is difficult to make comparisons between countries because of the vastly more international representation at the Milan Furniture Fair. However, talking in terms of regions, it is easiest to say that it is a European versus Japanese comparison.

Figure 8.12: Percentage of people of Native nationality discussions (comparisons between Tokyo and Milan)

Figure 8.13: Percentage of people of general nationality discussions (comparisons between Tokyo and Milan)
The proportions of males to females surveyed in both Milan and Tokyo are similar. However, cultural differences must be considered as well, to make these results useful.

Through empirical research discussions with Japanese people, the knowledge was gained that in Japan, women will generally contribute to the purchase of household goods, as the main decision makers within the home.
There is a discrepancy in this section that must be accounted for in decisions made for the re-design process. The ‘professional’ category was a grouping of all those attending the Milan and Tokyo furniture fairs on official basis, and the professionals as official attendees were discussed in comparison to those who were there as students or for general interest.

However, the breakdown of professions shows that there were very different professions attending.

In Milan, all those falling into the professional category were related to the design professions, such as industrial designers, interior designers, architects and design lecturers.

In Tokyo, professionals were segregated into four groups, with design professionals, making up 20% only of that group. The advanced design knowledge of those
professionals surveyed in Milan must contribute to the factors discussed concerning the appeal of both chairs.

The split of the professional groupings versus students and other interested parties was similar at both furniture fairs.

Figure 8.16: Percentage of professionals versus non-professionals surveyed (comparisons between Tokyo and Milan)
The overall preferences show clearly that in both furniture fairs the German chair was preferred, the Milan discussions generating a slightly higher preference towards the German chair. The response on preference for the Japanese chair was fairly equal, with the Milan rating slightly higher. There was a higher incidence of people not making a comment on preference in Tokyo.

**Gender preferences**
Overall, each gender preferred the German chair.

8.25 Comparison of responses: positive and negative aspects of the chairs
In both Milan and Tokyo, the younger age groups (with the exception of the teen group in Milan) showed the strongest preference for the German chair. This would indicate that the elements in that chair appeal particularly to that age group.

**Comments made on each chair**

![Figure 8.20: Percentage of comments made (comparisons between Tokyo and Milan)](chart)

**Types of comments, differentiation**

In Milan, most discussion centred on the positive aspects of the German chair. In Tokyo, the positive aspects of the German chair received more attention, however, the discrepancy between discussion on the positive aspect of the Japanese chair was the second highest ranking.

The positive aspects were all commented on more than the negative aspects of the chairs. People are definitely more inclined to talk about the positive aspects of the chairs when asked for a preference. Even if they prefer one chair to the other, they would often make comments on the positive and negative aspects of both.
There is a correlation between the fact that the German chair was preferred, and that it was the one commented on the most. The tendency to comment only on the positive elements was carefully avoided, the elements not liked were deliberately drawn from those in discussion.

**Positive Comments: Japan Chair**

![Comparison of positive comments made on the Japanese chair in Tokyo and Milan](image)

The two major points raised in Milan and Tokyo were exactly the same i.e. the simplicity of the design. This simplicity of the Japanese chair was definitely appealing to a niche of the market, without being as popular as the German chair. Those who would buy the Japanese chair on preference would buy it for that feature most of the time.

The second highest positive comment on the Japanese chair was the metal arm support structures underneath, however, this aspect of the chair was not mentioned in Milan.

Similarities
• Simplicity of design (stronger on the Milan side)

Influence of the design orientation of those questioned in Milan.

Differences

• Comments in Japan on popularity of metal bracing

The persons in discussions in Tokyo were more likely to point out individual details as opposed to talking about the whole design. Overall, it is reasonable to assume that there is a market for a simple chair with metal or other detailing in both markets.

**Dislike comments Japan**

![Comparison of negative comments made on the Japanese chair in Tokyo and Milan](chart)

Figure 8.22: Comparison of negative comments made on the Japanese chair

Compared with the positive comments, the more disliked aspects of the Japanese chair were a lower percent of overall comment.
The fact that the Japanese chair was ‘less decorative’ or not visually interesting, was the main negative comment in Milan, and also commented upon, but to a lesser extent in Tokyo.

In Tokyo the strength and safety concerned with the chair were raised as the major issue. People generally considered the section sizes as too thin and hazardous, if they break, and overall the population was concerned about the potential longevity and quality of the furniture. In Milan, the structure of the chair was mentioned as the second highest problem perceived in the chair.

The metal bracing on the legs was the second most disliked element in Tokyo. This was in contrast to one of the most liked elements by other people. Another factor was the metal fasteners, with this aspect closely related to the metal leg.

The Japanese chair was considered too small in Milan.

**Similarities**

- Comments on structure, (although greater in Tokyo)
- Dislike of metal elements (stronger in Tokyo)
- Need for greater visual detail (far greater in Milan)

**Differences**

- Far greater concern for lack of visual detailing in Milan.
- Disapproval of smaller size in Milan
- Dislike of external fastenings in Tokyo
The German chair was greatly appreciated in contrast to the Japanese chair for its decorative elements, while generating a strong response in both cities, there was a greater discussion the aspects of detail in Milan, whereas the comments in Tokyo were more general. The ply elements on the legs drew a lot of interest in both cities. Importantly the second highest area of comment in Tokyo was the appearance of comfort in the German chair. The next highest rated point in discussion pointed out in Tokyo was the extra bend in the backrest of the German chair (i.e. the bent back legs), an aspect closely related to comfort. The size of the German chair was considered a factor towards greater comfort in Milan. The contrast between the lighter ply veneer and darker Spotted Gum timber, was referred to in Milan.

**Similarities**

- Decorative elements, ply bracing on the legs very popular in both cities.

- Other decorative elements of the chair, as a generalized comment (Milan)
**Differences**

- Appearance of comfort (backrest, bent back leg) Tokyo as most important aspect

- Appearance of comfort (Size) Milan

- Contrast between veneer and timber colorings (Milan)

![Comparison of negative comments made on German chair in Tokyo and Milan](image)

Figure 8.24: Comparison of negative comments made on the German chair

The strength and safety issues were by far the issue of greatest concern raised in regard to the German chair in Tokyo, with particular regard to the component size. The perception of fragility was a big concern, in that the chair did not look robust enough to stand up to the rigours of daily use. The structure of the chair was also questioned in Milan, however to a lesser extent.
The primary concern in Milan was with the proportions of the chair. This factor would most possibly be derived between the different types of population questioned, because of the larger framed Europeans.

In Milan, the way the chair was visually segmented was considered an important issue, and more contingency in the overall concept would need to be developed as a design recommendation.

Comments were made in both cities regarding dislike of the backrest, due to its over-simplification, and not fitting in with the rest of the chair. In both cities, the external fastenings were mentioned as a downside to the chair however, it was of far greater concern in Tokyo.

**Similarities**

- The proportions of the chair of primary concern in Milan

- The was an agreement on dislike in general of the backrest (i.e. in terms of aesthetics, lack of visual detail were commented on in both cities)

**Differences**

Vastly greater concern for strength and safety parameters in Tokyo

Greatly more concern with external fastenings in Tokyo

**Conclusion**

A great deal of information has been learnt from the market-testing process discussed in this chapter. This new information will now be directed into a new design brief, and a second design process will be undertaken to re-develop the Japanese and German chairs.
Chapter 9
Redesign

9 Introduction, what was learnt from market based discussion?

The information gained through the discussion process undertaken through the two international exhibitions previously discussed was fed into requirements of a new design brief, based on the existing chair designs for the two tested markets.

The discussion process, the similarity of the overall preference results and the general similarities of the responses given have shown that the two chairs could be integrated into each market. There are not enough cultural differences for specific market development for each product. Having said this, however, the larger biases towards positive and negative issues with regard to each of the chairs, and discussed in the Tokyo and Milan markets, are evident for both chairs. These particular issues will be discussed and detailed through the redesign process in this chapter.

9.1 Redesign brief

(Extracted elements of the initial design brief - Parameters based upon market findings in Tokyo and Milan, also technical issues associated with the chairs, identified through the initial prototype process.)

**Japanese chair for the Japanese market**

- Strength and safety issues must be changed as a priority

- The timber sections must be made thicker to create the appearance of strength, to overcome market concerns about thin sections

- Metal bracing on legs, which were generally appreciated, will remain a feature of the chair
• The curved application of the metal bracing is the most attractive and unobtrusive way to be incorporated into the chair, while remaining a design feature.

• External fastenings – New method of joining must be devised for these attachments.

• Simplicity of design was valued highly, and must be kept as a feature of the design, however there is scope for more detailing work.

• More detailing work will overcome negative comment on the lack of detail on the Japanese chair in comparison to the preference of the German chair that has more detailing.

• More decorative elements could be added to the Japanese chair, particularly in the backrest and seat structure, without detracting from the simplicity of the design.

• As the German chair was preferred for its ‘comfortable appearance’ in Tokyo, particularly the bent backrest, a simple element such as this could be easily incorporated into the Japanese chair.

• A more comfortable seat for the Japanese market could add to the appeal of the chair.

• Scale remains satisfactory.

**German chair for the Japanese market**

• Appearance of strength and safety issues in the German chair is something that must change. The section sizes of the legs must be considerably larger.

• This could incorporate increasing the joint size.
• As the structural issues in the chair are due to excessive flexing in the second set of bracings, this must be investigated to give the chair a better structure, and a visually stronger appeal.

• The second set of bracing on the legs was the most highly appreciated decorative and visual element of the German chair, and this aspect of appreciation must be preserved.

• External fastenings in backrest and leg bracing must be removed.

• The appearance of comfort of the German chair was highly appreciated.

• The backrest may look too simple, and could be altered to provide more visual interest and better comfort within the chair design.

• The scale of the German chair could be slightly smaller for the Japanese market, although this was not raised as a particular problem.

• It is important to keep the decorative elements of the German chair.

**Japanese chair for the European market**

• The chair was considered not visually interesting, but was appreciated for its simplicity. Elements of the chair can be revised to create more visual interest without decreasing the simple appeal of the chair.

• The discrepancy between appreciation and rejection of the ‘simplicity’ of the design is less than was evident in Japan, meaning that more decorative elements are probably appropriate.

• The metal fasteners on the outside are unacceptable, and must be changed.
• Must be scaled up for the Milan market (scale still needs to be differentiated between markets)

• The ‘light’ appeal of the chair must be kept, while providing a more sturdy structure.

• The chair is not sturdy in structure and appeal, however, the section sizes can probably stay thinner than those sold to Japan as the problem was less in Milan than in Tokyo

• The laminated timber seat was appreciated in Milan, while lack of comfort provided by the laminated chair in Tokyo was a primary concern

• Providing there are not technical difficulties, the laminated seat would be better for the European market.

**German Chair for the European Market**

• ‘Poor proportions’, and the fact that the chair looks too sectioned, were major complaints regarding the German chair. As a design issue these should be addressed where possible

• The backrest should be more detailed, and perhaps longer, which will help with the proportional difficulties of the chair

• The structure of the chair was questioned with regard to section size and strength, however, not nearly as much as in Tokyo, meaning that the sections could be kept thinner for the European market. However, the chair must look more structurally sound than it does now

• This could mean compromising on section size of the timber, or adding additional bracing elements in the backrest or lower leg bracing
• External fastening must be removed

• The bent ply lower leg bracing must be kept in some way, because it was the most popular decorative element in the German chair

• The size, scale and comfort factor of the chair were appreciated in this market

• The contrast in colour between the timber and ply was appreciated in this market

*Technical issues, derived from design analysis of the first prototypes*

*Japanese chair*

• The backrest material needs to be revised due to inappropriateness to create required structure (i.e. short end grain causing problems, also there is a need to avoid metal fasteners in attachment)

• Metal arms should not be externally fastened on legs

• Metal arms must be more secure at the top where the seat attaches to the metal fastener

• Problem with movement where metal arm goes into the leg must be removed

• Too much movement where timber meets timber, must be reduced by a buffer between those components (i.e. front and back legs)

• Backrest is not strong enough, and thicker sections are required for strength.

• Seat, issue of lamination, and bar going through seat make it difficult for production and assembly, and the joint could be devised better for strength and structure
**German chair**

- There is a twist in the chair at the moment occurring because of the lower bracing on the chair legs. The top adjustable join is providing adequate structure, however, twist is occurring over the length of the legs below this.

- The current design is too high up the leg and allowing too much flex

- A different way of fastening the backrest and lower leg bracing must be developed

### 9.2 Japanese chair redesign

In this section of the chapter, aspects of the chair redesign will be discussed in relation to market feedback and technical issues raised through prototyping.
Figure 9.1: Sketching investigation of problems with backrest
Figure 9.2: Sketching investigation of problems with metal arms and metal arm attachment
Figure 9.3: Sketching investigation of problems with the leg to seat joint
Within the context of the Japanese chair, the backrest from a design perspective is the most important link in allowing an element of improvement in the redevelopment of the chair.

The need for more decorative elements to be added was identified as an important aspect of improvement for the chair, and is best and most simply implemented through alteration of the backrest. Also the comfort element of the Japanese chair was questioned, and it was presumed to be less comfortable than the more ‘comfortable looking’ Germany chair.

The comfort aspect, provided by the backrest in the original Japan chair was questioned in discussion.
Figure 9.5: Sketches showing backrest and comfort potential of the Japan chair

**Material**

The backrest designed and prototyped in the original Japanese chair was cut from solid timber, but later considered unfeasible in manufacture due to problems of short end grain on the attaching segments of the component.
Alternate materials must be considered for this component, if the backrest of the chair is going to be kept in the same style as the previous prototype. Plywood, metal and plastic could all be considered as possible replacement materials for this component.

Figure 9.6: If new materials were to be considered in the production of the backrest, different forms could also be considered.

Backrest forms with thicker sections, proposed to be made from bent plywood, are represented in the sketch work represented above. The idea of adding a form of binding as a further decorative feature in the backrest was also investigated.
Attachment

Two methods for attachment of a new backrest form, based on using a ply component to replace the solid timber component for the backrest, that is:

![Figure 9.7: Investigating new ideas for backrest attachment](image)

The first idea for attachment was to have a section of the backrest (vertical solid timber section) recessed and circular sections of the backrest, slotted over the top of the arms and secured in place with a stopper at the top.

However, gaining the almost full circle on the top of the backrest would be considered too difficult to obtain in a bent ply component.
The second idea for attachment was to use a screw fastening from the back of the timber section of the chair in to the ply. A fastener would still be visible, however it would be at the back of the chair, and could be disguised with a cover.

**Backrest form re-evaluation**

It was evident that to increase the perception of comfort in the Japanese chair, additions to the very minimal backrest would need to be made. The need for a further element of ‘detail’ or ‘decoration’ on the Japanese chair has also been discussed as something that would add popularity to the chair.

By adding to the simple form of the backrest, both of these issues can be addressed. The challenge is to add to the form in such a way that it does not diminish the simple appeal of the chair, which was its most popular aspect when the Japan chair was preferred to the Germany chair in both the Tokyo and Milan preference discussions.
Initial form evaluations, using computer generated images, to quickly construct and alter additions to the original Japanese chair backrest. Evaluation of such forms has proven beneficial in the solutions that have been reached in the redesign of the chairs.

Adding a further vertical element to the main horizontal elements of the backrest was the vehicle for this design experimentation.
The idea of different thickness, materials and colour was examined in an attempt to integrate this additional element into the theme of the chair.

Figure 9.12: A slightly wider distance between the two back legs and deeper curves in the horizontal components of the backrest to provide greater comfort in the chair.

The side image of this chair above shows this greater curve, which in addition to the vertical support creates a greater appeal of comfort than was evident in the previous chair.

Figure 9.13: A longer additional vertical section was also trialled in the backrest to see if a more integrated form could be achieved.

The addition of a vertical section was therefore abandoned, however the vertical section of the backrest still required additional horizontal support. This additional horizontal support was the theme that was taken forward into the redesign of the Japanese chair backrest.
The idea of replication of form in the backrest development with the intention of creating a more decorative, comfortable and structural addition to the Japanese chair was further investigated in the redesign phase.

The final design of the backrest and the process of evaluation that was taken to achieve it will be discussed when the final product is discussed.

**Seat: Laminated, upholstered**

The seat of the Japanese chair is another aspect that indicated that improvements could impact upon the viability of the chair, with particular regard to the perception of comfort.

The need for a greater appearance of comfort to appeal to the consumer was raised as an important issue for this chair in Tokyo. It was less of an issue in Milan, however, it was discussed. In Milan, the appreciation of the laminated timber seat was pointed out as a positive aspect of the chair, but in Tokyo, this element as a feature of the chair was not raised.

In the case of the international prospects for this chair, the most viable solution may be to create two options i.e. one chair, with the addition of an upholstered seat to create an appeal of comfort and convention and the second with the original timber laminated seat to appeal to those customers with a preference for more timber and less concern for absolute comfort in their chair choices.
Fortunately, the design and construction of the Japanese chair allows for a fairly simple adaptation from a laminated timber seat to an upholstered seat. This conversion is made the most viable by the ability to keep a timber frame around the chair.

### 9.3 Production problems

Re-evaluation of design and production of the seat to leg joint in the Japanese chair. Difficulties in production were raised regarding the metal rod that runs the length of the seat at the front and back, between the front and back legs, pinning the seat and legs together to create the joint. The metal rod in the Japanese chair prototype was inserted internally through holes drilled through the timber seat sections.
Initially it was intended that the seat sections in which holes were required for the insertion of the rod, would be shaped and drilled individually, then joined and the rod inserted. However, this is unviable for production, because alignment and shaping of the piece proved difficult.

An alternative method for this joining needs to be investigated. The decision to incorporate an upholstered as well as the laminated seat into the chair design required a solution applicable to the needs of both options.

Initially the idea of having a short rod in each end of the joint, as opposed to one running the length of the chair, was investigated. However, this was rejected as the initial idea of having the full rod was to allow the movement of the timber boards (trapped in the center of the chair) freely along the rod, to avoid constriction of movement, and placing stress on the joined areas of the chairs.
If short rods at each corner were to be used in the design, effectively an outer frame on four sides would be created, restricting internal component movement in all directions.

Figure 9.17: Alternate ideas for the seat section orientation

Rotating the location of the internal seat boards from running lengthways, in replication of the two end seat components, to placing them in the alternate direction as indicated in the sketch above was also considered, in conjunction with using four short rods in construction rather than two long ones.

This idea was rejected, however, due to the pressure the movement of internal timber boards would place on the end joints as the timber moves forward and backwards in accordance with the new placement of the boards. The placement of timber in this direction would create a great deal of pressure on the short rods in the event of timber movement. This solution would be substantially weaker than using full rods that accommodate the movement of the timber in the other direction.
Figure 9.18: The sketch above illustrates various ideas for the joining of a laminated timber seat using four short rods. It also displays the proposed difficulties that may be encountered.
Another idea generated with regard to this problem was to keep the length of rod (crucial in the design for allowing the movement of the timber) without causing problems in the structure of the chair, and avoiding the problems created by an internal casement of this rod in construction.
The idea was to superficially glue the sections of the seat together so it is held together as one piece. The leg holes are then drilled as per the first prototype, however, a section is then routed between the leg holes at either end of the chair to allow that the rod to be dropped into place and fastened using external brackets.

This method allows the same movement and structure as the rod that was threaded through internal section in the previous Japan chair design, however, construction is far more straightforward.

Figure 9.20: Sketching showing alternate joining mechanism, and ideas for assembly of legs and seat components

The idea of externally routing a section in the base of the seat, and allowing the rod to be inserted and held externally would perhaps create a better solution. However,
issues were raised as to the process of construction and assembly, particularly concerning the legs of the chair and retaining strength in the leg to seat joint.

As indicated in the images above, the legs would need to be threaded onto the rod, then located in the appropriate holes in the seat base and secured by the brackets. This method of assembly, given the new joint structure, does not appear to be more difficult than the previous method of assembly.

Figure 9.21: Sketches depicting ideas for assembly of front and back legs in the Japanese chair
An initial idea for the chair was to put a bend in the back leg to assist in creating a greater impression of comfort. However, it was later considered that this might be problematic, as the leg has to be slotted through a hole in the seat for assembly. As explained previously, the alterations to the backrest of the chair are intended to create extra comfort in the chair.

Because of the difficulty that would be encountered in assembly and the extra process it would add to the chair manufacturer, it was decided that the back leg would remain straight, relying on the additions to the backrest and upholstered seat to provide better comfort on redesign.
An important aspect of the chair design and timber properties in furniture application is raised here. A rubber ring for buffering needs to be applied to the back legs, and this buffer would not be seen except at the top of the chair. The idea of the application of a rubber insert can be seen in the sketching above.

The application of this buffer is important, because in the Japanese chair prototype the timber shrank due to change in climate and the fit between the leg and seat section became loose, meaning that the leg wobbles slightly and the strength of the joint is reduced.

There is less problem with the front legs because they do not come to the top of the seat sections, and are therefore better encased. However, a buffer around the top section of the front leg would also improve the structure of the chair.

Although buffers and their application were disapproved by manufacturers in a previous project when used in a jointing application, it seems that a timber on timber joint in Spotted Gum timber requires buffering.
The advantage of applying buffers in the scenario of the Japanese chair is that they can be made from a circular extruded tube, and slipped over the round legs of the chairs with relative ease.

To avoid buffering, the joining mechanism for the Japanese chair would need to be redesigned like the German chair where there are no timber-to-timber joints.

The Japanese chair was designed, to create and test mechanisms of timber-to-timber joints using Spotted Gum timber. This seems to confirm reality of the way the timber must be treated to be viable in its current, technologically unaltered context.

*Construction differences: laminated and upholstered Japanese chair seats*

Figure 9.24: Sketches of seat base configuration for the Japanese chair
Figure 9.25: Computer rendered image of the laminated version of the Japanese chair from the underside. The metal rod can be seen running between each set of front and back legs.

Figure 9.26: Sketches of seat base configuration for the Japanese chair with upholstered seat.
Figure 9.27: Computer rendered image of the upholstered version of the Japanese chair from the underside. The metal rod can be seen running between each set of front and back legs.

Figure 9.28: This semi-exploded view of the upholstered Japanese chair shows where the indents in the timber are required for the timber rod, leg and holding brackets to be secured into place.

Figure 9.29: Where the legs are inserted into the seat section, an extra recessed area has been included to provide further structure to the joint, an addition from the first Japanese chair prototype.
Figure 9.30: Exploded view of chair from the top. The metal rods, inserted into the leg components are ready to be pressed up into seat sections and fastened into place by the appropriate brackets.

9.4 Metal fasteners

The metal arms used to secure a lower point of the leg and add additional structure to the chair are both an important structural and decorative element of the Japanese chair.

Particularly amongst those discussions held in Tokyo, there were some who disliked the addition of metal components to the timber chair. However, the addition of metal in a bracing format is crucial to the structure of the chair, when produced to be flat-packed and using Spotted Gum timber.

Generally the form of the metal support structure was well received in both Tokyo and Milan. As the overall form and simplicity of the Japanese chair was often commented upon as the advantage of the chair, the metal form was generally believed to integrate well into the chair design and be accepted.

Therefore the bracing system was left virtually unchanged as a visual characteristic of the chair.
The one visual aspect of the chair that was changed the external fixings into the leg. This aspect, along with the external fastenings on the backrest of the chair, was widely criticized. Also, a technical problem was arising from this attachment, because the metal rod was able to slide within the leg as the fixing was located through and not anchored in the leg. This problem was overcome in a standard and simple manner, by inserting a threaded end into the timber leg rather than through and it as in the previous design.

This attachment would create a simplified process, as the end of the metal support strut could be threaded and fed directly into the attachment inserted into the timber leg. This idea can be seen in the sketching above. It also stops the problem of the rod sliding in the timber leg as the rod end is anchored, and not just located through the timber.
Some further issues were encountered with the metal attachment that secured the supporting metal struts to the base of the seat. The most relevant issue was that it was difficult to fasten due to the size of the fastening component at the base. Secondly, in the original design, there was a gap left between the metal holder and the base of the seat, so that the metal support struts could be compressed up into the timber seat base as the component was fastened, giving the struts a firmer fit.
The first issue raised can be addressed by making the base component of the mechanism far bigger, with the addition of finger grips that will vastly assist in the assembly of the product.

The second issue is addressed by removing the gap that was left between the metal mechanism and the timber seat base, ensuring a better and more consistent fit. Instead of relying on a press into the timber to secure the supporting struts, a texture can be created on the surface of the metal, to ensure that there is no slip possible for the metal struts.

9.5 The Japanese chair:

Chair option: number one

The aspects of the Japanese chair, given its flat pack componentry and adaptable joining system lends itself well to some slight options within the one chair design. In this case, some slight aesthetic preferences gathered between Tokyo and Milan were
identified as appropriate areas to have slight variations in the chair designs, although the changes are subtle and bear no real cultural significance.

The purpose of having some subtle options in this chair are based on slight market preferences, however, in reality the differences are slight and would probably not make a great deal of difference to markets. The differences, which are relatively easily achieved in terms of production, add more options for the manufacturer, and display the easy versatility of the flat pack design and how that can be exploited in the creation of a range of furniture.

Figure 9.34: The larger backrest element in the chair providing greater comfort and a more detailed aesthetic

Figure 9.35: The final chosen design for the upholstered Japanese chair

It was decided that with the intention of fulfilling the needs of the Japan market, the chair would have an upholstered seat. The backrest of the chair, while keeping the same form on the original Japanese chair, would be produced from a thicker ply material, fastened from the back and replicated three times.

This backrest keeps the theme of the original chair, and adds a more decorative quality through replication while being produced from a more appropriate material. This formation in the backrest also provides the appearance of greater comfort and strength to the chair.
As can be seen in the side profile of the chair depicted in the computer image above, the curves in the backrest are altered in depth as they go down the chair, creating a comfortable and supportive angle for the back.

Figure 9.36: The three sectioned backrest could also be applied to the chair with the laminated seat, intended more for the European market, but almost equally as applicable in Tokyo.

Figure 9.37: In the image above, the three-part backrest can be evaluated in both the laminated and upholstered seat contexts.

**Chair option: number two**

Figure 9.38: In the second option for the re-designed Japanese chair, the laminated seat is retained as the option.
The major difference in this chair design is the addition of a second support and structure in the backrest, in addition to the deepening of the curve in the backrest to provide greater comfort.

Adding only a slight change to the backrest (more than the previous three replication backrests discussed above) allowed the simplicity of the chair to be retained. The addition of the straight backrest component below the curved one, adds greater structure to the chair and improves the comfort. The initial complete timber theme of this chair is retained in this redesign option.

9.6 Final Designs: Japanese chair

Scale: The scale of the chair on the left is larger than the one on the right. This alteration in scale is proportional across all elements of the chair.

![Figure 9.39: The scale of the chairs is an important point of differentiation in the products that are sent to each market. The smaller scale upholstered chair on the right intended for the Japanese market, the larger on the left for the European](image)

![Figure 9.40: Options, material variations](image)
Points of note:

- The section sizes of the timber legs have been increased to create greater strength and structure in the chair

- The method of production for the seat to leg joint has been revised

- Following this, the laminated timber seat and new upholstered seat version of the chair have been developed. The upholstered seat was developed with the specific intention of creating an image of greater comfort around the chair

- The backrest of the chair has been redesigned, again with two different options presented

- These new backrest options endeavor to provide a greater decorative aspect to the chair, provide better comfort, and add to the structural appeal of the chair

- The width between the backlegs and the depth of the curve on the backrest has been increased. The increase of the backrest curve depth is due to the adoption of a more appropriate material for this component
• The join between the seat and back legs (timber-to-timber section) is recommended to be buffered due to timber movement, and the difficulties encountered in using a timber-to-timber joint in Spotted Gum

• The metal leg bracing has effectively been unchanged, with the exception of the fastenings onto the timber legs being removed from sight.

• Alterations to the top metal component of this bracing mechanism have also been made, first to assist in ease of assembly, and second to rectify an unsuccessful attempt in providing an appropriate securing mechanism for the metal support struts between the mechanism and the timber seat base.

9.7 Redesign German chair, for both markets

The German chair was significantly the most popular chair in both the Tokyo and Milan discussions. While popular, there were still aspects of the chair that could be redeveloped to create a better solution to specific needs in both markets.

Bracing

The first issue that needed to be addressed in the German chair was that after the initial prototyping process there was still a problem with stability. After analysing the problem with the assistance of other designers, it was determined that in their present form, the bracing components were not providing enough strength to the lower parts of the chair legs.

However, this bracing section was also a highly popular decorative feature of the chair, stated as such in both market-testing environments. The popular decorative element that was created by the bracing structure is an important part of the chair and changes, although necessary for the structural integrity of the chair, should not alter the visual and decorative popularity of the bracing element.
It was decided to look at a bracing form that runs diagonally between the legs rather than from front to back, crossing in the centre, such as in the previous design. The arms of the bracing were made considerably thicker, as there was too much flexing in the 10 mm depth of the previous arms.
In increasing the thickness of the arms, the need for doubling up on components can be reduced, increasing the appropriateness of the chair in cost and production. However, the overlapping of the components again provided the main interest as a decorative element.

Figure 9.43: Lower leg bracing redevelopment

To counter this problem, diagonal interlocking forms were investigated. The idea of forming an ‘s’ shape between the four legs was intended as both a structural and decorative element.

The initial forms shown above were offset from the center, in an attempt to secure the leg attachments on different angles. However, the visual effect was not appropriate for the chair, or appropriate in replacement of previous forms. The depth of the arms now used is 30 mm, triple the depth of the previous arms.

Figure 9.44: A further widening of the arcs on the ‘s’-shaped arms improved the form slightly however, this was still not entirely appropriate for the chair
This in turn altered the form of the ‘s’ shaped arms to create a more symmetrical form, better fitting in the context of the chairs, and more appropriate in the replication of the previous decorative form.

*Attachment of the supporting arms to the timber legs*

The issue of attaching the curved arms of the ply support structure to the legs of the chairs with metal fasteners was largely criticised in Tokyo but to a lesser extent in Milan. This issue needed to be addressed with regard to redesign. Ideas were generated to find a new method for this joinery while providing a simple and effective flat-pack solution.
A method of slotting into the timber leg was an obvious solution to eradicate the external fastenings, and also an opportunity to provide a further detailing element in the chair.
The idea of incorporating a split into the arm of the ply ‘s’ shape allows the form to have a decorative element that can also assist in creating the non-mechanical fastening in the joining to the leg that is required.

This is important in keeping the decorative aspect of the ply leg component that was considered such a successful feature of the chair.
It was decided that two separate pieces would be required for the joint, and the idea of pulling a section from the ply arm to hold the opposite side of the timber leg is feasible but difficult in production, and as a structural section of the chair.

Figure 9.50: Two separate sections, further illustrated
Figure 9.51: Sketching indicating how the slotted arm attachment would exist, to hold the leg bracing in place and give it appropriate structure

Figure 9.52: The supporting arm may need to be located by two fasteners to give it more structure. This is indicated in the sketch above

**Bracing on the chair frame**
Computer generated images show the re-designed bracing element in context with the rest of the chair design.

![Image of the revised bracing element in context with the rest of the chair design.]

Figure 9.53: The structure of the bracing provides the option of experimenting with various materials to further decorative additions and strength enhancement.

In keeping with the previous German chair design, the chair could be made from an all ply bracing structure. An important aspect of the redesign of this bracing mechanism is that it is less segmented into parts. The previous bracing on the German chair consisted of four overlapping arms.

The arms of the bracing in the redesign are two interlocking single arms, running diagonally, rather than from the front and back and overlapping in the centre. These changes were made to improve the strength of the bracing component and therefore the structure of the chair.

Another criticism of the German chair was that its proportions were not well balanced. The nature of the four-part leg bracing system was no doubt contributing to the ‘broken up’ overall effect of the chair. While remaining ‘decorative’ in its curved format with additional detailing where the arms attach to the timber legs, this new format for the leg bracing improves on the proportional discrepancy of the chair, by bringing the bracing into an aesthetic, single unit.
Figure 9.54: The final form of the lower leg bracing

Backrest

The backrest was one aspect of the German chair that was criticised in both markets, and it was commented that the backrest of the chair was too plain and did not tie in with the chair as an overall piece.

In addition to this, and particularly in Milan, the chair was commented upon as being un-harmoniously proportioned. This comment regarding the broken proportions of the chair affects all aspects of the chair. The segmentation between all of the horizontal sections of the seat, including backrest, seat and leg bracing, are all contributing factors in this problem.

However, the elongation of the backrest vertically could be a quick fix mechanism that can be employed to the chair design, without a great deal of alteration required.
Figure 9.55: Sketching for a new backrest form
As can be seen in the redesign sketches above, the redevelopment of the backrest maintained a similar theme to the previous German chair backrest, with the addition of another horizontal section.

**Material**

The pressed ply backrest was a very successful component of the German chair, however, the attachments (i.e. screws through the front of the components into the chair legs) were criticised.

**Attachment**
To negate this problem, a joining mechanism derived from the theme employed in the attachment of the leg bracing to the timber legs has now been employed in this chair design.

An additional small section of ply has been added to the back of the main section of each backrest component. There is a slot in the small back section of ply, which is then slotted into the timber back legs, securing the backrest components in place.

Figure 9.57: Detail of the plywood backrest sections showing the attachment mechanism founded on the same principal as the lower leg plywood attachments

9.8 Final redesign: German chair

Points to note include:

- The timber leg section sizes have been increased to create the appearance of greater strength and structure

- The backrest has been elongated and enhanced through the addition of a third horizontal pressed ply component
• The elongation of the ply backrest also contributes to the proportional continuity of the chair

• A more structural formation for the lower leg bracing has been developed, increasing the strength and structure of the chair, while retaining the technical aspects and assisting in better combining the proportions of the chair

• The joining mechanism of those components has been re-evaluated, to include an extra ply section, with slots into the timber legs of the chair to create the join in both the backrest and ply leg-bracing section. This eradicates the need for metal fasteners

9.9 Chapter Summary

This chapter outlines that fact that, given the feedback obtained through the Tokyo and Milan exhibitions, there is not enough evidence to support the niche market design theory tested in the project method, that is: that a product designed with particular cultural and market characteristics in mind will be better appreciated and therefore find success in the market.

However, there was specific feedback gained for each chair in each market and this information was used to create a redesign brief – a set of parameters through which the existing chairs could be re-developed to presumably make them more appropriate to both the Japanese and European consumer markets.

The re-design brief was created through the compilation of major comments made during the Tokyo and Milan exhibitions, and also the re-assessed technical aspects of the two chairs. The re-design brief differs from the ‘results’ of the surveying as it contains technical data, and a synthesis of positive and negative comments gained through the surveying process.

As in previous design chapters of this thesis, sketches, and computer generated images have been laid out, with accompanying annotations to guide the reader
through the design process at this stage, in applying the survey information into the design process and once again creating a final outcome.

The results of this process have been defined in this chapter in both aesthetic and technical alterations which have been exemplified through the visual imagery produced, of the new German and Japan chairs.
Chapter 10
Conclusions: Market specific design

10 Introduction

The results of this investigation have made a decided contribution to new knowledge in the primary related industry of forestry and the secondary manufacturing industry of furniture. In attempting to develop indoor furniture from Spotted gum timber for export markets, several issues relevant to the industries mentioned above have been addressed.

The parameters of this investigation have been developed within the primary and secondary industries needs, within a particular geographic region of Australia. However, the results found in this investigation have implications beyond the case study parameters of the geographic location, having implications to related industries in Australia and other manufacturing nations of the world.

This unique contribution was made possible by testing a new method of approach, with regard to existing issues in both the related industries. A brief overview of the main relevant issues, used to initiate the new method of testing in the pursuit of contributing a theory for their solution is as follows:

*Why is the timber (primary) resource important?*

Value adding to the Spotted Gum timber resource, an economically pre-eminent species known by the trade name, is important to the timber industry.

*What secondary industry would most benefit from a design led investigation involving value adding to the properties of the timber resource?*

The furniture industry was identified as such an industry, however, extensive background investigations in both timber properties and manufacturing history showed, that the properties of Spotted Gum timber and traditional design and
manufacturing techniques of indoor furniture manufacturers, do not work harmoniously together to create a value added product.

Related furniture industry issues – Decrease of traditional domestic market share

The furniture industry is facing problems relating to the decrease of their traditional domestic markets due to the increasing saturation of these markets with cost competitive imports, in the majority from low wage earning countries.

How is the decrease in domestic market share best countered? Why was export investigation established as a major related issue?

In the address of the issue of decreasing domestic market share, export initiative has been identified as required for manufacturers to sustain and increase their customer bases. Value adding to the timber resource through furniture manufacturing, logically points at export as a focus of new product development initiatives, and reclamation of market share.

10.1 Previous projects: as a basis for new project development

What has been learnt from previous product development from Spotted Gum timber in research and manufacturing capacities?

Prior projects, the nature and success of which have been outlined in the early chapters of this thesis have provided much information which could be used to achieve technically successful product development from Queensland hardwood timber.

Past investigations in the area of indoor furniture production from Queensland hardwood timber had involved:
- **Scientific investigation** - commissioned by Metaform members, including furniture manufacturers. Scientific testing of the properties and performance of Spotted Gum timber in various indoor furniture related trials was undertaken.

- **Manufacturing investigation** - product development by interested furniture manufacturers in the design production and in some cases market release of Spotted Gum and other various Queensland Hardwood timber furniture.

- **Design research investigation** - furniture prototypes and joints were produced by designers at the Canberra School of Art, again on commission for the Metaform involved manufacturers. The products developed as a result of this investigation made considerable contribution to the generation of technical design ideas for the use of Spotted Gum timber.

Most of the research work listed above, had focused on technical issues in the development of more appropriate ways of designing and joining and producing Queensland hardwood furniture.

In some of the product development conducted by the manufacturers, market issues were addressed with regard to the each individual and collaborating companies own market agendas. In some instances also, Metaform-developed Queensland hardwood furniture was exhibited at trade fairs in both Australia and overseas.

However, little documented market information was gathered from these market experiences by manufacturers, and the issue of lack of market awareness was raised as an important issue by furniture manufacturers at the final meeting of the Metaform organisation, attended at the beginning of this investigation.

*Did lack of existing export market and subsequently design for export knowledge, became an avenue of primary interest within the investigation?*
Manufacturers of indoor timber furniture (involved in the case study aspect of the investigation) had little export market knowledge, from a new product development perspective.

The challenge therefore became how best to combine technical product development issues in designing indoor furniture products from Spotted Gum timber, with export market objectives.

Further to this, few furniture manufacturers had initiated new product development with export objectives in mind. This led to new questions about the technical aspects of the timber application not previously addressed in designs developed by researchers and manufacturers, such as the appropriateness of ‘flat pack’ design, and export market orientation in the design phase.

10.2 Investigative approach

Given the background information, what must the design led process undertake within this investigation?

As this investigation was conducted from a design research perspective, the background knowledge gained with regard to materials and manufacturing industries provided the appropriate insights into the major relevant issues concerned. This information was then used to determine an appropriate method to integrate industrial design skill and knowledge in addressing the issues at hand.

The skill of an industrial designer, working within a design research investigation and given the issues at hand would be best used to:

Develop furniture for international export markets from Spotted Gum timber, with the perspective of small to medium sized manufacturers in Australia in mind.
This objective was then opened up to research method questions, including what factors were known within this objective and what were not. What was the primary leading concern around which the other objectives would revolve?

What was known?

- The properties of the timber made it difficult to use in a fine furniture application.
- The timber had been tried unsuccessfully in both manufacturing and experimental furniture design projects
- This investigation would be required to look at further forms of experimentation in furniture design to re-address the established issues.
- Furniture manufacturers were interested in export as a means of countering depleted domestic market share.

What was not known?

- What would be appropriate export markets for the manufacturers concerned?
- How to develop a product which will appeal to the chosen export destination?
- How to develop market information for these destinations, and integrate this knowledge into the design development process?
- How to determine whether the method used for gathering and disseminating market information into the design process was appropriate?

With this agenda realised, the issue of how to test whether the method employed in the development of the new timber furniture products was appropriate in achieving success in an export market capacity was considered.
The properties of the timber and its difficulties in furniture application are to some degree known, however new and more experimental products will need to be developed, which will be untested in a technical capacity.

However, if the products were to be developed from a purely technical perspective, being successful or otherwise would provide manufacturers with no insights as to their market appropriateness.

To provide the required insight, market information prior to product design commencement must be established and integrated into the product design process, as the first and largest unknown in this investigation.

Following this, it must be considered whether the market information developed was appropriate to the export market targeted, and whether or not the generation of market information and its integration into the design process was valuable.

The major new contribution to knowledge in the design research investigation came through a market testing strategy.

In summary:

It was decided that the testing process in the investigation, must provide reasons as to the success or otherwise of the international product development theory, which is considered the most relevant to the issues at hand, and therefore implemented in the investigation.

### 10.3 The market investigation stage

The importance of market-led design development, and the lack of market direction and export oriented design work associated in the furniture manufacturing industry consulted had been acknowledged within the investigation. How best to approach these market parameters in an industrial design-led, design research investigation was then addressed.
Determining the best approach to product design for a niche export market - What aspects in this investigation make the approach novel, resulting in the generation of new information?

It has been determined (see Chapter 4) that a new product or products would be developed to give the best advantage to technical solutions required in the investigation.

There are two major recognized options for new product development for export markets. They are:

- Multi-market product development
- Niche market product development.

In consideration of the most appropriate export market integration product and design strategy taken in this investigation, several issues were brought into consideration:

- How do small to medium size manufacturers (in various industries) approach exports, and what tactics have provided the best result?

- That success for small manufacturers in various industries appears to be related to niche market targeting, including niche direction in design innovation.

- How has industrial design traditionally contributed to the advancement of industry?

- What has been learnt from traditional industrial designer relationships to manufacturing industries, with regard to market/product integration?
• The improbability, given global manufacturing structure and concerns, of developing a multi-market product produced by a small manufacturer in a high wage earning country, being competitive on cost alone.

• Difficulties defining parameters for testing the success of a multi-market product and design development strategy.

• The advantageous perspectives that can be drawn from the notion of combining design expertise, with niche market information to design market intended furniture products.

• It was conjectured that the application of a niche market infiltration design method would find a reduced risk for manufacturers through this design method.

• By approaching niche markets from a design perspective, a significant starting point is created in product development.

• What is learnt from choosing niche market information as a starting point for product development and evaluating its success, could provide significant information, translatable to other methods of approach for export product development.

Given the significance of the reasons outlined above, it was decided to gather niche market information from various markets pre-design, then design products for particular niches in various global markets.

10.4 Resultant testing method employed

Two case study markets were chosen, and an initial set of market information for each of the case study destinations generated and an appropriate furniture product from the same genre (i.e. two indoor dining chairs) placed in their intended (or as close to intended as possible) markets. Each of the two products designed was tested for
market appropriateness in each of the two case study markets. This testing was conducted through a series of relevant questions being directed to those attending the testing venues.

This testing process was conducted to determine how appropriate was the design method (i.e. for the approach of export markets) developed and implemented within this investigation.

As a consequence of determining the appropriateness of each chair for its intended and other market, a judgment was made on the appropriateness of designing for a specific market niche.

10.5 The comparative testing of market specific products is novel because:

- The market information generated as a background to the product design has been generated from a design-led perspective, including qualitative interpretation of market information in the knowledge generation process

- The testing of new products was previously untried in any market conditions. The parameters of the products designed with regard to material and export consideration required that novel joining systems be developed. The project elements (materials into exports) creating novelty in the designed outcomes

- Unique parameters generated for case study selection

- The Exhibition of the chairs in each of the case study markets for which they were designed, and also in the market for which they were not designed

- Gaining a comparison of each market reaction, according to the specific market driven design properties of the chair, placed in the two markets
• The unique position of the design researcher, able to access and address the needs of a range of industry concerns, rather than the industrial designer being obliged to design within the parameters of one manufacturer’s specifications

_Conclusions about the research question_

What was the question?

How to generate information that would assist Queensland furniture manufacturers in their approach to export markets, with new products developed from Queensland hardwood timbers.

_To assist in answering this question, the action was taken to:_

• Test whether or not a specific niche market approach was the most appropriate approach for developing export products for the furniture industry.

_To prove or disprove the success of this theory by:_

• Establishing the degree to which cultural influences impact on furniture popularity in various world markets, and should cultural variation factors concern small Australian furniture manufacturers.

_Establish conclusions by_

• Analysis of insight from an overall perspective as to which chair was preferred in each (or both) of the markets

• Discuss insight generated as to the most influential factors in both of the markets tested, and how these were treated in the re-design phase of the investigation

• Comment on the success of the each of two chairs in their intended market
• Comment on the success of each of the chairs in their non-intended market

• Comment on the comparison of the chairs in both markets

• Comment on the comparisons between the markets

• Discuss how results were used in the re-design phase of the investigation

• Discuss the major influences that were discovered in each of the markets through the chair testing process.

• Considerations of the timber used and its appropriateness in both markets

• **Summary:** How have the findings agreed or disagreed with all of the initial questions posed?

### 10.6 Limitations

*Design interpretation*

Given the nature of the products tested as newly designed objects in this investigation, there is always going to be an element of subjectivity both in the appropriateness of the chair design for each market, and also in the response that was given to them. This subjectivity is due to the nature of design as a creative profession, and its innate link to interpretation.

However, constraining parameters were carefully applied throughout the investigation to gain the best outcomes within the method employed.

The various choices made in each chair design, and the relationship of those choices to the specific cultural and market factors associated with the case study markets in each case, have been discussed.
These points were mainly considered in the extensive board market evaluations that were undertaken prior to the case study market choices being made, and the equally as broad background analysis of market of both the two case study markets selected.

*Experimental use of non-traditional furniture timber*

The non-traditional furniture timber (Spotted Gum) from which the two indoor dining chairs were developed, and the resultant non-traditional joining systems used in the resultant furniture, inevitably resulted in unique furniture forms.

In the final pieces of furniture, the joining systems contributed to the aesthetic themes of the chairs. When during the market testing process, aspects of the joining systems were commented upon. These comments were assessed as to their meaning within the context of the overall chair design, and exceptions to this rule were made when required.

The treatment of various comments that were made through the market testing process has been explained in Chapter 9 (The exhibiting process) and Chapter 10 (The redesign phase.)

*Themes of both exhibitions*

The difference of the style of the exhibition has been extensively discussed with regard to both of the furniture fairs. (Milan Furniture Fair and International Furniture Fair Tokyo).

Again, the contexts of the fairs, and an understanding of the differences in national representations and various other demographics have been thoroughly discussed in chapter 9 (The exhibiting process.)

**10.7 Results**

*Two interpretations of the testing information, one conclusion*
Theoretical conclusions

Re-design conclusions – the physical manifestation of theoretical knowledge

Through the market testing process, consumers at the international furniture fairs were asked to give a preference as to which of the two chairs (Japanese or German chairs) they preferred. Following this, they were also asked to point out what elements of the chairs they liked or disliked to make that preference. These two major aspects of questioning can be used to draw theoretical conclusions regarding differences and resultant market design strategies for product design.

In this investigation, the theory produced through this questioning has been immediately integrated into a re-design, creating a physically manifest, secondary form of conclusion to the investigation. Both the theoretical and re-design conclusion aspects will be discussed in this chapter.

Comparative overall preference results in both markets

In both the Japanese and European markets, the chair designed for the German market consistently proved to be the most popular consistently across the various demographic groups including gender, age and profession.

The independent qualities of that chair (being culturally linked as intended, or otherwise) are more appreciated, proving that in this case there is little variation in consumer appreciation between the sections of the German and European markets tested.

The fact that the German chair was preferred, and the consistency of this preference throughout the various demographic groups in both markets, provides the consistency for a conclusive finding to be drawn.
The overall preferences and their weighting towards the German chair in both of the tested markets were an indicator as to what are popular furniture characteristics of both markets.

The specific elements will be further discussed in reference to the particular chairs, and will be discussed mostly in conjunction with the redesign phase of the conclusion (Section 3 of this chapter.)

The physical results of the chair redesign back up the theoretical conclusions drawn from the overall preference data. Both aspects of investigation support the theory that there is little cultural difference in consumer preference in the Japanese and European furniture markets.

These resultant factors feature heavily in the re-design phase of the investigation, which considers both of the chairs presented at each of the exhibitions and the redevelopment of the chairs according to these findings.

_In the Japanese market_

![Overall preferences of people surveyed - Japan](image)

Figure 10.1: Overall preferences in Japan

The result of a preference for the German chair in the Japanese market, reiterates the already broadly identified phenomenon, that popular ‘European style’ design, derived from a typical European styling in furniture is dominant in more than just Europe. The
evident popularity of European design in Japan means that the Japanese consumer when considering an imported product is likely to be influenced by ‘European styling,’ regardless, of associations of quality and status, and the origin of the furniture.

This conclusion was again impressed by another result gained through discussion in Tokyo. Due to the consistency in nationality, those who discussed preference for the chairs in Tokyo were asked to give an approximate price on one or both of the chairs. The average estimate for the price of the German chair was higher than that of the Japanese chair. The higher price estimate would indicate that the features of the German chair made it considerably more valuable than the Japanese chair.

![Cost Estimates for the German Chair](image1)

![Cost Estimates for the Japanese Chair](image2)

Figure 10.2: Estimates for price of both the Japanese and German chairs were made in the Japanese Market
In the European market

The German chair was more popular in the European market, however this was to be expected as the chair was designed with this result in mind.

Comparisons

Figure 10.4: Overall preferences in Japan
The preferences for the German and Japanese chairs in each market are very similar. This leads to the conclusion that the desires of the consumers in each market are also similar.

In Tokyo, the German chair was given 16% greater preference than the Japanese chair, while in Milan, it was given 19% more than the Japanese chair.

*This is just greater than the expected variance from the size of samples.

**Implications of the result that there is little difference in appreciation of consumers between the Japanese market and European market.**

The results would imply that designers could design with either market in mind and expect that their product should be successful in both, but in varying degrees. As a broad generalisation, and taking the limitations of the testing process mentioned earlier in this chapter into account:

- The result of the preference has also proven that from a design perspective, if designers were to intend a product for the European market, it should also be successful to the same degree on the Japanese market (depending on the product and design objectives).
- A product that is designed with the intention of infiltrating the Japanese market, should be successful to an equal degree on the Japanese and European markets, but with less of success than a product intended for the European market, also sold in both markets.

**How does this affect the design method employed in this investigation?**

Having said this, however the method for initial product design in this investigation, the targeting of a specific niche market, and generating a concept based on that markets needs are still relevant as an appropriate starting point for designers.

The case study is limited, and conducted in two large and prominent world markets. To conclude that the information is correct, it would perhaps be relevant to conduct
similar tests varying parameters, and these parameters will be discussed at the end of this Chapter.

10.8 Conclusions on the Research Problem: Redesign

The redesign phase of this investigation, based on the market test findings has been thoroughly represented in this chapter. The liked and disliked qualities of both the chairs in both the intended markets have been established, and steps could be taken to understanding why some features were successful and others were not. This understanding was gained through analysis of the responses within their various contexts, and then fed back into the design process.

Significant cultural differences, or general themes raised in different proportions?

Similar to the findings of the overall preferences for the chairs, the findings of positive and negative features of the two chairs were again mainly similar in both markets. This result was along the same lines as the general preference results mentioned above, pointing to little cultural variation between the appreciations of the two. The major differences in the positive and negative preferences varied slightly, the proportions of the comment made on positive and negative aspects established in each market varies more than the meaning of the comments.

The important appearance of strength

Major examples of this result include the strong negative comments made against both chairs regarding the strength and structural appearance of the chairs in Tokyo. These issues were also raised in Milan, but to a far lesser extent.

As a result of this perception, the section size of the timber was increased in re-design of both chairs.

Comfort appeal
The comfort appeal of each chair was also discussed in the two different markets. In Tokyo, the comfort of the chairs was discussed, mostly with regard to the perception of lack of comfort in the Japan chair. The German chair, with its bent and more supportive backrest, was considered more comfortable. In Milan, the German chair was also commented upon as the more comfortable, but purely due to its larger size.

*Scale: Important differentiation*

One of the issues that was raised as an important point of difference between the two markets was scale. This aspect was often discussed with regard to the comfort of the chairs.

Although there were not many comments made on the scale of the chairs, it is important that two different scales are supplied to the different markets, due to the smaller size of apartments in Japan.

*Decoration versus simplicity*

One of the main aims of design within the styling of the Japanese chair was the object of simplicity of form in the overall design of the chair. When the Japanese chair was preferred, it was for this reason. The object of the German chair was not to be particularly decorative, however, there were more decorative elements in the German chair, which became the dominant reason for its preference.

This aspect of decoration is closely linked to value and the perception of value across a broad section of consumers. It appears that by having a greater aspect of decoration, the value of the chair was more highly rated and therefore more popular.

This perception was justified in the Tokyo market where consumers were asked to consider how much they would pay for each of the chairs. The German chair was perceived as slightly more expensive than the Japanese one.

The perceived value of ‘decoration’ was an interesting issue for address in the re-design phase of both chairs. In the re-design of the Japanese chair, this issue was
addressed to add a greater depth of interest and value being added through the addition of components, and elements such as the upholstered seat increasing the comfort and complexity of the chair design.

In the case of the German chair, the main appreciated decorative feature of the leg bracing structure had a technical strength issue. It was important to design around this, and yet retain the decorative quality of that aspect of the chair.

Analysis

Such comments may be the result of cultural specificities, however they relate to issues that would generally benefit both chairs, and can easily be incorporated into the re-design of the chairs to satisfy both markets, without making significant changes to their forms.

Market appreciation issues were not the only aspects addressed in the re-design phase. Technical problems, which had become evident in the prototyping of the chairs, were also re-addressed.

As the German chair was more appreciated, the certain qualities of the German chair appreciation which were sought, became paramount in identifying preferred qualities across both markets. The reasons why the German chair was preferred in general directly corresponded to a lack of that element in the Japanese chair.

It must also be pointed out that while the German chair was preferred overall, and certain conclusions can be drawn from that, the testing process employed does not provide a simple case of right or wrong. There was still significant support for the Japanese chair and its favoured qualities. From this, it can be assumed that while the Japanese chair was less popular there would be a niche for it in both the markets.

10.9 Final results of the Redesign
Assisted by the lack of cultural preference displayed between the two markets, the re-design of products that in theory should be appropriate to both markets was a relatively uncomplicated process.

![Figure 10.5: Redesigned chairs: Germany](image)

![Figure 10.6: Redesigned chairs: Japanese](image)

The re-design of the chairs, the properties of which have been derived from feedback given regarding the positive and negative qualities of each of the chair, provides further back-up to the argument, initiated through the similarities in preferences across both markets.

In the case of the German chair, the one design has been re-generated to be applicable to both markets.
In the case of the Japanese chair, two solutions have been put forward. The differences in the solutions do rely on variation in opinions between the two surveyed groups, but the size of the variations is slight, and both chairs should be applicable to either the European or Japanese markets.

10.10 Implications of the theories found

We have established through testing procedure that there is little difference between furniture design preferences in the Japanese and European markets. This finding can be significant to the group of manufacturers involved in the investigation, in their approach to design for export. However, the consequences of the result reaches beyond this.

It has been well established as discussed in preceding chapters of this thesis, that there is an increasing global trend of smaller manufacturers in developed countries facing similar issues to the case study group of manufacturers contributing to this investigation. With the decrease of local markets due to low cost imports, manufacturers need to look to exports to stabilise and increase market share. It will be difficult for these manufacturers to compete with their products on price alone.

The results of this investigation are therefore significant to the case study manufacturers, but they also have wider-reaching consequences for small scale manufacturers in Australia and in other developed countries around the world facing the same issues, providing insight as to the preferences of two of the worlds’ major furniture markets.

Proving that there is little cultural difference between these two markets, is a significant step of knowledge in approaching furniture design for these markets, not just for Australian industry but for small manufacturers on a global scale.

The increasing importance of industrial design in the approach to developing products for world markets, a fact already well acknowledged amongst those in related industries, has also been re-iterated through this project.
Industrial design was necessary to develop the experimental joining systems for an exportable product from Spotted Gum timber. If not for the involvement of industrial design, this would probably not be attempted by manufacturers. The success of the products when placed into the market environments in terms of their appreciation, particularly for their ‘different’ appeal.

In the immediate field, this has implications for manufacturers in Queensland, and suppliers of Spotted Gum timber.

10.11 Implications for further research

Given the success of the experiment, there are several options for continuing investigation along similar themes, to provide further information, and continue to assist small manufacturers, in negotiating the problems posed in developing new furniture products with the intention of export.

While the results of testing in this investigation are quite conclusive, the case study was small and could be improved in two main areas.

Those areas are:

- Testing of a broader range of case study markets
- Using various designers within the process.

*Broaden case study selection*

Re-apply the experiment with a broader case study selection, to gather further and more conclusive results.

*Testing using various designers*
Testing the specific market integration method using multiple designers to design and prototype the products for case study testing would provide further and more conclusive results as to the reliability of the theory.

By incorporating more designers into the testing process, the problem of subjectivity in the use of a single designer is eradicated. The process should be repeated through the use of products developed by other designers.

*Market information: dissemination to designers*

The market information that has generated in pre-product design was essential in determining design elements of the case study chair.

There is spin-off opportunity for the market information that was generated as a result of this investigation. The information could be disseminated to other designers, as a head start in development of products for the European and Japanese markets.

*Alter the product*

Western-style dining chairs were chosen for investigation for various reasons. Dining chairs are an extremely popular style of furniture and very conventional. However there are many forms of furniture that bring association of many parameters in design, user and market parameters.

To gain further understanding of the process that has been tested, in establishing parameters for export market design, it would be useful to also investigate other furniture product.

*Reverse the testing process*

We know that on the basis of this investigation, there is little difference between consumer appreciation in the Japanese and German markets. Now that this has been established, it would prove interesting to reverse the testing process, i.e. to design a product, intended for a market (or any market) and test the response to that product in
various markets, to gauge whether the assumption of little variation in market appreciation is consistent through this method.

Conventional materials provide different insight.

Repeat the testing method using more conventional materials and common joining techniques employed by Australian manufacturers and more commonly found in global markets, with fewer experimental results. This would provide better chances for market adoption and infiltration.

10.12 Future projections regarding the products developed as a result of this investigation

The two case study chairs and various other concepts generated this investigation are also a valuable resource. The market appropriate chairs have been developed, as well as experimental joining systems for difficult-to-glue species of timber.

Technical parameters

The joining systems due to their experimental nature would require some testing for their structure and strength properties to be determined, allowing for components requirements to be properly determined.

The performance of the chairs through transportation and therefore climatic variables should also be tested with regard to the quality and assembly of the product in its desired designation.

Final conclusion summary

Finally, it can be considered that the market findings from exhibiting the two (case study) chairs (designed with Japanese and German market intentions) in representative forums in both the Japanese and a European (Milan) markets, showed a strong preference for the attributes of the German chair, and an equal but lesser preference across both markets, for the Japanese chair.
The consistency of the findings (the preference given for one of the two chairs) in both markets, and similarities which can be drawn between the reasons given by consumers for their preference in both markets, results in the conclusion that there is very little cultural difference in acceptance of the furniture items between the two markets.

This finding has significant repercussions for design methods in approaching furniture design for export; particularly the two markets used in this case study. From the findings in this investigation, it can be conjectured that based on the properties of the two chairs examined, a product designed for either of the markets should find equal success in both markets. However, products designed with the attributes of the German chair (with the European market in mind) should have more success in both markets than products designed with the attributes of the Japanese chair.

The redesign was based on ‘positive’ and ‘negative’ comments made in each of the markets tested. The re-design phase of the investigation, uses the findings gained through the market testing process, and directly implemented the findings into the design process.

By altering aspects of the Japanese and German chairs based on the assessment of comments gained through the testing process in this investigation, the results of the re-design bring the products in line with the finding that either of the chairs could be successful on either the Japanese or European markets.

Due to the results of the testing method employed in this investigation, the design method used as an approach to export market infiltration in this investigation can be considered in two ways.

First; with respect to the Japanese market, it was less successful in the development of a product, for that market than with one intended for another market. However, it must be considered that the success of the German chair on the Japanese market
revealed the extent to which European design influences the major world market in Japan.

Second; the success of the Japanese chair and German chair in both of the markets (in varying degrees) would imply that the method of designing for a specific niche market is successful. Beyond the expectations related to infiltrating only one niche with each product, it has been useful in determining market entry needs for both. The method employed in this investigation (i.e. focus on a theme of niche market concerns) could gain manufacturers an advantage in approaching export market development.
Appendix 1

Initial design brief

Structure, project brief: L. Ginters CRC Wood Innovations, Project 2.2 September 2002

The project

To value add to what is a traditionally a low-end application species (Spotted Gum) with properties typical to that species and a particular geographic location, through the development of indoor furniture specifically suited to export.

Aim

To develop the advantages inherent to commercially viable species of Queensland hardwood timbers, (mainly Spotted Gum) for the production of fine high-end timber furniture. It is intended that indoor furniture manufacturers located in South Eastern Queensland can manufacture this furniture.

The main advantages of the Queensland hardwood timbers are, their high strength capacities, allowing for smaller sections sizes to be used. They are unique looking timbers with good aesthetic qualities and natural appeal.

There are also disadvantages inherent to Queensland hardwood timbers. The use of adhesives with traditional interlocking joints is very difficult in a high production scenario. As a moderately high movement timber, transportation of assembled joints through different climates is difficult. There are also high cost factors associated with material, production and transportation, therefore the furniture design must be intended to infiltrate high end markets to re-coup production expenditure.

The furniture must also be suitable for export markets, with the intention of expanding the market share of the manufacturers concerned. Given this expectation, other production issues come into play, such as climatic variables that the timber furniture will be subjected to in transportation from Australia to various global destinations, and the cost and efficiency of this transportation.
At this stage of the investigation, sufficient export market knowledge has not been accumulated in order to design to a specific market requirement. The focus of developmental work at this stage will investigate solutions to technical issues in dealing with the timber in production.

The product range investigated for this project will be indoor dining furniture, which is important as dining table and chairs are generally the largest selling items of the Queensland indoor furniture manufacturers. At this stage the design methodology will be based on technological led solutions. The design undertaken will focus on new and innovative solutions for the joining of timber sections in indoor furniture products. This is essential as the inherent properties of Queensland hardwoods do not allow for the traditional methods of furniture production that are applied to other species of timber.

**Design Parameters:**

**User Considerations**

*Function –*

*User/Market*

The products must function as indoor dining furniture, and due to the requirements of the manufacturers, this dining furniture is intended to be of traditional western format.

The weight of the timber will require that the furniture components are fine.

The exact user of the furniture is unknown. This requires market research however it must be considered from a perspective of function that the using demographic will be quite broad.

The furniture will be intended for everyday use in a dining scenario.

*The product range*

Several variations on dining chairs and tables, all of different and experimental forms, to provide alternative joining techniques and create a ‘brainstorming’ effect of ideas.

**Product Considerations**

The product considerations will include:
Strength, applicable to dining furniture
High quality indoor finishes, which are durable and appropriate to everyday use
Versatility in form, exploration of folding/stacking forms for space conservation.

Safety
The strength and durability of the product are of primary concern in that they will withstand daily use.
The products must be detailed to an extent that there is less chance of breakage or wood splintering.
The material for production of the products must be of high quality to obtain the thinness of section required for the products.
The finishes on the furniture must be user friendly.

Ergonomics
A domestic dining chair is used frequently and comfort is generally a primary consideration in the consumer’s purchase.
The chair must be used by a wide range of adults and children with a variety of needs. This will come into consideration particularly with finishes and complementary materials used in the products.
Generally the furniture will be considered towards its traditional use of dining, however multi purpose use of the products will also be considered.
Heights and scale of the product will at this stage be kept within a general scale, but with further market research the size requirements may change.

Aesthetics
The strength properties of the timbers will allow thinner sections to be used than is traditional with furniture, therefore creating unique aesthetic potentials.
The natural features of the timbers used must be presented at best advantage, as the selling point of the timber is its unusual aesthetic and visual effect.
The timber material will be exploited as much as possible in the designs, however, complementary materials may be required for both joinery and detailing. In these cases, various materials will be investigated.

Ecological considerations -
Environmental Considerations
The timber identified for use will be harvested from regrowth forest. It is intended that there will generally be a plantation resource available in the near future, perhaps five to ten years, that supplement the regrowth resource. It must be considered that the least amount of labour utilisation and energy use in production will be advantageous in production of the products. The use of short length timber sections, particularly in line with utilisation of short sections and young plantation sections is an aim for all products in the pursuit of better utilisation. Minimisation and utilisation of off-cuts must be considered.

**Sustainable**

The designs are intended to value-add to the timber being used through the development of feasible joining techniques to apply this timber. The designs are intended to allow the timber to exhibit its natural properties in exceptional strength and durability, to use less timber to create more high value products. The products should be designed in such a way that parts are replaceable, extending the life of the products.

**Production Considerations**

**Materials**

Queensland Hardwood timbers, in particular Spotted Gum

Various other materials will be experimented with in the course of design development in association with this material.

Components to be produced from standard lengths of furniture grade material.

**Components**

Consider the equipment, constraints of the manufacturers and their abilities to manufacture certain components. Maximum utilisation and minimum waste of timber is important in producing components and cutting unit costs. Innovative joining systems will probably require various non-traditional component shapes. Easy assembly of components important, especially in flat packed products.

**Manufacturing systems**
Looking at techniques, within the parameters of the Queensland hardwood indoor furniture manufacturers visited.
Investigating other production techniques where required, especially bending techniques where technology is available and manufacturers interested in its progress.
Surface requirements to be investigated for finishing, due to prior experimental work. Adhesives will generally not be investigated in this process.

**Form and structure**
Innovative structures will be investigated utilising materials that are not traditionally used in the context of furniture joinery and production.
At this stage, the forms will be kept as simple as possible due to that fact that there is more market research required to determine correct aesthetic decisions.
The form will be dictated in part by the forms of experimental joining systems/structures investigated through the design process, and in part by the function of the product itself.

**Export Requirements**

**Market**
To be determined, as market research is required to create target markets for export. Unique properties of the timber and the necessity of using novel joining techniques will provide unique design parameters, providing a point of differentiation in global markets, which this will be particularly advantageous in attracting high end consumers.

**Design**
Knock-down furniture is perfect for export, lessens technical problems and costs encountered in international transportation. Strength properties of the Queensland hardwood timbers can still be well exploited through the use of flat packed furniture. The thinner sections that can be achieved using a Queensland hardwood timber allows the achievement of lighter smaller products, taking up less space and weight in shipping.

**Production**
As the cost of the furniture production will be relatively high given the various constraints of the project, high-end markets must be targeted. Further market research is required.
Production will also be small scale, and exclusive niches must be identified.

**Market Considerations**

**Market**

Further market research is required to further identify market parameters.

Market to be determined:

The indoor dining furniture will need to be aimed at the high end and probably quite niche consumer markets, given the labour costs in production and the relatively high costs of the material used.

**Distribution**

Market to be determined:

It is probable that as the market directions will be international, the furniture may be flat packed for distribution. It is likely that due to the market end, the furniture will be distributor-assembled and not buyer assembled.

Both areas must be considered for viability.

**Merchandising requirements**

Type of store the products will be distributed from:

High-end specialty stores.

**Cost pricing structure**

The costing should be competitive within the existing furniture ranges available. This is not able to be determined yet as markets have not been determined.

An approximate total would be around A$ 350 – 450 per dining chair, A$ 1500 – 2000 placing the products in a fairly specialized high end category. However dealing with costs inherent to materials purchase and particular production issues with the material, which will escalate the price, high-end design, quality and finish, are essential.

Difficulties in production and assembly must be accounted for in pricing.

**Maintenance**

The design must account for the poor stability properties of the timber.

The designs should allow for the tightening of the components and removal of components to allow for replacement and re-tightening of joints.

**Expected product life**
To be determined by market, however given the high-end niche nature of the market, it should be expected that the products would outlast expectations (perhaps over ten years.)

**Production rates**

Production is to be evaluated dependent on manufacturing abilities, since the turnover of manufacturers surveyed ranges between A$ 1 million and A$ 7 million, the production capacities of the various companies. However as the companies are generally small, there will most likely be difficulties in the production runs of some of the products given the various difficult attributes of the timber, and requirements of components from various non-timber materials. Production runs of 50 – 100 off per chair, and corresponding production runs for accompanying tables.

**Social Considerations**

**Statutory requirements**

Consider and apply the following as necessary:
- Design to exceed ASA standards
- Use of standard timber sizes
- Non-toxic timber and surfaces

**Social/cultural considerations**

To be determined - market research required

**Ethnic/Religious product needs**

To be determined – Market research required
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