Journal of Forest Products Business Research
Volume No. 2, Article No. 2

Determining Consumer Preference for Furniture Timber

H.R. Bigsby, C. Rai, and L.K. Ozanne

The authors are, respectively, Senior Lecturer, Commerce Division, P.O. Box 84, Lincoln University, Canterbury, New Zealand, email: bigsbyh@lincoln.ac.nz; Technical Officer, Churia Forest Development Project, P.O. Box 1457, Kathmandu, Nepal, email: chfdp.gopa_ageg@gtz.org.np; and Senior Lecturer, College of Business and Economics, Private Bag 4800, University of Canterbury, Christchurch, New Zealand, email: lucie.ozanne@canterbury.ac.nz.

ABSTRACT

The study makes use of the Q-sort method to determine consumer preferences for furniture timber as a means of finding alternatives to the New Zealand furniture industry's traditional timber which has now become difficult to source. A survey of furniture consumers was undertaken at a furniture show using a set of finished 17 timber samples. Respondents were asked to arrange the timber samples according to those they most liked, most disliked, and were indifferent to. In an open-ended question, respondents were then asked to explain why they made their particular selections. The results indicate that color and grain are the key timber attributes consumers use to form their preferences and that five consumer segments can be identified based on common preferences for color and grain. The results show that locally grown timbers will be able to meet the first preferences of 30 percent and second preferences of 44 percent of New Zealand consumers, providing manufacturers with an opportunity relative to imported furniture.

Keywords: Consumer preference, furniture, timber preference, wood characteristics

Introduction

The furniture industry is an important part of the wider wood products industry, as wood is one of the most popular raw materials for furniture (Sinclair 1992, Drlickova et al. 1999, Pakarinen 1999). Which timber species are used in furniture manufacturing is determined by a range of factors, including availability and cost, the technical characteristics of the timber that make it desirable from a furniture manufacturing perspective, and the decorative characteristics that make it desirable for consumers. As with any product, consumers evaluate furniture based on the attributes of the furniture. Studies have shown that the most important attributes for wood furniture are quality, durability, price, design, quality materials, attractiveness, safety, color, and environmental attributes (Bigsby and Ozanne 2001, Chung and Dung 1999, Ozanne and Smith 1996, Drlickova et al. 1999). Other studies have shown that typically the timber used in furniture will have a decorative appearance, be strong, and will be easily worked (Clifton 1994, Mandang and Sudardji 2000, Liu-Fan 1978, Vernay 2000). Important features for decorative appearance for Scots pine (*Pinus sylvestris*) include texture, knots, coloration, and contrast (Broman 1995).

With timber availability and cost, and consumer preferences changing over time, an important question for those in the furniture and wood products industries is how to determine consumer preferences for the timber that goes into furniture. New Zealand provides an interesting context for this type of problem. In May 2000, the Government of New Zealand announced a logging ban on all publicly owned native forests that was to take effect in March 2002 (Burton 2000, MAF 2001). The logging ban has had a significant effect on the furniture industry because these forests provided almost all of the rimu (*Dacrydium cupressinum* Lamb.) that was the mainstay of the industry. Although there are about 1.3 million hectares of privately owned native forests (20.3% of total native forest), which were not affected by the logging ban, these forests can supply only a small portion of the market demand for rimu (Auckland Specialised Timbers 2001, MAF 2001). The result of the logging ban is to create uncertainty among furniture manufacturers about what they can do to offset the shortage of rimu. Manufacturers can apply a number of different strategies to cope with this problem, including new technology to increase utilization of remaining supplies of rimu (e.g., veneers, laminating, finger jointing), or to switch timber species entirely.

The objective of this study was to determine the attributes that New Zealand consumers consider important in furniture timber so that alternative timbers to rimu can be identified. In general the studies mentioned earlier look at furniture, with timber as only one of a set of considerations. However, since the key question is determining what specific timber attributes consumers prefer across a range of timbers, rather than the characteristics of the furniture per se, it is important to identify a method that can do this.

Consumer Preference Methods

The furniture decision process is common to any product and is generically know as ‘Consumer Preference’, or the attitudes which determine consumers’ choices between alternative commodities or groups of commodities (Bannock et al. 1998). Consumer preference studies, based on an analysis of product attributes, are a common approach in consumer behavior science (Engel et al. 1993). There are a number of methods in the literature that can be employed to investigate consumer preference. These methods can be broadly categorized as attribute determination and attitude determination.

In attribute determination, the objective is to determine what attributes consumers use when evaluating a product. A ‘product’ is typically considered to be a bundle of attributes considered together. Attributes are the characteristics of the subject or product under study that contribute to how it is ‘perceived’ or ‘valued’. Determination of important attributes is typically a process of reducing a broad range of diverse information to a few composite measures that become identified as attributes. A common approach for determining important attributes is factor analysis. Factor analysis can be performed in a number of ways, including R-type and Q-type (Hair et al. 1998). In R-type factor analysis, the objective is to group variables or traits that possess a common underlying dimension. In Q -type factor analysis, the objective is to group individuals who establish a ranking of objects or products in a similar fashion. Another method of grouping individuals is cluster analysis.

In attitude determination, the objective is to determine a consumer’s overall evaluation of a product or bundle of attributes. Attitudes can be defined as an overall evaluation of a product (Engel et al. 1993). An attitude toward a product can be determined in several ways. In the multi-attribute model, a consumer’s attitude toward a product depends on the evaluation of the product as a bundle of attributes (Engel et al. 1993). In conjoint analysis, a consumer's attitude toward a product is considered in terms of the utility provided by a bundle of product attributes (Hair et al. 1998). In both cases, the model is based on a predetermined set of attributes for the product under investigation.

In general, it is necessary to determine important attributes of a product or an object before measuring consumers' preference. In the context of this study, the attributes that are used by New Zealand consumers to evaluate timber used in furniture are not known, and thus the focus of this study needs to be on attribute determination. This means that attitude-determining methods, such as the multi-attribute model and the conjoint analysis method are not relevant to this problem.

What is desired is a process in which furniture consumers reveal their preferences for various timbers, why they have those preferences, and then groups them with other consumers who have similar preferences. Since little is know *a priori* about why consumers may prefer a timber, at least some of the information gathering must include open-ended questions. This means that the method needs to facilitate a subjective assessment of the attributes of a number of timber samples while at the same time revealing an ordering of and identifying groups of people with similar preferences. The Q-sort method provides these characteristics. The Q-sort method involves respondents selecting "objects" or Q samples in a significant order (Brown 1980, McKeown and Thomas 1988). In Q-sort methodology, respondents rank order objects according to the condition of instruction, such as from "most liked" to "most dislike", or from "most agree" to "most disagree". Typically, statements of opinion are offered to respondents for rank ordering. Each respondent's rank ordering is called a Q-sort. After establishing a Q-sort, each respondent is interviewed to explore the reason behind the rank ordering. The Q-sorts from respondents are later correlated and factor analyzed for the extraction of groups of people who ranked the objects in a similar fashion. This provides a rigorous and systematic quantitative means for studying subjectivity (Thomas and Woods 2002).

While initially, Q-sort methodology was used in behavioral research (psychology) using statements as the objects that respondents evaluated (McKeown and Thomas 1988), more recently, Q-sort methodology is being used in a number of fields ranging from public opinion and attitude studies, to decision making, program evaluation (Oring and Plihal 1993), landscape research (Fairweather and Swaffield 1999, Swaffield and Fairweather 2000), genetically modified foods (Lamb et al. 2001), and parental choice of school (Bussel 1998). An important reason for selecting the Q-sort method were the studies by Fairweather and Swaffield (1999, 2001) and Swaffield and Fairweather (2000) which used an evaluation of photographs to study public perceptions of natural and modified landscapes, community attitudes toward employment activities arising from forest sector development, and visitor experiences at tourist locations. These applications of the Q-sort method, with their use of visual stimuli, were directly relevant to the intended approach of having respondents compare and rank timber samples. Thomas and Watson (2002) identify several benefits of using the Q-sort method including, a means for in-depth study of small sample populations that do not need to be randomly selected, an ability to capture subjectivity through respondent self-reference and reduced researcher influence, and a well-developed theoretical literature.

The extension the Q-sort method to marketing is intuitive since it would allow consumers who have similar preference patterns to be grouped together. As product preference is a common basis for segmentation (Kotler et al. 1998), these groups of respondents can be compared with furniture market segments. Although the Q-sort method has not been used in marketing literature, it is an obvious compliment to a similar method, cluster analysis that has been used extensively in marketing studies. While both methods group individuals, this is done in different ways (Hair et al. 1998). Cluster analysis is based on distance-based similarity measures that group individuals based on similar magnitudes of scores and distances from other groups. The Q-sort method is based on pattern-based similarity measures that group individuals based on similar preference patterns and covariance structures. An important distinction is that cluster analysis imposes assumptions about population homogeneity across broad groupings, making the decisions of the researcher about sample selection an important part of the final outcome, while the Q-sort method does not allow the researcher to influence results (Thomas and Watson 2002).

Methodology

The Q-sort method follows similar stages as other survey methods. First, the researcher must develop the Q samples that will be used to represent the spectrum of alternatives in the problem. Second, the Q-sort must be properly administered using the Q samples, and finally, the Q-sorts must be analyzed. The following sections outline the selection of the Q samples for the study, the how the Q-sort procedure was done, and the selection of respondents.

Selection of Q Samples

A Q sample can be defined as a purposively selected set of stimuli that is offered to respondents for rank ordering in a Q-sort. As mentioned earlier, using statements of opinion as a Q sample is common in Q-sort methodology, but it can also be objects or photographs. In Q-sort methodology, a great deal of attention is given to selecting Q samples (McKeown and Thomas 1988, Fairweather and Swaffield 1999). Typically, all dimensions of the topic under study are identified and Q samples are selected which represent all dimensions. In the case of this study, three areas had to be considered simultaneously in the selection of the Q samples. The first concerns the types of timbers that would be used, the second the number of samples that respondents could reasonably be expected to consider, and the last the form in which the timber would be presented to respondents.

Since the objective is to determine consumers' preferences for furniture timber, the dimensions considered important when selecting timber samples included source of the timber, staining, and future availability. To cover the range of sources, timbers from New Zealand natural forests and plantations, imported timbers, and recycled sources were considered. In addition to natural colors, staining can be used to modify timber color to meet market preferences and this was also considered. Finally, timbers with an uncertain future supply were not considered because this would not lead to sustainable options for manufacturers. An initial list of potential timber samples and staining strategies was established through interviews of eight furniture manufacturers in Christchurch, based on what they were commonly using or planning to use. In addition, retail shops were visited to to determine the range of timbers and stains used in imported furniture, and local forest owners were contacted to gauge the potential for local plantation timbers.

It was important to keep the number of timber samples relatively low in order to shorten respondents' time and effort, and increase the likelihood that they would participate in the survey. Based on the experiences of Fairweather and Swaffield (1999, 2001) and Swaffield and Fairweather

(2000), a Q-sort consisting of 17 samples has been successful and this number of samples was adopted for this study. The list timber and staining options was reduced to 17 samples by a subjective process that considered the frequency of current use, potential for future use, and availability of samples for the survey. The final list of 17 timber samples used in the study is shown in **Table 1**.

Table 1. Timber samples.

Sample	Common name	Source	Stain	Forest type
1	European beech	Europe	None	Natural forest
2	NZ beech	New Zealand	None	Natural forest
3	NZ beech	New Zealand	Dark color	Natural forest
4	*E. regnans*	New Zealand	None	Plantation
5	Fijian Kauri	Fiji	None	Natural forest
6	Macrocarpa	New Zealand	None	Plantation
7	Mahogany	Honduras	None	Natural forest
8	Oak	United States	None	Natural forest
9	Oak	United States	Dark color	Natural forest
10	Pine (Radiata)	New Zealand	None	Plantation
11	Pine (Radiata)	New Zealand	Dark red color	Plantation
12	Pine (Radiata)	New Zealand	Rimu color	Plantation
13	Rimu	New Zealand	Medium color	Recycled
14	Rimu	New Zealand	None	Natural forest
15	Salusalu	Fiji	None	Natural forest
16	Blackwood	New Zealand	None	Plantation
17	Tawa	New Zealand	None	Natural forest

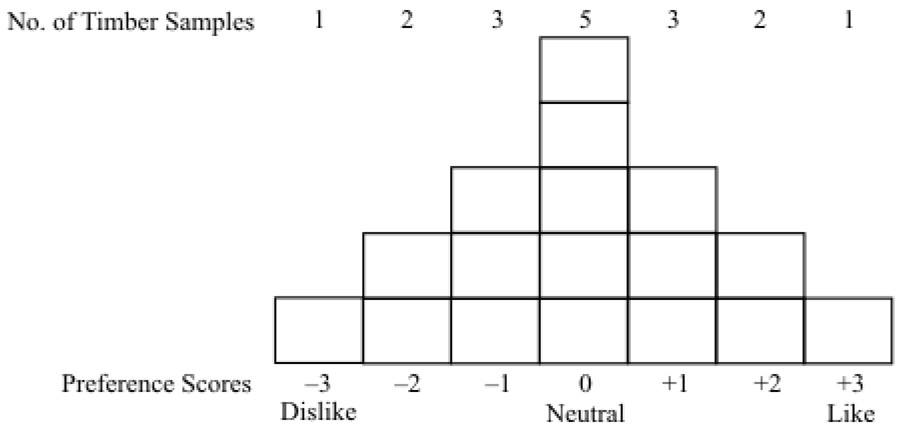
Initially, the intention was to have 17 pieces of finished furniture, each identical except for the timber and/or stain used, to ensure that the timber was the key feature being assessed. However, two issues, one being the cost of 17 finished pieces of furniture, and the other being the space required for respondents to do the ranking, meant that this was not possible. Photographs of a single piece of furniture with each timber option were also considered. It was decided that photographs would not adequately represent timber characteristics such as color and grain, and that it was still important for respondents to be able to touch the timber as part of the decision process.

The final decision was to use timber samples, each 20 cm by 20 cm by 2 cm. This size was considered to be a reasonable compromise between a smaller size that would not represent the characteristics of the timber well (e.g., grain, color, and knots), and a larger size that would have taken more space for sorting. With this timber size, the arranged timber samples required a table space that was 1 m by 1.4 m. To bring out timber characteristics, each timber sample was finished with the same 30 percent gloss, and a white table cloth was put on the table to provide a neutral background for the timber samples.

Q-Sorting

Q-sorting can be defined as a process whereby each respondent performs a rank ordering of Q samples in a continuum as defined by the condition of instruction. The condition of instruction is a guide to establish a Q-sort based on personal preference and as defined by the researcher. The condition of instruction used in this study was as follows. The 17 timber samples were presented to each respondent simultaneously after they had been randomly laid out on the display table. The respondent was instructed to separate these samples into three preference groups–liked, neutral, and disliked–with six samples into the liked and disliked groups, and five into the neutral group. In the next step, each respondent was requested to further sort out the liked group of timber samples into the one most liked, the two medium liked, and three less liked. Then, respondents repeated the same procedure for the disliked group of timber samples, resulting in the one most disliked, the two medium disliked, and the three least disliked. In the third step, the disliked, neutral, and liked timber samples were placed on the left, middle, and right side, respectively, resulting in the structure shown in **Figure 1**.

Figure 1. The structure of the Q-sort. (Source: adapted form Barry and Proops (2000, p. 26.)



Each timber sample had a specific number and this was recorded. After establishing their Q-sort, each respondent was then asked to explain why they liked or disliked the timber samples. Focus was given to the left and right corner samples. The process described here was the result of pre-testing which identified that the initial plan to ask respondents a question on all 17 timber samples would be too tedious and time-consuming, and hence the focus on the most liked or disliked timber samples (left and right corners of the Q-sort). In addition, respondents were walked through the Q-sorting process by researchers who had been trained to use the Q-sorting procedure.

Factor Analysis

A factor can be defined as a group of respondents grouped together based on their commonality of ordering of Q samples (timber samples in this study). In other words, a factor is a group of respondents whose Q-sorts are more or less similar. Factor analysis is a statistical process that can be used to extract factors and interpret them based on the commonality of Q-sorts. Factor analysis was done using the PQ computer software package (version 2.06)[1]. The factor analysis process can be divided into two stages: factor extraction and factor interpretation.

(1) PQMethod is an MS-DOS program that was adapted, revised, and maintained by Peter Schmolck (p41bsmk@unibw-muenchen.de). The Fortran code on which it is based was originally written by John Atkinson at KSU. Freeware copies of PQMethod are downloadable as a self-extracting zipped archive at www.qmethod.org.

Factor extraction is the process by which the factors, or similar groups, are determined. In the first step, the preference scores for each Q-sort are coded using the scores in **Figure 1**. With the structure of this problem, the scores ranged from –3 for most disliked to +3 for most liked. In the second step, each Q-sort is correlated with every other Q-sort, generating an inter-correlation matrix. From the inter-correlation matrix, preliminary factors can be extracted using the centroid procedure (Barry and Proops 2000). In the third step, the final number of factors is determined. There are two methods that might be used for determining the appropriate number of factors (Brown 1980). One is where eigenvalues are greater than 1.00 (e.g., Barry and Proops 2000). The other is where there are at least two significant loadings of Q-sorts on a factor (e.g., Fairweather and Swaffield 1999, Swaffield and Fairweather 2000). A factor loading is statistically significant at the 0.01 probability level when the factor loadings exceed 2.58 x SE_r (Brown 1980).[2] In this study, the two significant loadings method is used. For 17 timber samples, a significant factor loading must be greater than 0.625. In the fourth step, the significant factors are rotated in order to extract a meaningful factor solution, or to clearly bring out the relationship of the factors to each Q-sort. There are a number of factor rotation techniques, however the PQ software package uses the Varimax technique, and this was used in the study.

(2) SE_r can be calculated by the following equation, where N is the number of timber samples.

$$SE_r = \frac{1}{\sqrt{N}}$$

Factor interpretation is a process of determining the key characteristics of factors. Although there is no specific rule for factor interpretation, Brown (1980) suggests a two-step process of factor interpretation. In the first step, the Q samples are arranged for each factor as in **Figure 1** and the researcher tries to visually interpret each factor. In the second step, the respondents' views on each Q sample are analyzed and compared with the first step interpretation. The approach here was to select respondents with the highest factor-loaded Q-sort because these respondents are most associated or identified with the factor. From these steps a 'theme' is drawn for each factor.

Market Segmentation

Although Q-sort methodology has not been applied in marketing research, this method can be used to identify market segments. The factor analysis process will form different groups of consumers based on their common likes and dislikes of furniture timbers. As such, they can be thought of as a market segment. The profile of these market segments can be established by gathering information on demographic characteristics for each respondent and using cluster analysis. To do this, after the Q-sort was completed, respondents completed a questionnaire containing a number of questions about furniture ownership and recent purchases (furniture materials, timber species used), and questions for demographic information (age, education, and income). Respondents were also asked to indicate the key attributes that they use to evaluate furniture.

Respondents

Selection of respondents in Q-sort methodology is not unimportant, although it is not as important compared to the selection of Q samples (McKeown and Thomas 1988). As the focus of this study was the rimu furniture industry in the Canterbury region of New Zealand and consumer preference for alternatives to rimu, it was considered important to ensure that the manufacturers' target consumer group was surveyed, that being the middle to upper segments of the furniture buying population (solid wood furniture). A number of options for conducting the surveys were considered, the key criteria being that they had to provide space for the survey to take place, and that they focused on people who were interested in purchasing the furniture represented by local manufacturers (interested in the purchase decision being studied). Initially, the survey was going to be carried out in a number of different furniture showrooms; however, the presence of the Christchurch Furniture Show made it possible to carry out the survey at one location. The survey was carried out at the furniture show in June 2001.

There is no specific rule to estimate the appropriate number of respondents in Q-sort method research. McKeown and Thomas (1988) argue that the number of respondents depends on the nature of subjectivity under investigation, with studies of "intersubjectivity" requiring a larger number of respondents, and studies of "intrasubjectivity" requiring only a few respondents. For this study, it was decided to interview as many respondents as possible during the furniture show, and increase the degree to which the results could be generalized. Two tables were set out at the furniture show in order to conduct two Q-sortings simultaneously.

Eighty-two furniture show visitors (respondents) were interviewed over two days. Based on earlier interviews with manufacturers, the sample population is believed to be a good representation of the target furniture-buying population segment. About two-thirds of respondents were female, a large proportion were older (59% in the 41 to 60 age group) and higher-incomes (53% earning above $40,000), and 44 percent had a University education.

Results

As was discussed previously, the survey consisted of two parts, one being the Q-sort procedure and the other being a questionnaire covering furniture purchases and demographic information. The results of the furniture purchase questions are presented first as they provide broad indications to furniture manufacturers about furniture purchase patterns and intentions, and should provide an indication of what might be found in the Q-sort process.

Furniture Purchases

Respondents were asked about their current furniture and furniture purchased in the last year, including material types and choice of timber species. Also, they were asked what timber attributes they use to evaluate furniture. As can be seen in **Table 2**, solid wood or solid/veneer wood is the most common form of furniture, and customers are buying furniture material types in a pattern similar to the current furniture they own.

Table 2. Household furniture.

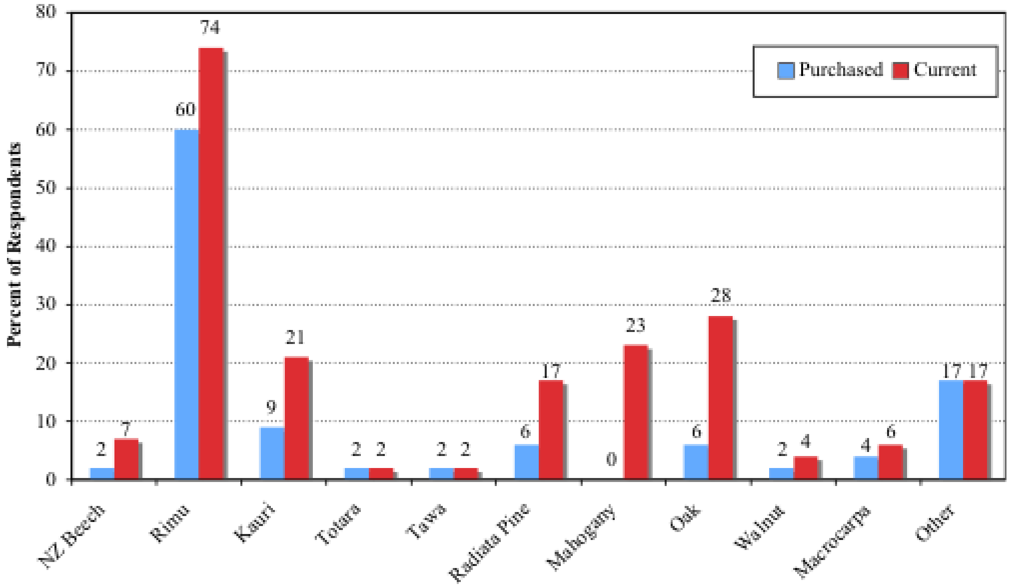
Types of materials	Number of respondents[a]			Purchases in the past year[b]
	Living room	Dining room	Bedroom	
Solid wood	59	59	56	40
Veneer/solid wood	28	25	22	7
Upholstery	36	27	17	13
Metal/wood	11	9	13	4
Composite/melamine	7	5	7	1
Metal/composite/melamine	2	2	0	0
Plastic	2	2	0	0
Other	8	0	4	3

[a] Total number of respondents was 82. The values under the different rooms show the number of respondents out of a total of 82 respondents. For example, 59 and 56 respondents had solid wood furniture in their living room and bedroom, respectively.
[b] Total number of respondents who had purchased furniture in the past year was 51.

Respondents were asked about timber species used in solid wood and veneer furniture, in both furniture purchased in the last year and current furniture in their home. For this comparison, the total number of respondents for current furniture was 82, while the total number of respondents for purchased furniture was 47. This latter number includes only those respondents who purchased solid wood and veneer furniture in the last year.

As can be seen in **Figure 2**, rimu is the most common species, both in wood furniture purchased in the past year and in current furniture. **Figure 2** also shows that rimu is the only timber species still being purchased in proportion to existing furniture. Other traditional species are being purchased less frequently. From these results, it can be expected that the majority of respondents would prefer rimu and rimu-like timbers in the Q-sorting.

Figure 2. Comparison of timber species used in current and recently purchased furniture. Note: other consists of less abundant species such as rosewood, ebony, and rubber wood.



Timber Preferences

Preferences for timber were studied using the Q-sorts of timber samples and analyzing these responses to determine factors, or groups of respondents with similar preferences. Using the process described in the methods section, three factors (A, B, and C) were defined by 61 of the 82 respondents (**Table 3**). The values in **Table 3** are factor loadings that indicate the degree of correlation between the Q-sort of a particular respondent and the Q-sort represented by a particular factor.[3] For example, the factor loadings of respondent 1 are 0.08, 0.72, and 0.26 for Factors A, B, and C, respectively. Using the significant factor loading value of 0.625 discussed previously, this means, the Q-sort of respondent 1 is strongly correlated (72%) with Factor B, slightly correlated (26%) with Factor C, and weakly correlated (8%) with Factor A. Strongly correlated factor loadings are indicated by an "X" in **Table 3**. These factor loadings are also called factor defining Q-sorts.

(3) A factor loading is a correlation coefficient (*r*), calculated as the ratio of the sum of the squared differences between the scores for each sample squared for the Respondent (S_R) and the Factor (S_F) to the sum of the squared scores combined, and then subtracting this from 1.00. A perfect positive correlation is +1.00, a perfect negative correlation is –1.00.

$$r = 1 - \frac{\sum (S_R - S_F)^2}{\sum (S_R)^2 + \sum (S_F)^2}$$

Table 3. Factor loadings.[a]

Respondent	Factor A	Factor B	Factor C	Respondent	Factor A	Factor B	Factor C
1	−0.08	0.72 X	0.26	42	0.76 X	0.13	0.29
2	0.72 X	0.03	0.21	43	0.27	0.27	0.75 X
3	−0.43	0.44	0.05	44	0.76 X	−0.15	0.55
4	0.41	0.18	0.66 X	45	0.37	0.04	0.73 X
5	0.55	0.59	0.46	46	−0.27	0.23	0.10
6	0.40	0.41	0.31	47	−0.29	−0.54 X	0.29
7	0.55	−0.44	0.33	48	−0.07	−0.24	−0.14
8	0.00	−0.00	0.36	49	0.08	0.42	−0.16
9	0.27	0.61 X	0.22	50	−0.73 X	−0.27	0.23
10	0.28	0.62 X	0.19	51	−0.30	0.14	0.30
11	0.90 X	0.21	0.05	52	0.29	0.03	0.57 X
12	0.76 X	0.29	0.14	53	−0.16	−0.57 X	0.15
13	−0.61	−0.61	0.14	54	−0.66 X	−0.37	−0.03
14	0.64 X	0.55	0.13	55	0.15	−0.27	0.44
15	−0.79 X	0.24	0.20	56	−0.18	0.30	0.74 X
16	−0.80 X	−0.19	0.02	57	−0.22	−0.94 X	−0.04
17	−0.16	0.20	0.46	58	−0.10	0.10	0.09
18	−0.40	0.26	0.70 X	59	0.01	0.55 X	0.31
19	0.78 X	0.07	0.02	60	−0.36	0.09	0.28
20	−0.19	0.24	0.02	61	0.77 X	0.01	0.35
21	0.04	0.56 X	0.31	62	−0.15	0.72 X	0.37
22	−0.14	−0.51 X	0.00	63	−0.39	−0.33	0.66 X
23	0.76 X	−0.40	0.16	64	0.04	0.75 X	0.17
24	0.68 X	−0.16	0.34	65	0.62	−0.26	0.63
25	−0.09	0.40	0.26	66	0.36	0.65 X	0.47
26	0.08	−0.34	0.15	67	−0.46	0.22	0.08
27	−0.24	0.08	0.63 X	68	0.25	−0.80 X	−0.08
28	−0.44	−0.60 X	0.04	69	−0.03	−0.56 X	0.28
29	−0.37	0.75 X	0.11	70	0.02	0.93 X	0.06
30	−0.01	0.50 X	0.05	71	−0.89 X	−0.08	−0.01
31	−0.06	0.52 X	0.15	72	0.79 X	0.35	0.29
32	0.27	0.01	0.78 X	73	0.25	0.76 X	0.31
33	0.56 X	−0.17	0.30	74	0.21	0.36	0.10
34	0.63 X	−0.03	0.06	75	−0.48 X	0.29	0.01
35	−0.70 X	−0.50	0.31	76	0.58	0.33	0.56
36	0.52 X	0.21	0.23	77	0.05	−0.40	0.52 X
37	0.79 X	0.43	0.08	78	−0.03	0.29	0.84 X
38	0.52	0.19	0.58 X	79	−0.17	0.33	0.52 X
39	0.06	−0.60 X	0.48	80	0.60 X	0.37	−0.14
40	0.40	0.69 X	0.01	81	0.17	0.50	0.60 X
41	0.18	−0.31	0.71 X	82	−0.27	0.62 X	−0.09

[a] Strongly correlated factor loadings are indicated by an “X”.

The Q-sorts of the 21 remaining respondents did not load on these factors. While these 21 respondents also have a preference order for timber, they were not sufficiently similar to other respondents to create a new factor or their own group and in effect remain as 21 individual preference orders. Since the objective is to identify groups of consumers, the remaining results consider only those respondents associated with Factors A, B, and C.

A feature of the results is that Factors A and B have both positively and negatively loaded respondents. Such factors are called "bipolar", meaning that these factors carry two "poles", or sets of preference order. In each of these factors, the preference order for timbers from the most liked to the most disliked is the reverse for each of the two poles. In bipolar cases, Brown (1980) suggests that two separate factors are created to represent the poles, arguing that the negative end merely being a reflection of the positive end. In the remaining part of the analysis, the positive and the negative poles in both Factor A and Factor B are treated as a separate factor and thus, named as Factor A1, Factor A2, and Factor B1, Factor B2 (**Table 4**). Unlike Factor A and Factor B, Factor C has all 15 respondents loaded positively.

Table 4. Factors and numbers of defining respondents.

Group	Number of respondents	Percent of respondents	Remarks
Factor A1	16	20	Positively loaded to Factor A
Factor A2	7	8	Negatively loaded to Factor A
Factor B1	15	18	Positively loaded to Factor B
Factor B2	8	10	Negatively loaded to Factor B
Factor C	15	18	Positively loaded to Factor C
	21	26	Did not load to a factor
Total	82	100	

A factor array of timber samples can be determined for each factor in **Table 4**, showing the preference order of timber samples in the actual shape of the Q-sort distribution. The factor arrays for Factor A1, Factor B1, and Factor C are shown in **Figures 3, 4, and 5**, respectively. Factors A2 and B2 can be seen in **Figure 3 and Figure 4** with the preference order of timber samples from liked to disliked going from left to right.

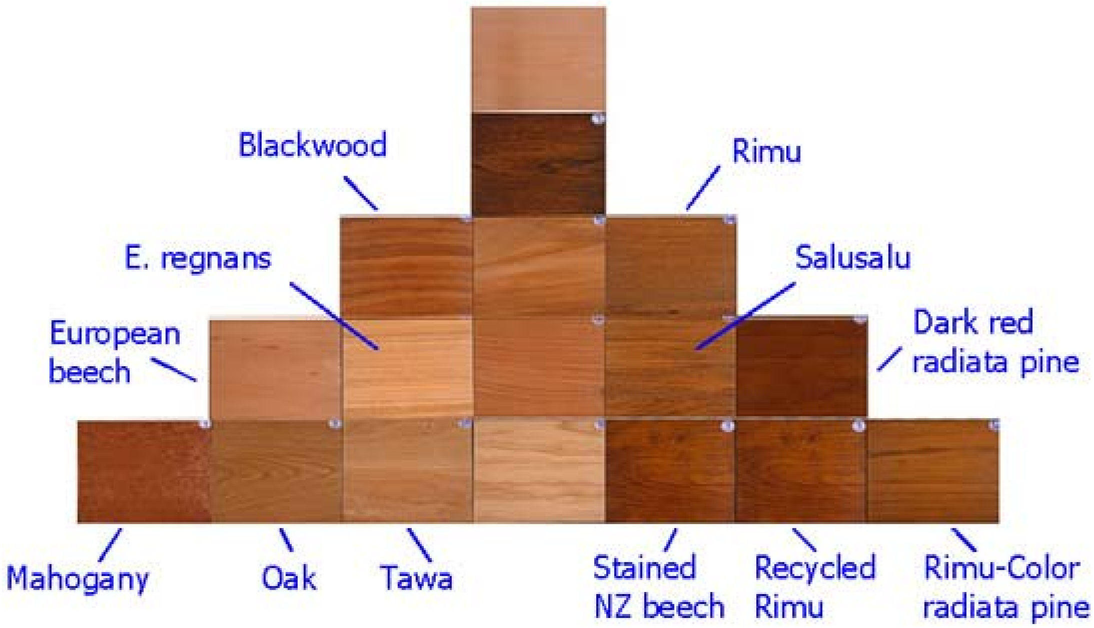
Factor A1 Golden-red Timber Group

Color is the most important criterion for furniture timber for this group. They prefer a golden-red color, and rimu-look stain, defining this color as being "warm." They like medium color timber that is not too light or dark. They will also accept some degree of stain on wood. They dislike green, yellow, and light, unstained timber and describe them as "cold." Similarly, they also dislike a variety of colors on the same timber. Grain is the next most important criterion for this group, with a preference for relatively coarse grain. They accept some degree of variation in grain but they dislike fine and too much grain on timber. In their words, they define such timber as "busy" or "spotty." The group also likes the recycled look, such as nail holes in timber.

Factor A2 Mixed Grain and Light Color Timber Group

Grain is the most important criterion for these respondents, followed by color and hardness or durability. This group of furniture customers preferred both some coarse grain (mahogany, oak) and some fine grain (European beech, New Zealand beech) timbers. However, they dislike radiata pine, which also has coarse grain. They indicated a preference for hardwood timber and disliked softwood timber. They considered that hardwood was a more durable timber and therefore, high quality compared to softwood timber. It was observed that most of the respondents in this group recognized the timber samples while they established their Q-sorts. From this observation, it might be construed that these respondents are more knowledgeable about furniture timbers and established their Q-sorts based on the perceived quality of the timber. Color is the next most important criterion, with a preference for light and natural colored timber.

Figure 3. Factors A1 and A2.



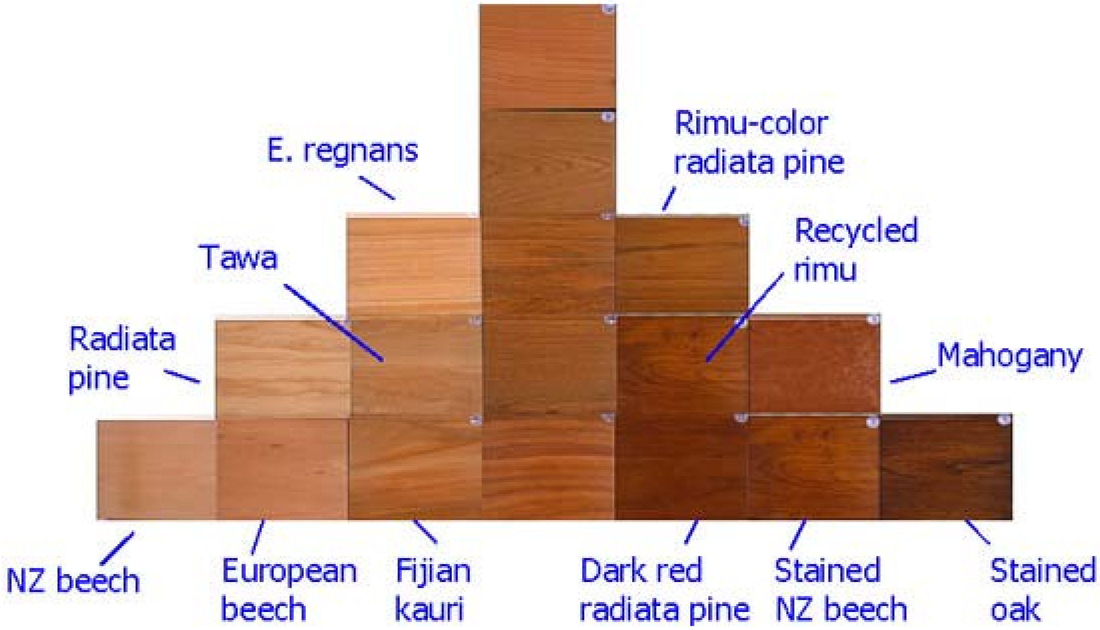
Factor B1 Dark Color and Coarse Grain Timber Group

For this group, color and grain are the most important criteria for furniture timber. They have a preference for dark colored timber that they consider to be "warm, smart, classic, expensive, old fashioned, and antique." In contrast, they describe light colored timber as "bland, characterless, wishy-washy, cheaper, and sick looking." They prefer coarse (oak) and spotty (mahogany) grain, describing these grains as "attractive, old character, natural, and unique."

Factor B2 Light Color and Fine Grain Timber Group

Furniture customers of this group have the opposite preference order of furniture timber than Factor B1. Respondents in this group prefer light colored and unstained timber. They describe light colored furniture timber as simple, clean, warm, quiet, modern. They dislike the dark stained timber and describe it as out-of-date, overpowering, older peoples' furniture, gloomy, and busy. They like fine grain timbers, for example, European beech and New Zealand beech, and dislike coarse grain timbers (e.g., oak).

Figure 4. Factors B1 and B2.



Factor C: Medium Color and Fine Grain Timber Group

Again color and grain of timber are the most important criteria for this group (**Figure 5**). They prefer golden, medium stained timber for furniture. They describe such color as warm, honey color, medium color, natural, and matching. They dislike both dark stained and light colored timber. They describe light colored timber as cold, cheap, bland, pale, not practical and dark stained timber as old looking, old fashioned, gloomy, and ugly. They prefer fine and consistent grain (e.g., Fijian salusalu and rimu) compared to coarse and non-consistent grain (e.g., oak) on timber.

Figure 5. Factors C.

Identifying Consumer Segments

The five factors, or groups, of furniture consumers form potential market segments for furniture manufacturers. However, in order for manufacturers to identify these market segments they need to find useful characteristics that correspond to a particular segment. Based on the demographic data collected in the survey, each factor can to some extent be described in terms of gender, age, education, and income (**Table 5**). However, the small number of respondents limited the use of statistical tests to establish whether these differences are significant.

Table 5. Demographic profile of factors.

Factor	Gender	Age	Education	Income
A1	Female	Middle age (38% 41 to 50)	High (69% university or tertiary level)	Medium to high (56% 20,000 to 60,000)
A2	Male	Older age (43% 51 to 60)	High (57% university or tertiary level)	Very high (57% above 60,000)
B	Female	Young age (46% 20 to 40)	Medium (60% high school or trade level)	Medium (73% 20,000 to 40,000)
B2	Female	Young or older (50% 31 to 40 and 50% 51 to 60)	Medium (38% high school level)	Medium (38% 20,000 to 40,000)
C	Even	Middle age (40% 41 to 50)	High (60% university level)	High (77% above 40,000)

Conclusions

The purpose of this study was to identify opportunities for domestic New Zealand furniture producers to replace a now scarce domestic species, rimu, with alternative timbers that are acceptable to furniture buyers. This was accomplished by studying preferences for different furniture timbers of visitors to a furniture show using a set of timber samples and the Q-sort method. The results indicate that there are at least five market segments with unique preferences for furniture timber that could be targeted by furniture manufacturers. The results also suggest a number of opportunities for managers in both the New Zealand forest and value-added sectors to capitalize on these preferences.

About a third of respondents have species grown in New Zealand in their top three choices of timber ("most liked"). These are the "golden-red" timber group (20% of the sample), which had all three of their most preferred timbers coming from New Zealand sources, and the "light color and fine grain" group (10% of the sample), which had two New Zealand sources in their top three timbers. Another 44 percent of the sample had a domestic timber as one of the next three most preferred timbers (somewhat liked). These are the "mixed grain and light color" timber group (8% of the sample), which has three New Zealand species, the "dark color and coarse grain" group (18% of the sample), which also has three New Zealand species plus one more as its next most preferred species, and the "medium color and fine grain" group (18% of the sample), which had two New Zealand species plus on more as its next most preferred species.

A key question is whether a competitive advantage for New Zealand producers is a local source of timber rather than using imported timbers such as mahogany, European beech, Salusalu, or oak. If local sources are a competitive advantage, the main opportunities offered to New Zealand producers are with stained radiata pine and New Zealand beech. Furniture quality radiata pine is plentiful and supply will not be a problem for producers. The key issues for use of radiata will be to ensure that the stain matches consumer preferences. There are, however, currently problems in the supply of New Zealand beech. The results suggest that there are opportunities for a long-term strategy of investment in the management and processing of beech forests. There are also some opportunities with what are currently minor plantation species such as blackwood and *E. regnans*. Again, in the longer term, the forest industry could increase their investment in plantations of these alternative species, although this will not provide a short-term solution for furniture manufacturers.

The application of the Q-sort method in this study expands on previous literature by providing a basis for studying preferences for the timber used in the furniture by presenting them with a range of real pieces of timber used for furniture making. Resource constraints often mean that studies of timber preferences are survey-based and use pictures. Where this study is different is that it provided respondents with actual samples of timber that respondents could simultaneously see, touch, hold, and feel while deciding their preference. This is believed to be a preferred compromise between the use of photos of furniture and the expense of replicating a number of pieces of furniture in different timbers. An indication of the success of the method is the willingness of some respondents to wait for up to 30 minutes for the opportunity to participate in the survey.

The Q-sort methodology could be applied in other situations where unknown preferences or attributes need to be identified. For example, this approach might be utilized to enable manufacturers to understand how consumers might evaluate an abundant but underutilized species, for example low-grade hardwood lumber (Cumbo et al. 2003, Wang et al. 2004), lesser known species, for example known durable species from Bolivia that could be used in outdoor applications such as *Cariniana estrellensis* and *Dipterax odorata* (Barany et al. 2003), or a species with a high occurrence of defects, for example character-marked Alaskan birch (Donovan and Nicholls 2003). In addition, using pictures of actual pieces of furniture, the Q-sort technique might be used to gauge the acceptability of alternative designs, materials, or manufacturing techniques.

Future research could explore the timber preferences of the lower end of the furniture market, since this study is focused on the middle to upper end of the furniture buying population identified as the consumers most likely to purchase rimu furniture. While these 21 respondents also have a preference order for timber, they were not sufficient to create a new factor or their own group. Now that the initial attribute determination research has been conducted, a conjoint approach could be designed that combined timber features such as grain (fine, medium, coarse), and color (light, dark, red, etc.) with other furniture attributes such as price, durability, or forest certification. This would allow furniture manufacturers to determine the relative values that consumers place on furniture attributes.

Literature Cited

Auckland Specialised Timbers. 2001. Rimu specifications. Online: **www.timspec.co.nz/rimu.html** Dec. 9.

Bannock, G., R.E. Baxter, and E. Davis. 1998. Dictionary of Economics. 6th ed. London: Penguin Books.

Barany, M., A.L. Hammett, and P. Araman. 2003. Lesser used wood species of Bolivia and their relevance to sustainable forest management. Forest Prod. J. 53(7/8):28-33.

Barry, J. and J. Proops. 2000. Citizenship, Sustainability, and Environmental Research: Q-sort Methodology and Local Exchange Trading Systems. Cheltenham: Edward Elgar.

Bigsby, H.R. and L.K. Ozanne. 2001. Consumer preference for environmentally certified forest products in New Zealand. New Zealand J. of Forestry. 46(3):36-41.

Broman, N.O. 1995. Visual impressions of features in Scots pine wood surfaces: A qualitative study. Forest Prod. J. 45(3):61-66.

Brown, S.R. 1980. Political Subjectivity: Applications of Q-sort Methodology in Political Science. New Haven: Yale Univ. Press.

Burton, B. 2000. Environment New Zealand: Government bars rainforest logging. Environmental Bulletin, May 18.

Bussel, H. 1998. Parental choice of primary school: An application of Q-methodology. The Service Industries J. 18(3):135-147.

Chung, D.H. and S.M. Dung. 1999. Purchasing behaviour of furniture consumers in Taipei City. J. of the Experimental Forest of National Taiwan Univ. 13(2):165-180.

Clifton, N.C. 1994. New Zealand Timbers. Wellington: GP Publication.

Cumbo, D., R. Smith, and P. Araman. 2003. Low-grade hardwood lumber production, markets, and issues. Forest Prod. J. 53(9):17-24.

Donovan, G. and D. Nicholls. 2003. Consumer preference and willingness to pay for character-marked cabinets from Alaska birch. Forest Prod. J. 53(11/12):27-32.

Drlikova, E., A. Kusa, H. Palus, M. Supin, A. Zauskova, and D. Jelacic. 1999. Research of customer preferences on furniture market in the Slovak Republic. Development trends in production management for forestry and wood processing. 10:93-96.

Engel, J.F., R.D. Blackwell, and P.W. Miniard. 1993. Consumer Behaviour. 7th ed. Orlando: The Dryden Press.

Fairweather, J.R. and S.R. Swaffield. 1999. Public perceptions of natural and modified landscapes of the Coromandel Peninsula, New Zealand. AERU, Research Rept. No. 241. Lincoln Univ.

Fairweather, J.R