Examining the Effect of Environmental Certification, Wood Source, and Price on Architects' Preferences of Hardwood Flooring

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This article examines the importance architects place on three factors, environmental certification, wood source, and price, when specifying hardwood flooring. Architects were presented with nine flooring scenarios, in which the three factors were present in varying levels. They were asked to rank the scenarios from the least preferred to the most preferred. Data were obtained from a mail survey of architects in Oregon and Washington, U.S.A. (n = 402). Conjoint analyses determined that architects consider price and wood source to be the most important factors when specifying hardwood flooring. Interestingly, environmental certification was considered the least important factor. The respondents were then separated into three groups for further analysis based on whether they identified themselves as more influenced by environmental factors (biocentric) or human needs (anthropocentric). This analysis showed that the biocentric group favored wood source over price and environmental certification, while the anthropocentric group favored price.

Keywords architects, hardwood flooring, conjoint analysis, environmental certification, wood source
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1 Introduction

Over the past two decades, wood flooring has gained significant market share in the U.S. floor coverings industry. While carpet and rug coverings maintain the greatest share of the overall flooring market, they have lost approximately eight percent of the market to wood flooring over a twenty-year period. This loss in market share is not temporary; wood flooring is expected to gain additional market share over the next several years (Bond et al. 2007). This study chose to focus specifically on hardwood flooring because it comprises 85% of the total wood flooring market (Bond et al. 2007).

An array of professionals with varying degrees of influence is involved in the design and construction of a building. The process is often complicated and incorporates the opinion and expertise of those both inside and outside the supply chain. However, the final specification decision is often a product of the collaboration among architects, builders, and homeowners (Damery and Fisette 2001). Architects often play an influential role in product specification for both residential and non-residential construction projects. This influence can be attributed to the fact that architects generate blueprints and that many residential buildings are completed prior to sale, thus limiting homeowners' input (Wagner and Hansen 2004).

Architects tend to have greater influence on the visible parts of a building than they do on the frame (Roos et al. 2008). Consequentially, much can be gleaned from their preferences with respect to hardwood flooring. However, it is important to realize that every project is different, and that architects' specification decisions often depend on the overall style and intent of the project (Roos et al. 2008). Understanding which factors influence architects' specification preferences is of great interest to marketers in the forest products industry. This is partly due to the fact architects are often considered frontrunners in the adoption and use of forest products (Johnson 1998), and partly because they are constantly learning about and considering the use of new products (Kozak and Cohen 1997). This interest in new products is somewhat unique to the forest products industry, and could be an effective avenue through which to introduce and promote new products.

Another way architects can influence materials used is when a building is constructed to meet the requirements of a green building program. Two of the largest in the U.S. are the Leadership in Energy and Environmental Design (LEED) and the Green Globes building programs. The green building programs award points for everything from water efficiency to materials and resources used. For example, the LEED program awards points for materials with recycled content, local materials, rapidly renewable materials, and Forest Stewardship Council (FSC) certified wood, to name a few (USGBC 2009). The Green Globes program awards points for products similar to those specified in LEED. The current shift toward environmentally responsible construction and building certification has caused many architects to specify materials based on the points or credits received from green building programs. Although unheard of twelve years ago, green building programs have gained tremendous recognition and increasing use since their introduction. It is important to understand both the prevalence of green building and the impact it has made on architects' specification decisions.

It is important to explore architects' specification preferences due to their highly influential role concerning the visible products used in a building. As hardwood flooring is a visible building component, it was chosen as the product of focus in this study. This study has the potential to help manufacturers, distributors, and marketers in the forest products industry better understand one of their key customers – architects. Understanding whether price, environmental certification, and/or product locality is more important to architects can help those along the forest products supply chain focus their production and marketing efforts.

2 Literature Review

2.1 Knowledge Gaps

The majority of studies involving architects and wood products focused on their overall perceptions of wood, rather than focusing on individual product attributes (Kozak and Cohen 1999, O'Connor et al. 2004, Bysheim and Nyrud 2008). On the contrary, little research has been done to identify the factors considered by architects when specifying forest products. Roos et al. (2008) found that among other things, architects often consider energy efficiency, environmental impact, aesthetics, and cost when selecting building materials. The three factors considered in this study, environmental certification, wood source, and price, will be discussed in turn.

2.2 Environmental Certification

Within the last decade, environmental certification has gained much attention and recognition within the marketplace. Green building programs, such as LEED, have driven much of that attention. Within the context of the forest products industry, the majority of research surrounding certification preferences has focused on the consumer or those within the supply chain (Ozanne and Vlosky 1997, Irland 2007). However, little work has been done concerning architects and their specification preferences with regard to environmentally certified products (Wagner and Hansen 2004).

It is important to understand which product characteristics influence architects the most, so those attributes can be highlighted through marketing. According to Wagner and Hansen (2004), "Architects are seen to be environmentally conscious specifiers of construction materials" (p. 20). However, when compared to attributes such as appearance, uniform quality, and dimensional stability, architects placed lower relative importance on environmental sustainability regardless of the product type (Wagner and Hansen 2004).

With regard to environmental certification, more work has been done assessing consumers than architects. Teisl et al. (2002) found that price and quality are the most important considerations for consumers with respect to forest products, but that environmental labeling could be influential as well. Work by Ozanne and Smith (1996) and Ozanne and Vlosky (1997) found that certain segments of consumers are more interested in environmentally certified products, but that this interest does not extend to the majority.

Within the major green building programs (LEED and Green Globes), forest certification plays a major role in the allocation of points for wood products. There are some major differences between these two green building programs with respect to wood products. The LEED system provides credit for certified wood products only if the wood is certified under the FSC scheme. The Green Globes system is more inclusive and provides credit for wood products certified under several forest certification schemes including the Forest Stewardship Council (FSC), the Programme for Endorsement of Forest Certification (PEFC), and the Sustainable Forestry Initiative (SFI).

2.3 Product Source

Product source has its roots in the general business and marketing literature. This literature describes two schools of thought concerning product source: 1) high quality and/or prestige associated with the product's source; or 2) less energy and resources consumed by transportation of local products, as well as supporting a local economy.

2.3.1 Product Source: Quality and Prestige

Every place has an image, which is often beyond the marketer's control (Papadopoulos and Heslop 2002). However, a product's Country of Origin (COO) can be a successful marketing tool when used to promote ideas of quality and superiority. The relationship between a product's COO and perceptions of that product has been studied on numerous occasions. The consistent finding was that consumers do use COO as a basis for judging product quality (DeBono and Rubin 1995), and that it can be as important to consumers as other product attributes including price and brand name (Okechuku 1994, Schaefer 1997, Papadopoulos and Heslop 2002). Li and Wyer (1994) agree that a product associated with a country known for high quality often adds to the product's success. Oftentimes, the effects of COO are dependent upon the consumer's familiarity with the product, the importance of the purchase, and the amount of information available (Li and Wyer 1994). An example of COO having a positive effect on consumers is with German engineering of automobiles. Consumers often have a positive association with German cars due to their top quality and success throughout the years. This link between high quality cars and Germany has created a positive COO effect. In addition to its positive influences on a given product, COO can have negative repercussions. Aspects of a country that are unrelated to the product, such as politics, economics, and military actions, may cause consumer animosity toward the product itself (Hong and Kang 2006). In certain circumstances, consumers may judge a product based on the reputation of its COO without considering other product attributes (Hong and Kang 2006). Product images based on their country of origin are important to many, such as exporters and domestic producers whose local market dominance is being challenged (Papadopoulos and Heslop 2002). One recent example of COO having a negative impact on products is with goods made in China. A series of issues with products made in China ranging from workforce issues to toxic chemicals in drywall/plasterboard and dog food have resulted in skepticism from consumers about Chinese goods in general.

In addition to its COO, a product can be associated with smaller geographic areas such as a region, state, city, or community. This more limited geographic association is often referred to as a place-name, which can be used for product branding purposes. According to deWit (1992), "place-names are used to enhance the perceived distinctiveness, authenticity, or quality of a product" (p. 327). An example of the use of a place-name is the Real California Cheese marketing campaign, which uses a combination of printed ads and television commercials to build consumer awareness concerning California cheese. The campaign is one of the most intensive marketing campaigns for any commodity group in the history of the United States (California Milk Advisory Board 2007). Throughout the world, associations between food and place-names are commonly used. Examples of this are Idaho potatoes, Mexican tequila, Maine lobsters, French wine, and Australian beef.

2.3.2 Product Source: Local Products

Over the past decade, a wide variety of products have been marketed as "local." Marketers in several industries have successfully differentiated products by marketing them as local, which has resulted in price premiums and the stimulation of regional economies. The food, apparel, and forest products industries are among those to offer local products.

In order to successfully market a local product, it is important to understand how consumers define "local," as well as how they value the local aspect of a product independent from other attributes (Darby et al. 2008). Examples of product attributes often confounded with the local attribute are freshness, shorter transportation distances, fewer environmental impacts, higher quality, and support for smaller companies (rather than giant corporations).

The idea of "local" is already being applied to industries other than food, such as the forest products industry. The Build Local Alliance, based in Portland, Oregon, is a network of companies working to establish a market for Forest Stewardship Council (FSC) certified forest products from Oregon, for Oregon. The Alliance members offer a range of wood products and services such as hardwood flooring, lumber, large timbers, green realty, consulting, and construction (Build Local Alliance 2009). Similar to other local products, local forest products could benefit the Oregon economy, environment, and reduce the volume of imports into the United States.

Local product sourcing is an important consideration within LEED green building programs. For example, within the LEED for new construction rating system, points may be attained for using building materials that are extracted, harvested or recovered, as well as manufactured, within 805 kilometers of the project site (LEED 2009). Up to two points are available if more than 20% of the material (measured by value) was sourced from within the 805-kilometer radius. The Living Building Challenge, a green building program created by the Cascadia chapter of LEED, has developed a tiered system of criteria for sourcing materials based on the shipping weight of materials (The Living Building Challenge 2008). The heaviest materials must be sourced within a 400-kilometer radius of the site. Lighter, lower density materials can be sourced within a 1610-kilometer radius. Allowances are also given to assemblies that actively contribute to the performance of the building after installation, with a range of up to 4830 kilometers. Renewable energy technologies are allowed the greatest radius, with sourcing allowed out to a 14 500-kilometer radius from the site. Wood products are uniquely positioned to qualify for the local credit under green building programs because forests and forest products manufacturing facilities are located well within a 805-kilometer radius of most major urban centers in the U.S. This is particularly the case in the U.S. Pacific Northwest.

2.4 Price

In general, an item's price is of higher importance to those purchasing it, rather than those merely suggesting it. This is often the case with building owners and architects. A study conducted by Damery and Fisette (2001) surveyed architects in order to determine the most important factors when specifying products for residential construction. Architects were asked to rate the importance of four characteristics on their material purchase decision: performance, cost, appearance, and the recommendations of others. Not surprisingly, cost was rated as one of the least important characteristics (Damery and Fisette 2001). Another study, which was qualitative in nature, assessed Swedish architects' perceptions concerning wood in construction. Cost was considered an important factor, but its influence varied from project to project. A common phrase among architects questioned was: "The budget must be respected" (Roos et al. 2008).

A study by Anderson and Hansen (2004) assessed the impact of environmental certification on preferences for wood furniture, where college students were surveyed. Respondents were asked to determine the importance of five attributes, of which price and wood origin were two of the five. In general, price was the most important attribute. They also found that "the typical respondent is willing to sacrifice environmental certification for the sake of a lower price" (Anderson and Hansen 2004).

2.5 Environmental Value Orientation

As defined by Rokeach (1973), a value is "an enduring belief that a specific mode of conduct is personally or socially preferable to an opposite or converse mode of conduct or end state of existence." One's value orientation toward the environment can be displayed on a continuum, with anthropocentric orientations on one end and biocentric ones on the other (Vaske and Donnelly 1999).

An anthropocentric value orientation takes on a human-centered view of the environment, and considers human use and well-being the environment's primary role. A biocentric value orientation, on the other hand, is centered on the environment. The needs of humans are still important, but the greater environmental needs take precedence (Vaske et al. 2001). The twelve items of the New Environmental Paradigm (NEP) aim to appropriately place respondents along the anthropocentric-biocentric continuum. Since anthropocentric and biocentric orientations are not mutually exclusive, it is possible to place someone anywhere along the continuum (Vaske et al. 2001). Previous research has shown that one's environmental value orientation has an impact on their level of concern for the environment (Dunlap 2008), and that one's values are a better indicator of environmental consciousness (orientation) than the more commonly used socio-demographic characteristics (Diamantopoulos et al. 2003).

2.6 Conjoint Analysis

In this study, we use conjoint analysis to gain an understanding of how architects make specification decisions about hardwood flooring. Conjoint analysis is a multivariate statistical technique, which is often used to better understand how consumers make purchase decisions. It is based on the idea that consumers determine a product's value by combining the value of each individual product attribute. Conjoint analysis attempts to determine the relative importance respondents place on various product attributes, as well as the extent to which tradeoffs occur. The recent forest products literature has utilized conjoint analysis in a variety of applications (Reddy and Bush 1998, Anderson and Hansen 2004, Wang et al. 2004, Cheung and Chung 2007, Veisten 2007, Roos and Hugosson 2008).

Conjoint analysis differs from other multivariate methods because the researcher creates a set of products (real or hypothetical) by combining attributes of interest and corresponding levels. The combinations are then presented to the respondent, who is asked to determine their overall preference of each. Since consumers make tradeoffs in real purchasing decisions, the task asked of them is quite realistic.

3 Research Questions

This article uses conjoint analysis to determine the relative importance of three factors (environmental certification, wood source, and price) on the specification preferences of architects with regard to hardwood flooring. Two research questions are addressed in this paper:

1) Which factor (e.g. environmental certification, wood source, or price) most influences architects' specification preferences with regard to hardwood flooring?
2) Will architects' specification preferences differ based on their environmental value orientation?

It is assumed that the hypothetical hardwood flooring product with a low price, local source, and environmental certification will have the highest utility. In addition, it is expected that those with a more biocentric environmental value orientation will place the highest importance on environmental certification and product source, while those with a more anthropocentric orientation will place greater importance on price.

4 Methods

4.1 Study Data

Data for this study were obtained from a mail survey sent to architects in Oregon and Washington. Architects were identified from an address list purchased from Database USA. The list provided 1824 usable addresses for the mail survey.

4.2 Questionnaire Pretesting

An initial draft of the questionnaire was pre-tested in order to identify ambiguous, unnecessary or troublesome questions. It was sent to three architects and two people in academia; responses were received from all of them. The suggested changes were made to the instrument before mailing.

4.3 Mail Survey Administration

The questionnaire was administered in the winter of 2007 using procedures adapted from the Tailored Design Method (Salant and Dillman 1994). Participants received the four-page questionnaire, a personalized cover letter explaining the study and requesting their participation, and a prepaid postage return envelope. If so desired, participants could complete the questionnaire online; the web address was included in the cover letter. A number was stamped on the upper corner of each questionnaire to ensure those who had already responded were not included in the second mailing. A second complete mailing (questionnaire, cover letter, and prepaid postage return envelope) was sent to nonrespondents approximately three weeks after the first mailing. The adjusted response rate was 26% (402 returned/[1824 sent – 292 nondeliverables]). This response rate is somewhat low compared to previous studies involving architects (Kozak and Cohen 1999, Damery and Fisette 2001, Wagner and Hansen 2004), but is higher than that reported by (O'Connor et al. 2004).

4.4 Nonresponse Bias

A common concern in survey research is nonresponse bias. It is important to determine whether those who did respond are different in some way from those who did not. The bias associated with nonresponse can be attributed to two factors. For one, those interested in the subject of the survey are more likely to respond than uninterested people. Second, people with more education tend to return questionnaires more quickly than those with less education. In order to evaluate nonresponse bias, those who responded to the first mailing are compared to those who responded to the second mailing (Armstrong and Overton 1977). For this research, early and late respondents were compared on a total of ten attributes. T-tests revealed no statistically significant ($p < 0.001$) differences between early and late respondents.

4.5 Concept Measurement

4.5.1 Hypothetical Flooring Products

For the conjoint analysis, hypothetical products (scenarios) were developed and used in the survey. The products represented combinations of three flooring factors and factor levels related to hardwood flooring. The factor levels were determined based on current hardwood flooring prices, possible types of environmental certification, and three source categories of interest. Three levels were used for each of the three flooring factors:

1) Price per square foot ($2.50, $5.00, $7.50).
2) Environmental certification (FSC ecolabel, other ecolabel, no ecolabel).
3) Wood source (Oregon/Washington, other United States, outside United States).

Since each of the three factors had three discrete levels, the total number of possible combinations was 3^3 or 27 in order to be a full factorial design (Table 1). To reduce respondent burden, a smaller group of scenarios was generated using an orthogonal fractional factorial design in SPSS Conjoint 10.0 software. As a result, the number of scenarios included in the survey was reduced to nine. The scenarios not included in the survey can be estimated additively from the constants and utility scores produced by conjoint analysis. This is extremely useful because the scenarios not included in the survey can be compared to those that were included, and the preference for all twenty-seven scenarios can be determined.

For the nine scenarios, respondents were asked to imagine they were specifying 1000 square feet of hardwood flooring for a custom home. They were then asked to rate each scenario from 1 "the one you most prefer" to 9 "the one you least prefer." To facilitate analysis, the responses were recoded to 1 "the one you least prefer" to 9 "the one you most prefer."

4.5.2 Environmental Value Orientation

Environmental value orientation was assessed using the New Environmental Paradigm (NEP) (Dunlap and Van Liere 1978). The NEP has been used extensively to better understand peoples' environmental value orientation.

Table 1. Hardwood flooring scenarios presented in the survey.

Scenario	Price per square foot	Environmental certification	Wood source
1	$2.50	Other ecolabel	Oregon/ Washington
2	$2.50	FSC ecolabel	Other U.S.
3	$2.50	No ecolabel	Outside U.S.
4	$5.00	Other ecolabel	Other U.S.
5	$5.00	No ecolabel	Oregon/ Washington
6	$5.00	FSC ecolabel	Outside U.S.
7	$7.50	Other ecolabel	Outside U.S.
8	$7.50	No ecolabel	Other U.S.
9	$7.50	FSC ecolabel	Oregon/ Washington

[a] Each factor (price per square foot, environmental certification, wood source) has three levels.

5 Data Analysis

5.1 Respondent Preferences for Hypothetical Products

In conjoint analysis, the factors (i.e. price per square foot, environmental certification, and wood source) are the independent variables and the preference ratings are the dependent variables. The conjoint output gives utility scores, or part-worth estimates, that recognize the preference for each factor level; percentages of averaged importance ascribed to each factor; and correlations between predicted and observed preference ratings (i.e., Pearson R and Kendall's tau goodness of model fit statistics). Conjoint analysis breaks down each respondent's ratings of a hardwood flooring scenario into utility scores for each of the flooring factors. The utility scores represent the importance of each factor level in the respondent's preference for a particular flooring scenario. To predict the preference for each flooring scenario, including those not present in the survey, the utility scores can be added together with the constant. For example, the total utility for a flooring scenario with \$2.50 per square foot, an FSC ecolabel, and sourced from other United States would be:

$$\begin{aligned}\text{Total Utility} &= \beta(\text{constant}) + \beta(\text{price per square foot}) \\ &+ \beta(\text{environmental certification}) \\ &+ \beta(\text{wood source})\end{aligned} \quad (1)$$

or $5.0032 + 0.9561 + 0.9637 + 0.1503 = 7.0733$. The total utilities can be calculated for all twenty-seven possible scenarios, and then ranked from most preferred to least preferred.

Conjoint analysis differs from ordinary least-squares regression in that it deletes cases with missing values and cases with the same rating across all scenarios. A respondent that answered 1 "the one you least prefer" for all nine scenarios, for example, would be excluded from the analysis because they would not be demonstrating a preference for the different factors and corresponding levels. Averaged importance percentages are standardized, and are calculated by dividing the range of utility scores for each factor by the total range in utility scores across all factors. A measure of the conjoint analysis goodness of fit is provided by Pearson R model fit statistics, which range from 0 (poor fit) to 1 (perfect fit).

5.2 Effect of Environmental Value Orientation

Following conjoint analysis performed on all respondents as a single group, respondents were separated into subgroups by K-means cluster analysis. Respondents' answers to the New Environmental Paradigm (NEP) items (Dunlap and Van Liere 1978) were used to determine their subgroup membership. Prior to running the cluster analysis, Cronbach alpha was used to test for reliability and internal consistency of the NEP items. The alpha values were .81 for the combined biocentric items and .75 for the anthropocentric items, which suggests that the items for each reliably measured their dimension. Deletion of any variable from its dimension (biocentric or anthropocentric) did not improve that dimension's reliability.

6 Results

6.1 Preferences for Hypothetical Products

Conjoint analysis was initially conducted for all respondents as a single group. The average importance for each factor is shown in Table 2. In ranking the flooring scenarios from least to most preferred, price (35.25%) and wood source (34.01%) were the most important factors. Environmental certification (30.74%) was the least important factor. Overall, price most influenced architects' specification preferences with regard to hardwood flooring (Research Question 1).

The average utility scores for each factor level are displayed in Table 2. These utility scores are averaged across all respondents and help explain average preference of the nine flooring scenarios. The sign (positive or negative) and magnitude of a utility score signify the relative value placed on each factor level. A positive factor level utility signifies scenarios containing that level were preferred (constant + factor level utility); a negative factor level utility indicates scenarios containing that level were undesired (constant – factor level

Table 2. Utility scores and averaged importance for nine hardwood flooring scenarios: respondents as one group.

Factors	Utility score	Averaged importance [a]
Price per square foot		35.25%
\$2.50	0.956	
\$5.00	0.353	
\$7.50	–1.309	
Environmental certification		30.74%
FSC ecolabel	0.964	
Other ecolabel	0.376	
No ecolabel	–1.339	
Wood source		34.01%
Oregon/Washington	1.218	
Other U.S.	0.150	
Outside U.S.	–1.369	
Constant	5.00	
Goodness of fit [b]		
Pearson's R	0.999	
Kendall's tau	1.000	

[a] Averaged relative importance of the factors totals 100%.
[b] Goodness-of-fit statistics valid at $p < 0.001$ (Pearson's R) and $p = 0.001$ (Kendall's tau).

utility). For example, if a respondent placed more value on a particular factor level, such as FSC certification, they would rank scenarios containing the FSC factor level higher than scenarios without it.

Of the three price factor levels, "$2.50 per square foot" had the highest average utility score; "$7.50 per square foot" had the lowest. In general, respondents favored scenarios that included the $2.50 factor level when compared to those with the $7.50 factor level. However, if a scenario with the $7.50 factor level contained additional factor levels considered highly important to the respondent, a tradeoff may occur. In other words, the respondent may be willing to accept the $7.50 factor level if bundled with two desirable factor levels, such as FSC certification and Oregon/Washington sourcing. Of the three environmental certification factor levels, "FSC ecolabel" had the highest average utility score, while "No ecolabel" had the lowest. The "Oregon/Washington" wood source factor level had the highest average utility score; "Outside U.S." had the lowest.

As discussed previously, utility factors can be used to determine the rank of each hardwood flooring combination. The total utility of the eighteen combinations not included in the survey can be determined by summing the factor level utility scores with the constant. In this way, all 27 combinations can be ranked in order of most preferred to least preferred (Table 3). Table 3 reveals that the three most preferred flooring combinations have "Oregon/Washington" as the wood source factor level. The top two combinations are both $2.50 per square foot, with an FSC or other ecolabel. It is not until the ninth combina-

Table 3. Total utilities and rankings for all combinations and scenarios of hardwood flooring from most (1) to least (27) preferred.

Price per square foot	Environmental certification	Wood source	Total utility	Rank
$2.50	FSC ecolabel	Oregon/Washington	8.1414	1
$2.50	Other ecolabel	Oregon/Washington	7.5533 [a)]	2
$5.00	FSC ecolabel	Oregon/Washington	7.5382	3
$2.50	FSC ecolabel	Other U.S.	7.0733 [a)]	4
$5.00	Other ecolabel	Oregon/Washington	6.9501	5
$2.50	Other ecolabel	Other U.S.	6.4852	6
$5.00	FSC ecolabel	Other U.S.	6.4701	7
$5.00	Other ecolabel	Other U.S.	5.8820 [a)]	8
$7.50	FSC ecolabel	Oregon/Washington	5.8763 [a)]	9
$2.50	No ecolabel	Oregon/Washington	5.8384	10
$2.50	FSC ecolabel	Outside U.S.	5.5543	11
$7.50	Other ecolabel	Oregon/Washington	5.2882	12
$5.00	No ecolabel	Oregon/Washington	5.2352 [a)]	13
$2.50	Other ecolabel	Outside U.S.	4.9662	14
$5.00	FSC ecolabel	Outside U.S.	4.9511 [a)]	15
$7.50	FSC ecolabel	Other U.S.	4.8082	16
$2.50	No ecolabel	Other U.S.	4.7703	17
$5.00	Other ecolabel	Outside U.S.	4.363	18
$7.50	Other ecolabel	Other U.S.	4.2201	19
$5.00	No ecolabel	Other U.S.	4.1671	20
$7.50	No ecolabel	Oregon/Washington	3.5733	21
$7.50	FSC ecolabel	Outside U.S.	3.2892	22
$2.50	No ecolabel	Outside U.S.	3.2513 [a)]	23
$7.50	Other ecolabel	Outside U.S.	2.7011 [a)]	24
$5.00	No ecolabel	Outside U.S.	2.6481	25
$7.50	No ecolabel	Other U.S.	2.5052 [a)]	26
$7.50	No ecolabel	Outside U.S.	0.9862	27

[a)] Scenarios presented in the survey.

Table 4. Utility scores and averaged importance for nine hardwood flooring scenarios by cluster group.

Factors	Utility score	Averaged importance [a]
Anthropocentric Group		
Price per square foot		38.10%
$2.50	1.096	
$5.00	0.312	
$7.50	–1.409	
Environmental certification		30.65%
FSC ecolabel	0.984	
Other ecolabel	0.405	
No ecolabel	–1.389	
Wood source		31.25%
Oregon/Washington	1.141	
Other U.S.	0.131	
Outside U.S.	–1.271	
Constant	5.06	
Goodness of fit [b]		
Pearson's R	1.000	
Kendall's tau	1.000	
Mixed Group		
Price per square foot		34.44%
$2.50	0.902	
$5.00	0.398	
$7.50	–1.300	
Environmental certification		32.35%
FSC ecolabel	1.048	
Other ecolabel	0.350	
No ecolabel	–1.397	
Wood source		33.21%
Oregon/Washington	1.056	
Other U.S.	0.176	
Outside U.S.	–1.232	
Constant	4.99	
Goodness of fit [b]		
Pearson's R	0.999	
Kendall's tau	1.000	
Biocentric Group		
Price per square foot		34.91%
$2.50	0.937	
$5.00	0.344	
$7.50	–1.282	
Environmental certification		29.95%
FSC ecolabel	0.923	
Other ecolabel	0.381	
No ecolabel	–1.304	
Wood source		35.13%
Oregon/Washington	1.357	
Other U.S.	0.113	
Outside U.S.	–1.470	
Constant	4.99	
Goodness of fit [b]		
Pearson's R	0.996	
Kendall's tau	1.000	

[a] Averaged relative importance of the factors totals 100%.
[b] Goodness-of-fit statistics valid at $p<0.001$ (Pearson's R) and $p=0.001$ (Kendall's tau).

tion that the price factor level "$7.50 per square foot" emerges. This scenario likely appeared in the top ten because its other two factor levels, "FSC ecolabel" and "Oregon/Washington," have large and positive utility scores.

6.2 Effect of Environmental Value Orientation

In order to determine if the environmental value orientation of respondents had an impact on their preferences for wood flooring cluster analysis was performed based on responses to the NEP scale. K-means cluster analysis revealed three groups: a more biocentric group, a mixed group, and a more anthropocentric group. These three groups are the most common configuration when cluster analysis is used with the NEP scale. The biocentric group had 185 respondents, the mixed group had 136, and the anthropocentric group had 75.

Once the respondents were broken into the three groups, conjoint analysis was performed on each group individually. The averaged importance of the three factors differed for each group (Table 4). The biocentric group considered wood source (35.13%) the most important factor, followed by price (34.91%). Environmental certification (29.95%) was considered the least important factor. The mixed group considered price (34.44%) the most important factor and environmental certification (32.35%) the least important. The anthropocentric group considered price (38.10%) the most important factor, and environmental certification (30.65%) the least important. All three groups considered environmental certification the least important factor when specifying hardwood flooring. Counter intuitively, the biocentric group considered environmental certification the least important factor when compared to the mixed and anthropocentric groups.

7 Discussion

This study demonstrates how three typical flooring attributes influence architects' specification preferences. It is important to note that although conjoint analysis attempts to recreate the actual purchasing (or in this case, specifying) process, people don't always do what they say. However, the findings show that architects consider price and wood source the two most important characteristics when specifying hardwood flooring (Research Question 1). Environmental certification was found to be the least important. This result was interesting given the focus on certification in the major green building programs. One potential reason for this may be the consequence of respondents' previous experience with limited availability of certified wood products. Previous research has shown that architects in Oregon often have difficulty sourcing certified material in the volumes required for large scale projects (Knowles et al. 2009). An additional explanation is that cost is the driving factor in the decision making process, and this focus on cost outweighs considerations for certified wood products.

The utility scores for "No ecolabel," "$7.50," and "Outside U.S." were all large and negative values. The presence of any one of these factor levels in a flooring scenario took away from its preference rating. This result shows that respondents strongly preferred wood flooring from the US over imported sources and wood from a certified source over wood with no environmental certification. However, a flooring scenario could still be preferred over others if the respondent deemed the two remaining factor levels as favorable.

When compared to respondents as a single group, specification preferences differed among respondents based on their environmental orientation (Research Question 2). The biocentric group consider wood source the most important factor, while both the mixed and anthropocentric groups consider price the most important. All three groups considered environmental certification the least important factor with regard to their specification preferences for hardwood flooring. This result indicates architects in the Pacific Northwest view local wood source as more important than environmental certification, which is consistent regardless of the environmental value orientation of the respondent. Consequently, there may be room for development of local hardwood flooring markets. Manufacturers and marketers of wood flooring should consider developing materials to show how their products meet the local requirements of green building programs, particularly those firms located in the Pacific Northwest. This can easily be implemented by providing the location of the manufacturing facility that is producing the material. More sophisticated versions can be created using currently available mapping software to allow the customer to track the distance from the job site to the manufacturing facility.

8 Limitations

As with any study, certain limitations exist. The main limitation for this study is geographical; only architects from Oregon and Washington were included in the survey mailing. This fact could have led to regional data, which might not represent the country as a whole. Further research needs to be done in order to better understand architects within the United States and those in other countries.

An additional limitation is that the results of conjoint analysis do not always accurately reflect real world purchase decisions. It is possible that respondents chose the more "socially acceptable" answers, rather than the answers that truly reflected their thoughts and opinions (Forsyth et al. 1999). As a result, further research needs to be done in order to understand the decisions architects would make when actually purchasing wood flooring products.

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