PREFERENCES FOR PRESSURE-TREATED WOODEN DECK MATERIALS

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Abstract. Environmental regulations and restrictions have increased the need for new treatments of wood for outdoor residential use. Further, new tastes and the growing importance of do-it-yourself retailing have initiated a need for more knowledge in the industry about end-consumer preferences for outdoor wooden products. In this study consumer preferences for different types of outdoor decking were analyzed using the conjoint analysis approach. The results indicate that environmental certification is an important product attribute for many customers, together with price and type of treatment. Service and ready-to-assemble products are of low importance. Significant preference differences between customer subgroups were identified. Conjoint part-worth values were also used to distinguish three consumer segments. Finally, the utilization of the conjoint results for simulation of market shares dynamics for hypothetical products is demonstrated.

Keywords: Conjoint analysis, marketing, consumer choice, market segmentation, market shares.

INTRODUCTION

Increased awareness of potentially harmful effects of traditional preservative wood treatment has resulted in new regulations for the use and handling of treated wood in Norway (Jacobsen and Evans 2003), the EU (EC 2006), the United States (EPA 2005), Canada (Fell et al 2006), and Australia (APVMA 2005). Studies (eg Townsend et al 2003 and Lebow et al 2004) have shown that wood treated with chromated copper arsenate (CCA), or creosote, a petroleum-based preservative, leach toxic chemicals to the environment if exposed to water. The new regulations on wood preservatives create a dilemma for the wood industry since treated wood for outdoor use is a promising market niche. This situation has led to the search for new, environmentally low-impact techniques for wood treatment.

Wood is often used to construct residential outdoor applications. WEIWP (2007) estimated the garden timber volume at 1.3 Mm^3. In the UK, the demand for wooden garden furniture and decks has increased, driven by fashion trends and exposure in magazines and TV programs (UNECE/FAO 2004). Shook and Eastin (2001)

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reported annual construction of over 6.5 million residential decks in the United States.

When making a purchasing decision regarding decking material, consumers evaluate different products based on the prevalent attributes, and whether the product can satisfy a specific need (Eggert and Ulaga 2002). Hence, a product can be considered as a bundle of attributes, and the consumer will choose the product with the most preferred attributes (Lancaster 1966). Based on customer value and satisfaction, adaptation of product attributes can be the key to a successful differentiation that improves a producer's position in consumer markets or in specific market segments (Kotler 2000). Product attributes that can influence the purchasing decision for outdoor wooden decking could be product price, environmental properties (ie silvicultural practices and chemical treatment), aesthetic properties, and tradition. The consumer normally makes a combined assessment of the product attributes, assigning more importance to attributes that are expected to increase utility the most. To design the products to meet consumer needs, producers have to identify the most salient product attributes. Examinations of consumer preferences should also consider the simultaneous assessment of several attributes (Lancaster 1966; Engel et al 1986).

Previous studies and ongoing discussions in the wood industry offer several potentially important product attributes to be further explored. Visual impression, treatment, and price are normally included in preference studies. Environmental issues in forest industries are receiving substantial attention both from the public and governmental organizations (UNECE/FAO 2007). Forest Environmental Certification informs the consumer that the wood originates from forests that have been managed according to preestablished environmental, social, and economic standards (Rametsteiner and Simula 2002). Although the certified forest area is increasing in many countries, the share of certified wood products lags behind. However, there are also signs of an increased interest for green purchasing of wood (UNECE/FAO 2007). Producers are increasingly focusing on adding value to their products through developing products that are user-friendly, and ready-to-assemble solutions for wooden decks are now available in several countries. Finally, the service component is frequently advocated as an important success factor for the wood industry (ECWI 2004; Korhonen and Niemelä 2003).

When developing new decking materials, it is essential to be able to assess consumers' valuation of different product attributes and offerings. This requires methods to estimate preferences with regard to these attributes, taking into account interpersonal differences and tradeoffs.

MEASURING PREFERENCES CONCERNING WOOD PRODUCTS

Different aspects of customers' preferences for wood products have been investigated in empirical studies: suppliers vs customers ratings of lumber and supplier performances (Weinfurter and Hansen 1999); lumber quality dimensions (Hansen et al 1996); lumber requirements among industrial customers at wood treating plants (Reddy and Bush 1998); consumer preferences for indoor furniture (Pakarinen and Asikainen 2001); and preferences for specific applications or species (Jonsson 2005; Nicholls et al 2004; Dunn et al 2003).

Several studies have also addressed consumer attitudes toward certification and the willingness to buy certified wood products (Ozanne and Smith 1998; Forsyth et al 1999; Kärnä et al 2003; Bigsby and Ozanne 2002; Veisten 2002; Ozanne and Vlosky 2003; Hansmann et al 2006). These studies suggest a limited overall willingness to pay for environmentally certified wood products, but they also indicate the presence of specific segments of green customers. There are few survey studies concentrating on treated wood. Smith and Sinclair (1989, 1990) studied DIY-customers and builders perceptions of treated lumber products, and found that the most preferred attributes were straightness, appearance, and grade. Reddy and Bush (1998) investigated tradeoffs between lumber attributes

and price of softwood lumber for preservative treatment. Vlosky and Shupe (2002) found that homeowners in general have a positive impression of treated wood, although a small segment is reluctant to buy treated wood because of health concerns. Similar results were also found in a later study by the same authors (Vlosky and Shupe 2004). The authors concluded that homebuilders in general are positive toward treated wood, but there is a need for better information on the handling of treated wood products. Donovan and Hesseln (2004) investigated whether recent concerns about the risks of CCA have created market opportunities for playground facilities made of naturally decay-resistant wood. They found that consumers are willing to pay a premium for childrens' play structures made from nontoxic materials. This result corresponds with that from another study that investigated playground manufacturers perceptions of treated wood: health criteria are the most important considerations for their material choice (Vlosky and Shupe 2005). Consumer perceptions regarding residential deck materials were investigated by Fell et al (2006). Based on two conjoint studies from 2000 and 2003, the authors concluded that consumers have become more negative toward treated wood, and more positive to wood-plastic composites during the study period. The inquiry revealed that type of material, lifetime, and price were the most important quality attributes, whereas annual maintenance was rated lower.

In a literature review, Brandt and Shook (2005) observed that consumer preference studies in the wood sector have rarely applied established methods from market research. However, the general marketing literature provides several research methods that have been used successfully in a range of product areas (van Kleef et al 2005). More knowledge of private consumers' valuations of wood for outdoor use can provide useful information for a more focused product development in the forest sector. Product development based on consumers' preferences and tradeoffs is also likely to lead to increased utility for consumers.

The aim of this study is to analyze and quantify preferences concerning chemically modified/pressure-treated wood. We focused on materials that are used for residential decks. Tradeoffs between the different product attributes were evaluated. An additional purpose was to identify segments of customers and estimate market share dynamics for different product designs.

METHODS

Conjoint Analysis

Conjoint analysis refers to a number of decompositional methods for estimating consumer preferences from their/her overall evaluations of experimentally varied attributes (Green and Srinivasan 1978; Hair et al 1998). The approach has been employed for a number of wood products (Reddy and Bush 1998; Bigsby and Ozanne 2002; Anderson and Hansen 2004; Wang et al 2004; Fell et al 2006). Conjoint analysis combines the advantage of making an experimental design possible with realistic consumer choice situations. van Kleef et al (2005) emphasized the method's usefulness in product development, especially for product- and attribute-focused, incremental improvements. Green and Krieger (1991), Wittink and Cattin (1989) and Aaker et al (2003, p. 594) present a range of uses for commercial conjoint analyses, eg estimating customer preferences for different product designs, predicting profitability of market shares, assessing the impact of competitor products, strategic positioning, and product development. Conjoint analyses have on several occasions successfully predicted consumer choice (Anderson et al 1993). The opportunities that conjoint analysis provides was a sufficient reason for choosing this method for our study.

An additive full-profile model was employed. We compared three types of pressure-treated and chemically-modified products that do not have restrictions on use and few restrictions for deposition. All products were assumed to have a similar durability as long as they are maintained appropriately.

Different approaches were applied to identify

salient attributes for wooden decking: consultation of previous preferences studies on wood, qualitative interviews with nine homeowners about outdoor decking, and, finally, analysis of printed and web-based promotion material from the dominating wood producers and retail chains. We hypothesized that consumers' preferences are shaped by the visual impression, wood species, treatment, price, and service offerings. In Scandinavia, Scots pine (*Pinus silvestris* L.) is the dominating material for pressure treatment, and outdoor or garden applications, so all alternatives in this study were based on this wood species. The factors and levels are shown in Table 1.

The factors were all clearly defined to make product information easy to communicate to the ordinary customer (Hair et al 1998). Type of treatment was mentioned for each alternative, and an actual sample of the treated decking as well as a photo were shown to the consumers. Hence, treatment and visual appearance can be viewed as a 'superattribute' (Hair et al 1998, p 406). Although a separation of treatment and visual impression into two factors would be desired, this would render the investigation dubious, especially among well-informed subjects. Three deck materials were used in the analysis: pressure-treated wood using organic biocides, pressure-treated and chemically-modified wood (furfurylated wood), and pressure-treated wood that included copper (Wolmanit). The latter samples were bought from regular outlets, whereas furfurylated and organically-treated wood were at the time of the study not available on the regular Norwegian market, and therefore were ordered directly from the companies.

Upper and lower price levels were set only slightly above and below the price level in retail stores for wood and building material in Norway to apply clearly noticeable differences without making the alternatives unrealistic. The environmental certification attribute indicated if the wood was certified according to an international standard. Service was defined as personnel available in the store who were ready to answer about the product and give advice about product usage; the 'no service' alternative indicated that no personnel were available in the store that could answer questions or give advice. The ready-to-assemble kit came in precut decking modules and an instruction leaflet for installation. A similar product has recently been introduced into the UK and Swedish markets and the concept is widely used in other wood products markets (eg furniture).

The deck materials were presented as deck sample modules measuring 1000 × 625 mm, consisting of six boards measuring 1000 × 600 × 28 mm. The boards were placed with the growth rings facing up and fastened to two cross-studs by means of screws; the studs were 510 mm apart, and the gap between the boards was approximately 5 mm. The boards were presented on color photographs in the questionnaire and

TABLE 1. *Factors and levels.*

Dimension number	Factor	Levels	Number of levels
1	Visual appearance and treatment	a) Organic biocides with pressure treatment, ORG b) Polymerized wood with pressure and heat treatment, POL c) Copper and boron with pressure treatment, CU	3
2	Price	a) 16.8 US$/m^2 * b) 26.2 US$/m^2 c) 35.5 US$/m^2	3
3	Environmentally certified	a) No a) Yes	2
4	Service	a) No b) Yes	2
5	Ready-to-assemble	a) No b) Yes	2

* Note: 1 US$ = 6.392 NOK

also shown to the respondents. The questionnaire contained a brief description of the treatment. Further technical explanations, eg about the different treatment methods or details about environmental certification, were left out to avoid overly complex considerations of the respondents.

A balanced, fractional-factorial design was chosen to keep the number of stimuli down and make it possible to be handled by the respondents. Twelve stimuli and five holdouts were used in the study. Holdouts are rated by the subjects, but not used for the conjoint analysis. Correlation between holdouts provides an indication of the validity of the results.

Data Collection

Each respondent was asked to imagine a situation in which he/she was planning to buy a new wooden deck. The person was asked to state the likelihood of purchase of offerings with different combinations of the five attributes for wooden decking on a nine-point agreement scale. In addition, the questionnaire contained supplementary questions about gender, age, marital status, education, and income, as well as experience and current plans concerning home improvement projects.

Conjoint responses were collected at a house and garden fair in the Oslo region during a weekend in April 2006. A booth was hired at the fair and visitors were intercepted as they passed by and invited to participate. They were explained the purpose of the study, asked to evaluate the conjoint alternatives, and the holdouts were encouraged to examine the actual samples of the three types of decking. After completing the form, the respondents were awarded a lottery ticket.

Conjoint results were estimated for the whole sample and for subsamples of the responding population. The results were also used for a segmentation based on cluster analysis and utility ratings. Finally, market shares for different hypothetical product offerings were calculated.

RESULTS

Responses

A total number of 296 respondents completed the questionnaires. From the total sample, 56 answers were removed because they achieved low adj-R^2-estimates (< 0.3), and 30 answers were removed because of nonpositive Pearson correlations with the holdout samples. This restricted the number of useable answers to 210, ie the share of used observations was 69%. Further comparisons did not present any significant differences between retained and rejected answers.

Predicted utility for the observations and their actual ratings were compared. This comparison was also done for the holdout observations. The Pearson correlations between predicted and reported ratings were 0.956 for the stimuli that were used in the estimations, and 0.692 for the holdouts.

A comparison between collected socioeconomic data and official statistical information is shown in Table 2, which informs us that the study sample was biased toward the 45–66 age class, whereas both younger and older age classes were slightly underrepresented. Possible explanations are that the middle-aged group possesses the best combination of financial means, time (grown-up children), and physical capabilities to start home-improvement projects compared with the other two groups. Quite small divergences between the sample and the larger population were detected regarding the gender distribution.

TABLE 2. *Comparisons between the study sample and adult population means for greater Oslo[1] (2006), percentage.*

Age group/gender	Sample	Greater Oslo
20–44	48	51
45–66	43	35
>66	9	15
Female	46	51
Male	54	49

[1] Greater Oslo includes, in addition to the city of Oslo, 33 adjacent municipalities.

TABLE 3. *Conjoint results, total and per subpopulation.*

		Whole sample		Men		Women		Low income [2]		High income [2]		-40 yr		40 yr-		No experience		Experience		No plans		Plans	
	N [1]	210		110		92		61		149		107		103		82		127		58		152	
		Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp	Part-worth	Imp
	Intercept	3.92		3.96		3.87		4.10		3.84		3.93		3.90		3.97		3.89		4.02		3.88	
Visual appearance and treatment	Cu	−0.45	18	−0.28*	13	−0.67*	26	−0.48	20	−0.45	18	−0.39	17	−0.53	20	−0.62	24	−0.35	14	−0.63	26	−0.39	15
	Org	0.17		0.24		0.13		0.2		0.16		0.1		0.25		0.23		0.13		0.23		0.15	
	Pol	0.28		0.05*		0.54*		0.27		0.29		0.29		0.28		0.39		0.22		0.40		0.24	
Price	90 NOK/m^2	0.57	25	0.68	33	0.45	16	0.61	28	0.55	24	0.55	25	0.59	26	0.39*	16	0.68*	31	0.23*	9	0.70*	31
	140 NOK/m^2	−0.10		−0.07		−0.13		−0.15		−0.08		−0.09		−0.12		−0.12		−0.09		−0.08		−0.11	
	190 NOK/m^2	−0.46		−0.61*		−0.31*		−0.46		−0.47		−0.46		−0.47		−0.28*		−0.59*		−0.15*		−0.58*	
Environmentally certified	Yes	1.03	51	0.91*	46	1.19*	51	0.9	47	1.08	52	1.03	51	1.02	49	1.16	56	0.95	46	1.23*	61	0.95*	47
	No	−1.03		−0.91*		−1.19*		−0.9		−1.08		−1.03		−1.02		−1.16		−0.95		−1.23*		−0.95*	
Service	No	−0.03	1	0.04*	2	−0.09*	4	−0.08	4	−0.01	0	−0.07*	3	0.02*	1	−0.03	1	−0.03	1	−0.02	1	−0.03	1
	Yes	0.03		−0.04*		0.09*		0.08		0.01		0.07*		−0.02*		0.03		0.03		0.02		0.03	
Ready-to-assemble product	Yes	−0.09	4	−0.11	6	−0.05	2	−0.01	1	−0.12	6	−0.09	4	−0.09	4	0.04*	2	−0.17*	8	−0.06	3	−0.10	5
	No	0.09		0.11		0.05		0.01		0.12		0.09		0.09		−0.04*		0.17*		0.06		0.10	

[1] Sums of observations in paired comparisons less than 210 reflect missing values for this variable. *significant difference after t-test (normal distr.) or Wilcoxon, Mann-Whitney test (nonnormal distr.) ($p < 0.05$)
[2] Limit = 250 000 NOK/a

Conjoint Results for Subpopulations

Part-worth estimates (utility scores) and relative importances are reported in Table 3. Results are shown for the whole sample and for subpopulations. Importances are based on mean part-worths for the population and for subpopulations. This approach was chosen, rather than calculating the mean of the individual importances, since our focus was on the preference structure for the whole population and subpopulations. Furthermore, respondents' relative ranking of different levels may differ between persons. We therefore assumed that mean importances could result in misleading conclusions on population level, eg concerning the population's average relative weighting of different factors. Consequently, significance tests between subpopulations are presented only for the part-worth variables.

According to the results, respondents preferred a product with the following attributes: furfurylated pine, lowest price, environmentally certified, and sold in a store that can provide service. Ready-to-assemble package solutions were not preferred by this sample of Norwegian customers. The relative importances indicate that the most salient product attribute was environmental certification. Price and treatment/visual appearance were also assigned a high importance. The attributes service and ready-to-assemble product were, on average, of negligible importance to the respondents.

The results indicate that men and women value some attributes differently. Women, on average, seemed to put more importance on the visual impression and treatment, whereas price sensitivity was more pronounced among male respondents. Significant differences between men and women were also detected for the attributes of environmental certification and service; both properties were more valued by women.

There were no significant differences between income classes. Between age groups, the only significant difference was found for the service attribute, which was slightly more preferred by the young respondents. Consumers with experience, either due to profession or from extensive home improvements, were more price conscious, and less interested in the treatment method than the inexperienced respondents. Experienced customers were negative toward the ready-to-install decking product. Furthermore, plans for decking investments seem to be associated with a reduced enthusiasm for environmentally certified wood and an increasing price sensitivity.

Segmentation

Part-worths for the treatment, price, environmental certification, service, and ready-to-assemble product were used to segment the customers. The Ward clustering method was chosen for this purpose (Punj and Stewart 1983). The method minimizes the within-cluster sum of squares. When compared with other methods, it tends to generate clusters of somewhat uniform size. Five outliers were removed prior to the analysis (SAS 1999).

The cluster solution was chosen to differentiate the utility values while keeping the number of clusters down, thus avoiding unnecessary complexity (Punj and Stewart 1983). There are no clear-cut rules for choosing the number of clusters (Everitt and Dunn 1991). Hence, our solution was determined based on the pseudo F−criterion, and the pseudo t^2-criterion (SAS 1999). Altogether, these considerations resulted in a three-cluster solution (Table 4). Mean part-worths and calculated importances are provided, and clusters are also characterized by additional demographic variables.

Based on the clustering results, we identified the following three segments. Cluster 1, green customers, was the largest group of respondents, including 90 individuals. This group of potential customers was mainly focused on the environmental certification criteria, whereas price was less important. Interestingly, the segment valued the organic impregnation highest. The group did not show a gender bias, and estimated part-worths of service and package solutions did not deviate from the mean of the whole population.

TABLE 4. *Cluster solution.*

		Whole sample		Green customers		Aesthetic customers		Price-conscious customers	
		N = 210		N = 90 43%		N = 40 19%		N = 75 36%	
		Part-worths	Importance	Part-worths	Importance	Part-worths	Importance	Part-worths	Importance
	Intercept	3.92		4.06		3.87		3.73	
Visual appearance and treatment	Cu	–0.45	18	–0.10[a]	11	–1.76[b]	52	–0.20[a]	9
	Org	0.17		0.36[a]		0.31[a]		–0.09[b]	
	Pol	0.28		–0.26[a]		1.45[b]		0.30[c]	
Price	90 NOK/m^2	0.57	25	0.14[a]	8	–0.22[b]	8	1.49[c]	47
	140 NOK/m^2	–0.1		0.06[a]		–0.03[ab]		–0.33[b]	
	190 NOK/m^2	–0.46		–0.21[a]		0.25[b]		–1.16[c]	
Environmentally certified	Yes	1.03	51	1.57[a]	74	0.84[b]	27	0.88[b]	31
	No	–1.03		–1.57[a]		–0.84[b]		–0.88[b]	
Service	No	–0.03	1	0.07[a]	3	–0.37[b]	12	–0.01[a]	0
	Yes	0.03		–0.07[a]		0.37[b]		0.01[a]	
Ready-to-assemble product	Yes	–0.09	4	0.08[a]	4	0.03[b]	1	–0.35[a]	12
	No	0.09		–0.08[a]		–0.03[b]		0.35[a]	
Percentage women		46		44		68		36	*
Age		45		46		43		45	
Young customers		50		50		52		49	
University education		64		56		65		71	
Low income class		27		29		30		28	
Experience		62		54		48		77	*
Own work experience		56		51		55		57	
Plans		75		68		65		83	*

[a b c] Significant in Tukey all pairwise test ($p < 0.05$) *Significant in Fisher's exact test ($p < 0.05$)

Cluster 2, aesthetic customers, included 40 respondents. These persons were influenced by the aesthetic properties and the treatment of the deck material. They strongly preferred the dark furfurylated wood and disliked copper-treated wood. As with Cluster 1, cheap products were not necessarily favored. Rather, the respondents in this group actually tended to prefer high-priced products. In addition to treatment and aesthetics, environmental certification was important, albeit less than for the environmental customers. The majority of the respondents in this group were women and relatively few were planning to buy wooden decking. Members of the cluster preferred service when purchasing the products, perhaps due to less experience in home improvement work.

Cluster 3, price-conscious customers, included 70 respondents. They preferred cheap products, while aesthetics and environmental certification were not as important. Environmental certification was ranked as the second most important factor. However, on average, this segment was the least interested in eco-labeling. The respondents in this group were indifferent to service when purchasing the product, and the package solution had a clearly negative impact on utility. The majority of the respondents were male and they reported experience of DIY work; many were also planning to build a wooden deck at home.

Market-share Simulations

Predicted utilities from the conjoint analysis were used to calculate market shares for hypothetical products, and how these market shares can change when new alternatives are introduced. The most widely used method is the

Maximum Utility method (Kuhfeld 2005 p. 566). Results of the calculations are shown in Table 5. The ready-to-assemble product option is not considered since the analysis showed that preferences for this feature were small. We stated that at t = 0 there were three copper-treated products with different environmental attributes available on the market. Products not treated with copper were also available, but these products did not have an environmental certification tag and were quite expensive. At t = 1, new copper-free products were introduced: expensive environmentally certified products and a medium priced uncertified product.

The simulation shows that all incumbent products would lose market shares as new products were introduced, but the losses vary greatly. The highest losses were found for certified copper-treated products and uncertified furfurylated wood. At t = 1, environmentally certified products that were not copper-treated obtained a market share of 45%, despite their high prices. However, the cheap and uncertified copper-treated product was the original product that could best meet the new market situation.

DISCUSSION

Comparisons with the previous study on outdoor decking (Fell et al 2006) confirmed the high impact on preferences of treatment/visual impression and price. Other attributes are not similar across these studies, mainly due to the research focus and different market conditions in North America and Norway. Our results are also well in accordance with other studies stressing the importance of the visual impression (Broman 2000; Pakarinen and Asikainen 2001). Furfurylated wood was perhaps preferred because of its dark color and resemblance to dark and exclusive tropical hardwoods. The importance of environmental certification agrees with earlier results (Veisten 2002; Ozanne and Smith 1998; Bigsby and Ozanne 2002), but results from the present study suggest an even higher priority for this product attribute than has previously been reported. The preference for environmental certification is probably due to a desire among customers to have environmentally sound products in their garden. It may also suggest an ongoing trend toward green consumerism. Environmental considerations may also have generated the preference for decking products that are not treated with copper, even though the copper treatment is considered safe for public use. The low ratings for service may reflect the fact that product information and instructions are easily accessible for free on the internet, in 'life-style' TV programs, and in journals and promotion material. Hence, the importance of enhanced services for the wood products retailing sector is a recommendation with important reservations. Finally, there seem to be bleak prospects for a ready-to-assemble decking kit for the Norwegian market. This skepticism may be due to topographic conditions in Norwegian gardens; they are not always flat, thus preventing a standardized design for outdoor arrangements. However, it can also be explained by social norms about how home improvement work should be done.

TABLE 5. *Expected market shares and change - maximum utility model.*

Treatment	Price/m^2	Cert	Share at t = 0, percent	Share at t = 1, percent	Change
Pol	190	Yes		24.4	+24.4
Org	190	Yes		20.7	+20.7
Cu	140	Yes	35.2	19.5	−15.7
Cu	90	No	21.6	19.2	−2.3
Pol	140	No		5.2	+5.2
Cu	190	Yes	19.7	4.9	−14.8
Org	140	No		3.8	+3.8
Pol	190	No	15.3	1.4	−13.8
Org	190	No	8.2	0.9	−7.3

The higher valuation of environmental properties by women corroborates the outcomes of several prior studies showing that women are more positive toward eco-labeled products (Ozanne and Smith 1998; Anderson and Hansen 2004; Straughan and Roberts 1999). An interesting finding in our study, which should be further investigated, is that men generally put more emphasis on price whereas women give priority to visual appearance, treatment, and, to some extent, service. A new finding in our study is the

importance of experience of home improvement and plans for preferences. Several factors can produce this pattern: people with experience and plans may tend to change the wooden deck more often, and thus shift the focus toward cheaper products. More focus on price by customers that are at later stages in the decision process could also indicate a greater portion of realism as the investment decision.

The cluster analysis suggested three specially designed product and marketing propositions: certified decking targeted to 'green' customers, 'exclusive' deck materials for a somewhat smaller segment of customers with a focus on appearance, and special offers for price-sensitive, experienced buyers. A side issue in the segmenting study was the preference among environmental customers for labeled organic treatment, while aesthetic customers preferred the polymerized wood, which was also treated with organic compounds. A possible, unanticipated reason may be the name of the product. For people with environmental concerns, the Norwegian word for 'organic' may have a particularly positive loading. When compared with other cluster analyses by Forsyth et al (1999) and Bigsby and Ozanne (2002), we found a bias toward female customers in the group focusing on the visual impression, and that the low interest for green purchasing among men also can be explained by a focus on price. Our results also confirm Bigsby and Ozanne (2002) in that demographic variables give limited information for segmenting consumers, eg with regard to certification. Previous studies have also shown that green purchasing is formed more by attitudes than by socioeconomic factors (Kaiser et al 1999; Straughan and Roberts 1999; Diamantopoulous et al 2003).

The market simulation presented another perspective on the results from the conjoint analysis. Further examination of the results brings us to the conclusion that intensified service efforts are an uncertain market strategy as it does not seem to yield increases in market shares. On the other hand, the simulations indicate possibilities to charge price premiums for environmentally certified and aesthetically appreciated wooden decking.

CONCLUSIONS

The results indicate that Norwegian consumers' preferences for wooden deck materials are mainly influenced by three product attributes: environmental properties, product price, and treatment/visual appearance. Low preference ratings were given to opportunities to receive advice by a salesperson, and for ready-to-assemble decking products. This leads to the conclusion for producers to offer more environmentally certified decking on the market. They should also make efforts to improve the aesthetic impression of the decking products. However, any new concept including special advice, or product based on modules, requires a thorough knowledge about the customers' concerns and needs, before it is finally designed and marketed. Our study did not suggest a general need for these service offerings. On the other hand, nice-looking wooden decking with good environmental credentials can motivate a price premium.

We also suggest that producers of wooden decking consider different consumer segments for special offerings. In our case these segments could be given quite general labels, 'green customers,' 'aesthetic customers,' and 'price conscious customers.' These segments motivate in some instances different product designs and promotion arguments. However, consumer segments in other geographic markets may have different properties.

As in most consumer studies, the present analysis has shortcomings and the results should therefore be interpreted with caution. The substantial importance of environmental certification could have been exaggerated because this is regarded as a better ethical position. This suspicion is supported by the significantly lower partworths for this attribute among consumers that had plans to buy new outdoor decking. The green preferences among consumers of wood products should therefore be investigated further. This issue is also discussed by Forsyth et al

(1999). Still, recent articles in Scandinavian trade journals suggest an increased environmental awareness among end-consumers (see for instance that Nordisk Träteknik #21/2007 had one headline running "Environmental issues become 'hotter' in the DIY-sector").

A second reason for skepticism is the degree of external validity of the results. The respondents in the study were to some degree a 'convenient' sample with the common factor of visiting a house and garden fair, and agreeing to participate in the study. This feature may also correlate with special values and preferences, which in turn make the results less valid for generalizations. Based on the clustering results, a speculative interpretation would be that fair visitors are more experienced with home improvement work than average Oslo inhabitants, which would give reason to a disproportional bias toward the third cluster. However, other interpretations are also plausible.

Future research could expand toward additional wood products in the DIY sector. Much remains to be done when it comes to finding reliable predictors for consumer choice in this growing market segment. One challenge in this respect would be to test further hypotheses and procedures to predict green purchasing by buyers of wood products. The role of experience and plans for preferences, and differences between male and female customers should also be further investigated.

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REFERENCES

AAKER D, KUMAR V, DAY GS (2003) Marketing research, 7th Ed. John Wiley & Sons. New York, NY. 774 pp.

http://www.apvma.gov.au/chemrev/arsenic_summary.pdf (15 June 2007).

ANDERSON JC, JAIN DC, CHINTAGUNTA PK (1993) Customer value assessment in business markets: A state-of-practice study. J Bus Bus Mark 1(1):8–9.

ANDERSON RC, HANSEN EN (2004) The impact of environmental certification on preferences for wood furniture: A conjoint analysis approach. Forest Prod J 54(3):42–50.

APVMA (2005) The reconsideration of registrations of arsenic timber treatment products (CCA and arsenic trioxide) and their associated labels- report of review findings and regulatory outcomes, Summary report. Australian Pesticides and Veterinary Medicines Authority, March 2005.

BIGSBY H, OZANNE LK (2002) The purchase decision: Consumers and environmentally certified wood products. Forest Prod J 52(7-8):100–105.

BRANDT JP, SHOOK SR (2005) Attribute elicitation: Implications in the research context. Wood Fiber Sci 37:127–146.

BROMAN NO (2000) Means to measure the aesthetic properties of wood. PhD Thesis. Division of Wood Technology, Luleå University of Technology, Luleå, Sweden.

DIAMANTOPOULOS A, SCHLEGELMILCH BB, SINKOVICS RR, BOHLEN GM (2003) Can socio-demographics still play a role in profiling green consumers? A review of the evidence and an empirical investigation. J Bus Res 56:465–480.

DONOVAN G, HESSELN H (2004) Consumer willingness to pay for naturally decay-resistant wood products. West J Appl For 19:160–164.

DUNN MA, SHUPE TF, VLOSKY RP (2003) Homebuilder attitudes and preferences regarding southern yellow pine. Forest Prod J 53(4):36–41.

EGGERT A, ULAGA W (2002) Customer perceived value: A substitute for satisfaction in business market. J Bus Ind Mark 17(2-3):107–118.

ENGEL JF, BLACKWELL RD, MINIARD PW (1986) Consumer behavior. The Dryden Press, Fort Worth, TX. 633 pp.

EPA (2005) Chromated copper arsenate (CCA). chromated copper arsenate (CCA). Environmental Protection Agency http://www.epa.gov/oppad001/reregistration/cca/index.htm#general (15 June 2007).

EC (2006) Commission Directive 2006/139/EC of 20 December 2006 amending Council Directive 76/769/EEC as regards restrictions on the marketing and use of arsenic compounds for the purpose of adapting its Annex I to technical progress. European Commission. http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_384/l_38420061229en00940097.pdf (15 June 2007).

ECWI (2004) Roadmap 2010 for the European Woodworking Industries. European Confederation of Woodworking Industries. CEI-Bois. Brussels, Belgium. 34 pp.

EVERITT BS, DUNN G (1991) Applied multivariate data analysis. Arnold, London. 304 pp.

FELL RD, THOMAS J, HANSEN E (2006) Evolving consumer preferences for residential decking materials. For Chron 82(2):253–258.

FORSYTH K, HALEY D, KOZAK RA (1999) Will Consumers Pay More for Certified Wood Products? J Forestry 97(2):18–22.

GREEN PE, KRIEGER AM (1991) Segmenting markets with conjoint-analysis. J Mark 55(4):20–31.

———, SRINIVASAN V (1978) Conjoint Analysis in Consumer Research: Issues and Outlook. J Consum Res 5(Sep):103–123.

HAIR JF, ANDERSON RE, TATHAM RL, BLACK WC (1998) Multivariate analysis. Prentice Hall Inc. NY. 768 pp.

HANSEN EN, BUSH RJ, FERN EF (1996) An empirical assessment of the dimensions of softwood lumber quality. Forest Sci 42(4):407–414.

HANSMANN R, KOELLNER T, SCHOLZ RW (2006) Influence of consumers' socioecological and economic orientations on preferences for wood with sustainability labels. For Policy Econ 8(3):239–250.

JACOBSEN B, EVANS F (2003) Surface treatment of wood for outdoor use [*in Norwegian*]. Part 1. Tekniske småskrift. Norsk Treteknisk Institutt (NTI), Oslo, Norway. 37 pp.

JONSSON R (2005) The end consumer's choice of floorcovering in the Netherlands and the United Kingdom: A comparative pilot study of substitute competition. Wood Sci 51(2):154–160.

KAISER FG, WÖLFING S, FUHRER U (1999) Environmental attitude and ecological behavior. J Environ Psychol 19: 1–19.

KÄRNÄ J, HANSEN E, JUSLIN H (2003) Environmental activity and forest certification in marketing of forest products—A case study in Europe. Silva Fennica 37(2):253–267.

KORHONEN S, NIEMELÄ JS (2003) Strategy analysis of the leading European and North American wood-industry companies in 1998–2001. University of Helsinki Seinäjoki Institute for Rural Research and Training. Seinäjoki, Finland. 91 pp.

KOTLER P (2000) Marketing management—The Millenium Edition. Prentice hall International, Inc. London, 718 pp.

KUHFELD W (2005) Marketing research methods in SAS—Experimental design, choice, conjoint, and graphical techniques. SAS Institute Inc., Cary, NC, 857 pp.

LANCASTER K (1966) A new approach to consumer theory. J Polit Econ 74:132–156.

LEBOW S, FOSTER D, LEBOW P (2004) Rate of CCA leaching from commercially treated decking. Forest Prod J 54:81–88.

NICHOLLS DL, DONOVAN GH, ROOS J (2004) Consumer preferences for kitchen cabinets made from red alder: A comparison to other hardwoods. Wood Fiber Sci 36(3):432–442.

OZANNE LK, SMITH PM (1998) Segmenting the market for environmentally certified wood products. Forest Sci 44(3):379–388.

———, VLOSKY RP (2003) Certification from the U.S. consumer perspective: A comparison of 1995 and 2000. Forest Prod J 53(3):13–21.

PAKARINEN T, ASIKAINEN A (2001) Consumer segments for wooden household furniture. Holz Roh-Werkst 59:217–227.

PUNJ G, STEWART DW (1983) Cluster analysis in marketing research: Review and suggestions for application. J Marketing Res 20:134–148.

RAMETSTEINER E, SIMULA M (2002) Forest certification—an instrument to promote sustainable forest management? Forest Policy Econ 67:87–98.

REDDY VS, BUSH RJ (1998) Measuring softwood lumber value: A conjoint analysis approach. Forest Sci 44(1): 145–157.

SAS 1999. SAS Stat User's Guide. SAS Institute Inc., Cary, NC, USA.

SHOOK SR, EASTIN IL (2001) A characterization of the US residential deck material market. Forest Prod J 51:28–36.

SMITH PM, SINCLAIR SA (1989) The Do-it-yourself customer for CCA-treated lumber products. Forest Prod J 39:35–41.

———, ——— (1990) The professional contractor/remodeler: Market research for CCA-treated lumber products. Forest Prod J 40:8–14.

STRAUGHAN RD, ROBERTS JA (1999) Environmental segmentation alternatives: A look at the green consumer behaviour in the new millennium. J Consum Mark 16(6):558–575.

TOWNSEND T, SOLO-GABRIELE H, TOLAYMAT T, STOOK K, HOSEIN N (2003) Chromium, copper, and arsenic concentrations in soil underneath CCA-treated wood structures. Soil Sediment Contam 12:779–798.

UNECE/FAO (2004) Timber Market Statement—September 2004. http://www.unece.org/trade/timber/mis/market/market-62/unitedkingdom.pdf (15 June 2007).

——— (2007) Forest products annual market review 2005–2006. UNECE/FAO, Geneva. 163 pp.

VAN KLEEF E, VAN TRIJP HCM, LUNING P (2005) Consumer research in the early stages of new product development: a critical review of methods and techniques. Food Qual Prefer 16:181–201.

VEISTEN K (2002) Potential demand for certified wood products in the United Kingdom and Norway. Forest Sci 48: 767–778.

VLOSKY RP, SHUPE TF (2002) Homeowner attitudes and preferences for building materials with an emphasis on treated wood products. Forest Prod J 52:90–95.

———, ——— (2004) U.S. homebuilder perceptions about treated wood. Forest Prod J 54:41–48.

———, ——— (2005) Manufacturers' perceptions about using treated wood in children's playground equipment. Forest Prod J 55:190–193.

WANG QB, SHI GM, CHAN-HALBRENDT C (2004) Market potential for fine furniture manufactured from low-grade hardwood: Evidence from conjoint analysis in the northeastern United States. Forest Prod J 54(5):19–25.

WEINFURTER S, HANSEN EN (1999) Softwood lumber quality requirements: Explaining the supplier/buyer perception gap. Wood Fiber Sci 31(1):83–94.

WEIWP 2007. The wood preservation industry. Western European Institute for Wood Preservation. http://www.wei-ieo.org/headframe.htm (15 June 2007).

WITTINK DR, CATTIN P (1989) Commercial use of conjoint-analysis—an update. J Mark 53(3):91–96.