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A Method to Assess and Prioritize Customer Needs Among Substitute Materials

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ABSTRACT

Increasing the competitiveness of wood as a building material requires knowledge of quality improvements and/or product development needed to best satisfy customers. As such, information is needed regarding the impact on customer satisfaction of the fulfillment of different customer needs or requirements, especially relative to substitutes. This paper suggests the use of customer satisfaction modeling (CSM) for assessing end-consumer needs. The methodology is evaluated in the context of floorcoverings.

Results suggest that CSM is well suited for extracting information necessary for prioritizing customer needs: importance/impact and performance data for attributes as well as for customer benefits. The study indicates the necessity of considering substitute materials not only for performance comparisons but substitutes may also reveal otherwise latent customer needs. Practical and functional benefits exert the greatest impact on customer satisfaction, for wood flooring as well as its closest substitutes, laminate and textile flooring. Study results suggest that hygiene and a low cost over the product life cycle are the customer benefits to improve for wood flooring manufacturers, as their importance is high and performance relatively low.

Keywords: wood, building material, customer satisfaction, floorcovering

Introduction

Over the last several decades, wood has encountered increasing competition from alternative building materials (Wagner and Hansen 2004, Eastin et al. 2001, Anon. 2000, Burrows 1999). Today more than ever, the end-consumer, or the household, plays an essential role in the wood product supply chain, as the ultimate user and purchaser of the products and/or services. Moreover, the market for repair and remodeling (R&R) is growing in importance (Anon 2004, Eastin et al. 2001, Anon. 2000). In contrast to construction of new houses, where the influence of architects and structural engineers on material selection is dominant (Wagner and Hansen 2004, Anon. 1998), the household's assessments are generally more crucial in R&R, thus further highlighting the importance of the end-consumer.

A number of empirical studies have focused on the attitudes of architects and/or building contractors toward wood and substitute materials (Wagner and Hansen 2004; Eastin et al. 2001, 1999; Anon. 1998). The general attitude of end-consumers toward wood as a building material has also been investigated (Anon. 1998), as well as the visual impressions and attitudes toward wood (Broman 1996). Still, little is known about the causes of preference differences in preferences in specific building purposes/applications, material substitution from an end-user perspective. An exploratory study established important predictors of material preferences: *where* (in what usage context), *why* (salient evaluative criteria), and by *whom* (household characteristics) different floorcovering materials are used (Jonsson 2004). Beyond product positioning, a comprehensive picture of the competitive situation of wood is aided by information as to the impact on customer satisfaction of the fulfillment of different customer requirements or needs, as well as the performance of wood, relative to substitutes, in providing for these needs. This information (importance and performance) makes it possible to prioritize customer needs, thus providing valuable input to quality improvement methods. For example, quality function deployment (QFD), systematically translates customer requirements into measurable product and process parameters by moving downstream through successively lower levels of abstraction (cf. Akao 1992 for a comprehensive account of QFD).

This paper deals with material substitution in an end-consumer context. The study is situated within the research areas of consumer choice and satisfaction. None of these research directions deals explicitly with material substitution. However, elements of these avenues of research are relevant for the subject in question. The paper proposes a theoretical framework synthesized from constructs and concepts in these research arenas, suggests and demonstrates a methodology for gathering and analyzing data, evaluates the methodology, and discusses the managerial implications of the methodology.

Purpose and Implementation

Purpose

The purpose of this study is to suggest, and demonstrate, a method for assessing customer needs as to the importance and performance of various aspects of wood, relative to substitute materials.

Implementation

After exploring and analyzing concepts and constructs pertaining to the research areas of consumer choice and satisfaction, a theoretical frame of reference, synthesized from some of these constructs, is put forward. The theoretical framework provides the groundwork for operationalization, data collection, and analysis in this study.

The influence and involvement of the end-consumer generally increases as one moves from the construction toward the design sector (Anon. 1998). Floorcovering is a material application with a design profile, and the household typically makes the choice of floorcovering material. Thus, the methodology is evaluated in the context of floorcovering.

Theoretical Frame of the Study

Theoretical Background

Within-Category Choice

Most research concerned with consumer buying behavior deals with the problem solving activities of consumers. Research within this information processing framework, termed the "information processing perspective" by Holbrook and Hirschman (1982), has generally focused on within-category choice behavior: namely the choice between alternatives sharing the same features and/or brands in the same product category (Howard 1989, Myers and Shocker 1981).

Many consumer behavior researchers assume that consumers evaluate alternatives holistically, additively: comparisons are based on overall evaluations across attributes (Myers and Shocker 1981). Following this line of research, multi-attribute attitude models (attitudes as the sum of products of beliefs as to the degree alternatives possess certain attributes and evaluations of these beliefs) mirror the consumers' decision process. In this vein, Howard (1989) suggests that the importance attached to different evaluative attributes by consumers is the main source of individual differences in buying behavior.

Across-Category Choice

Other research within the "information processing perspective" explores what Kotler (1984) refers to as "generic competition", or across-category alternatives, which is the choice among alternatives from different product categories. In across-category consideration, several product categories are effective substitutes (Shocker et al. 2004). A number of studies have demonstrated that across-category choices differ from brand-level choices (Park and Smith 1989, Johnson 1988). Research results indicate that comparisons occur at more abstract levels the less (physically) comparable the alternatives (Corfman 1991; Johnson 1988, 1984). Thus, there is more than one way to create a given benefit (Ratneshwar and Shocker 1991), in the sense that the same benefit can result from different attributes. Hence alternatives from different product categories, though differing as to attributes, may offer the same benefits or consequences. To this end Graonic and Shocker (1993) demonstrate that across-category alternatives may be more similarly evaluated within a given context than the same product within two different contexts. Alternatives from different product categories, though differing as to attributes, may offer the same benefits or consequences.

Contextual Influence

Another area of consumer buying behavior research is devoted to the context, or the "situation in which a consumer might be involved or expect to be and which is presumed to impose constraints upon his or her decision" (Graonic and Shocker 1993). Contextual and situational conditions surrounding the buying decision have several dimensions: physical environment, social environment, time, buying and user roles, and state of mind (Belk 1975).

The context or situation has been shown to exert a powerful influence on a consumer's goals, and consequently the decision made (Ratneshwar et al. 2001, Warlop and Ratneshwar 1993). Studies by Belk (1975) and Ratneshwar et al. (1997) reveal that situational influences often dominate individual differences when it comes to product evaluations. The consumption context prescribes benefits that the

alternatives in question must meet (Graonic and Shocker 1993). Hence, the usage context (the situation in which a product will be used) is instrumental in defining the alternatives actively considered, as it acts as an environmental constraint defining consumers' ends or goals, thus limiting the nature of means (products) that can achieve those ends (Warlop and Ratneshwar 1993, Ratneshwar and Shocker 1991).

Means-End Theory and Customer Satisfaction

The means-end theory is based on work carried out by Tolman in the 1930s. The fundamental idea behind this theory is: "*The motivation to purchase a product is derived from the consumer's perception of it as a suitable means for generating pleasant feelings and for gratifying desires*" (Kroeber-Riel 1992, p. 142). Hence, the customer, within the framework of information processing, forms a conception of the suitability of the commodity in question (means) for fulfilling a specific want (end). In this context, a product or service is a concrete means to an abstract end (Peter and Olson 1990).

Cumulative customer satisfaction is a customer's overall evaluation of their purchase and consumption experience with a product or service to-date (Fornell 1992, Johnson and Fornell 1991). Other research focuses on more transaction specific satisfaction (Boulding et al. 1993). Customer satisfaction can thus be expressed as a function of current quality and past satisfaction (Anderson et al. 1994), or, as expressed by Bergman and Klefsjö (2003, p. 24): "*The quality of a product is its ability to satisfy, or preferably exceed, the needs and expectations of the customer*." Cumulative satisfaction models, in contrast to conjoint measurement or choice modeling, emphasize customers' perceptions of product performance, the resulting overall evaluations, and the behavioral intentions they create (Gustafsson and Johnson 2004). Cumulative satisfaction models rest on the use of latent variables. From the customer's perspective, the primary drivers of customer satisfaction are the abstract, latent variables – benefits – that a product or service provides (Gustafsson and Johnson 1997). These customer benefits are the customers' beliefs or perceptions regarding their consumption experience (Gustafsson and Johnson 2004). Cognitively, product benefits or consequences are derived from, or described by, one or more concrete product attributes (Olson and Reynolds 1983). By applying means-end or "laddering" (making links from product attributes to consequences or benefits and eventually to customer satisfaction) the attributes that best meet customer needs and drive customer choice can be determined (Gustafsson and Johnson 1997).

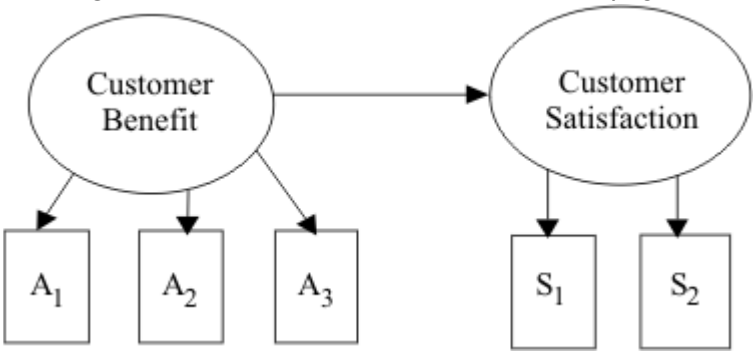
Theoretical Frame of Reference and Operationalization

Building application alternatives differs from alternatives in brand competition (within-category choice) in the respect that they do not necessarily share physical characteristics to the same extent. Consequently, these alternatives cannot be compared directly on concrete product attributes, but rather in terms of the benefits provided by the attributes, as suggested by research on generic competition. The comparison level has another dimension, related to the customer category investigated. Applications of quality improvement methods such as quality function deployment (QFD) are generally based on rather concrete product attributes (Herrmann et al. 1997). This level of customer input is generally justified for industrial customers, as in the QFD application by Wagner and Hansen (2004) targeting architects, but is less so in the case of end-consumers; the primary drivers of customer satisfaction in this instance tend to be the more abstract benefits that a product provides (Gustafsson

and Johnson 1997). Consequently, the translation of customer requirements into measurable product and process parameters should start with customer benefits. Firms focusing on root needs (i.e., benefits or consequences) can develop totally new markets (Johnson 1998). Hence, the chances of developing new product solutions that better meet customer demands should increase significantly. An example in this context would be the invention of the engineered, multi-layer wood floor, which, while maintaining the "real wood" appearance and tactile feeling, gives the floor increased stability.

The focus in this study is on cumulative customer satisfaction. Thus, when assessing customer needs in an end-consumer context the paradigm of the means-end theory should apply: the attributes of a product provide customers with certain benefits or consequences that in turn satisfy customer needs. Hence, the chosen approach for assessing customer needs should allow analysis on benefit and attribute level. The quality improvement method of customer satisfaction modeling (CSM), a cumulative satisfaction model, in linking inherently abstract or latent variables (LVs), such as customer benefits and satisfaction with concrete measures or manifest variables (MVs), meets this requirement. The aim of CSM is to provide information on how to increase customer satisfaction effectively. In CSM, meaning is ascribed to the LVs in two ways. First, LVs are assumed to be reflected in MVs (Gustafsson and Johnson 1997). In the present study, benefits, as LVs, are measured using customer ratings on attributes (A1, A2, and A3 in **Fig. 1**), and the LV satisfaction is measured using customer ratings of overall satisfaction and satisfaction relative to expectations (S1 and S2 in **Fig. 1**). Furthermore, meaning is ascribed to the LVs through the relation between benefits and satisfaction as stipulated by substantiated theory (Fornell and Cha 1994) (as a benefit improves, satisfaction should improve). CSM involves statistical estimation of the relationships in **Figure 1**. Thus, importance in CSM is estimated as the impact of a given set of variables on variables at the next level in the customer satisfaction model. The circumstance that importance measures are derived statistically allows for parsimony. Only performance data are collected, compared to acquiring importance and performance information separately. Hence, CSM was conducted to extract the information necessary for prioritizing benefits and attributes: importance and performance data.

Figure 1. Customer satisfaction model. (Figure adapted from Fornell and Cha 1994.)



To increase competitiveness, while maintaining areas of competitive strength (i.e., areas of high importance and high performance), areas of high importance and (relatively) low performance need to be improved. Performance benchmarking should be relative to competitors in the same market segment (Johnson and Gustafsson 1997). Considering substitutes can also reveal latent customer needs (Shocker et al. 2004, Wagner and Hansen 2004). Substitutes in this instance are material alternatives sharing a usage context. Consequently, the assessment of importance and performance as to customer needs must relate to a specific usage context.

The data necessary for assessing customer needs are suitably collected by means of structured interviews. The population in this instance consists of customers with experience of the floorcoverings in question.

Materials and Methods

Sampling and Respondents

The population for assessing customer needs consists of households with experience of the floorcoverings in question. Information was acquired by asking respondents if they had used the floorcovering materials in their homes. Only customers who answered yes to this question were interviewed. Each respondent was asked to evaluate one material only.

Interviews took place at retail floorcovering outlets in the Netherlands. Customers were approached when leaving the outlets (mangers did not want interviews to take place inside the premises). Cities covered included Almere, Amsterdam, and Wageningen, and the outlets were Doemere, Gamma, Hubo, Kwantum, Tapijtschuur, and Woonboulevard Arena. The questionnaires were translated to Dutch by a Ph.D. student at Wageningen University, who also conducted the interviews, using a paper-based questionnaire as an aid. The interviewer was instructed not to influence the respondents, only to explain the questions when asked. Each interview lasted from two (shortest) to five minutes (longest), with the average interview being approximately three minutes. The interviews were conducted between September 2004 and January 2005. A total of 100 customer interviews were conducted: 27 wood users (15 solid and 12 engineered wood users, respectively), 47 laminate users, and 26 carpet users.

Limitations

The positive outcomes of increased customer satisfaction are evident: increased profitability through increased customer loyalty and repurchase decisions. However, in this study only the assessment of the drivers of customer satisfaction is treated. The underlying implication is that increased customer satisfaction results in increased profitability. Hence increased customer satisfaction is considered a goal per se.

Customer satisfaction in the study is defined as the overall evaluation of a customer's consumption experience. The experience focused on is concerned with the actual usage of the floorcovering materials. The objective is to suggest and demonstrate a method for assessing the drivers of customer satisfaction, not to provide an all-embracing explanation of material preferences. Consequently, some variables possibly affecting material preferences, such as exposure to information and the location and design of the outlets, were not included in the analysis.

Due to the limited number of observations (two of three response groups have less than 30 cases, the minimum recommendation for Partial Least Squares (PLS) for CSM) caution is warranted in empirical generalizations. As such, results of this manner as presented in this paper are only tentative.

The attribute *Wood feeling* was inadvertently overlooked in translating the questionnaire for laminate users, and consequently was not included in the analysis. Unfortunately this introduces some

bias, since the variance structure of the Principal Components Analysis (PCA) would have been affected.

Despite these limitations, inferences on a more conceptual level, regarding the usefulness of CSM for assessing customer needs, are assumed valid.

Data

The data as to (i) *where* (the type of room(s) re-floored) and (ii) *why* (salient evaluative criteria or customer needs) different floorcovering materials are used emanates from the study of the Dutch floorcovering market presented in Jonsson (2004). In this instance customers were interviewed at seven retail floorcovering outlets in eight different cities/locations in the Netherlands. The sample size was 70 observations. Interview transcripts (57 pages in all) were translated into English. Evaluative criteria/benefits sought were obtained through open-ended interview questions concerning reasons for choosing the material(s) in question (planned refloorings and/or refloorings undertaken the last five years). Data regarding the general life situation were extracted from answers to fixed reply alternative questions on some household characteristics, thought to be of importance *a priori*: including self-reported household income (five income band alternatives) and whether there were any children in the household (yes or no alternatives). The individual experience thought to be of importance *a priori* was whether or not reflooring was undertaken by someone living in the household (question with fixed reply alternatives: yes or no alternatives). Data regarding usage context were obtained from open-ended questions as to type of room(s) considered and from a question with fixed reply alternatives: whether the dwelling in question was owned or rented (yes or no alternatives).

Wood today has been found to have a comparative advantage as a floorcovering material in Dutch living rooms (see Jonsson 2004). Other floorcoverings frequently used today in Dutch living rooms include laminated flooring, henceforth laminate, and textile flooring, henceforth carpet (**Table 1**). In this study, carpet and laminate are considered the main substitutes for wood.

Table 1. Where: Floorcovering materials used in Dutch living rooms.

Material	Percentage of living room use
Wood	42%
Laminate	30%
Carpet	11%
Ceramic tiles	8%
Linoleum	7%
Vinyl	2%

Table 2 displays what Jonsson (2004) has found to be salient evaluative criteria for wood, laminate, and carpet preferences. These criteria include benefits/consequences: Aesthetics; Hygiene; DIY (suitable for do-it-yourself), as well as attributes: *Good price* (not expensive); *Warmth*; *Softness*; *Sound absorbing*; *Natural material*; and *Wood feeling*.

Table 2. Why: salient evaluative criteria.

Laminate	Carpet	Wood
Aesthetics	Warmth	Aesthetics
Good price	Softness	Natural material
DIY	Aesthetics	Wood feeling
Hygiene	Sound absorbing	

CSM makes a distinction between observable and latent variables. Benefits, being LVs, need to be operationalized and assigned MVs to acquire meaning (Gustafsson and Johnson 1997). The approach suggested here is deductive. When salient evaluative criteria are benefits, observable measures (attributes) are proposed or implied. In contrast, when attributes are cited as evaluative criteria, the benefits that these attributes reflect need to be derived.

The interview transcripts from Jonsson (2004) suggest two aspects (MVs) of Hygiene: *Easy cleaning* and *Not getting dirty easily*. Hence, these MVs are assumed to reflect the benefit Hygiene. The benefit DIY is linked to perceived ease of installation, and it is assumed to be reflected in the attributes (MVs) *Pieces fit together easily* and *Clear installation instructions*. Aesthetic considerations voiced in connection with wood and laminate in Jonsson (2004) refer to the "wood properties", the MV suggested *a priori* in this instance is *Authentic wood appearance*. For carpet, the attribute reflecting Aesthetics is assumed to be *Nice color and pattern*. As for the attributes cited as evaluative criteria, *Good price* (initial cost: material cost (price) and installation cost) and *Durable* (an aspect of recurring costs) can be seen as providing a benefit suitably termed Low life cycle cost (henceforth LLCC). *Durable* was found to be a salient evaluative criterion for ceramic tiles preference only in Jonsson (2004), but is of such (potential) importance as to merit inclusion in the present analysis. *Sound absorbing* is hypothesized to reflect the benefit Nice atmosphere, whereas *Softness*, *Warmth*, and *Wood feeling*, all being tactile phenomena, are assumed to provide the benefit termed Nice underfoot. *Natural material* could reflect either of Nice underfoot, Nice atmosphere, or Aesthetics.

The reasons interviewees articulated for choosing a specific floorcovering material are typically those benefits and attributes salient for the floorcovering alternative in question (see Jonsson 2004). However, one should not automatically assume that other customer needs, cited as a reason for choosing substitutes, are of no importance for the satisfaction for those using wood. Rather, by considering these latent needs new market opportunities may develop. Hence, in acquiring importance and performance information for wood, customer needs cited for choosing substitutes only ought to be included, as long as they do not directly reflect the intrinsic nature of a particular material. Hence, the benefits Hygiene, DIY, and LLCC ought to be included when analyzing wood.

Respondents were asked to rate the performance of the floorcoverings on attributes (using a 1 to 7 Likert-type scale, from 1 = not at all to 7 = to a high degree), as well as assess their satisfaction with the floorcovering in question using ratings of overall satisfaction and satisfaction relative to expectations (again using a 1 to 7 Likert-type scale, from 1 = not at all to 7 = highly satisfied). Wood and laminate users were asked to state the degree to which their floorcovering was: warm under foot; providing

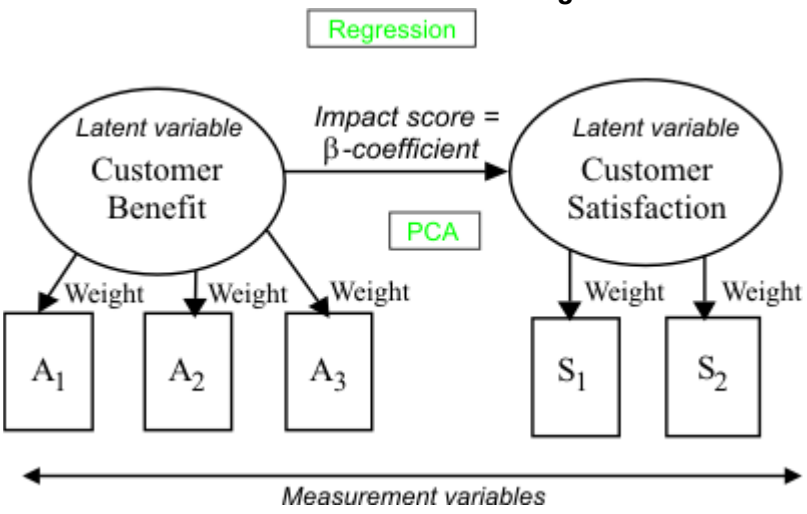
"wood feeling"; sound absorbing (pleasant acoustic-wise); a natural material; looking like "real wood" (had an authentic wood appearance); not expensive (had a favorable price); durable (hardwearing); easy to clean; not getting dirty easily. Laminate is, of course, not real wood flooring, but is nevertheless often mistaken for wood flooring, hence the attributes *Wood feeling* and *Natural material* were included in the questionnaire for laminate users. Respondents with experience of carpet were asked to state the degree to which their floorcovering was: soft under foot; warm under foot; sound-absorbing (pleasant acoustic-wise); nice in color and pattern; not expensive (had a favorable price); durable (hardwearing); easy to clean; not getting dirty easily. Those who had installed the floorcovering in question themselves were asked to rate it on the attributes *Pieces fitted together easily* and *Installation instructions were clear*. For respondents with experience of wood flooring, the questionnaire included a question as to the type of wood flooring used: solid or engineered wood.

Data Analysis

CSM links inherently abstract or latent variables (LVs), customer benefits and satisfaction, with concrete measures or manifest variables (MVs); customer ratings of the performance of products on attributes (A1, A2 and A3 in **Fig. 2**) and customer ratings of overall satisfaction and satisfaction relative to expectations (S1 and S2 in **Fig. 2**). There are two common methods for estimating this type of model: Partial Least Squares (PLS) and covariance structure models such as linear structural relationships (LISREL) (Fornell 1987). PLS is especially well suited to satisfaction modeling as PLS, being prediction-oriented, attempts to explain the ultimate dependent variable (Fornell and Cha 1994). Further, PLS copes with small samples, and does not impose distributional assumptions on the data (Wold 1982), an attractive feature as satisfaction data is typically skewed (Gustafsson and Johnson 2002).

PLS estimation renders possible the simultaneous evaluation of the measurement and structural portions of the model (Johnson and Gustafsson 1997). The approach used in this study when estimating the customer satisfaction model is a special case of PLS: Principal Components Regression (PCR). PCR combines Principal Components Analysis and Multiple Regression. An important advantage of PCR is that it does not require special software. Further, as this approach is more data driven, it is useful for evaluating assumptions regarding the relation of attributes and benefits.

Figure 2. CSM.



In CSM, performance information is provided for each level in the model. Performance information for the attributes, provided by survey ratings, is directly observable. Performance information for the LVs, satisfaction and benefits, are calculated as weighted indices of their respective MV ratings (Johnson and Gustafsson 1997). The MVs are factor-analyzed, by means of principal components analysis (PCA), to produce a set of independent factors or components (Gustafsson and Johnson 1997). The weight (the values given to a collection of MVs when calculating an LV index) are the loadings (the correlation of the individual MVs to the LV indices of which they are a part) after scaling to make the variance of LVs equal to one (Fornell and Cha 1994). Importance is estimated as the impact of a given set of variables on variables at the next level in the customer satisfaction model (Johnson and Gustafsson 1997). The benefit indices are regressed against the satisfaction index. The importance of a benefit is thus the ß-coefficient from the regression analysis, which has the desired interpretation as an impact score (Hayes 1992). When assessing the importance of attributes, one should consider both the attribute weights and the benefit impact scores by multiplying each attribute weight by the impact that its benefit has on satisfaction (Johnson and Gustafsson 1997).

The reliability of the measurement element of the model is satisfactory if the MV loadings are high or if the MVs used to measure a particular LV have relatively uniform weights. The theoretical or LV relationships are judged using two criteria: whether the estimated impact scores are significant and represent the predicted sign, and the amount of variation explained in the endogenous construct (Fornell and Cha 1994).

Results

The Relation of Attributes and Benefits

The initial PCA conducted on the data from respondents with experience of wood flooring (solid and engineered flooring, 27 observations in all) included the attributes *Warmth*, *Wood feeling*, *Sound absorbing*, *Natural material*, *Authentic wood appearance*, *Good price*, *Durable*, *Easy cleaning*, and *Not getting dirty easily*. *Pieces fit together easily* and *Clear installation instructions* had to be excluded in this instance, as there were only six respondents who had installed the wood flooring themselves. In the initial PCA (five components corresponding to the number of assumed benefits) each of the MVs associated with only one factor (had a single high loading) except *Authentic wood appearance* which did not load significantly on any of the components extracted. The two highest loadings for this variable were 0.52 and 0.57, respectively. A loading of at least 0.7 is required to account for at least 50% of the variables total variance. That *Authentic wood appearance* did not load significantly on any of the components extracted can be explained by the low variance of this variable. Due to this circumstance and the fact that *Authentic wood appearance* had the lowest commonality, it was deleted from the final PCA (Hair et al. 1998). The final PCA was consequently conducted with four components, corresponding to the number of assumed benefits, accounting for 84% of the variance. The number of observations for all variables included is 27. Eigenvalues are important to report since they provide information concerning how much variance each component represents in the data set (see Hair et al. 1998). Eigenvalues for the four extracted components were 3.0, 1.8, 1.5, and 0.9, respectively.

Judging by the pattern of component loadings in **Table 3**, *Easy cleaning* and *Not getting dirty easily* indeed seem to reflect the benefit Hygiene, as they both show high loadings on the first

component. MVs *Sound absorbing* and *Natural material* both exhibit high loadings on the second component, apparently reflecting the same benefit, Nice atmosphere. Attributes *Good price* and *Durable* having high loadings on the third component plausibly constitute good reflections of LLCC. *Warmth* and *Wood feeling* loaded together on the fourth component and appear to reflect the benefit of Nice underfoot in this instance.

Table 3. Principal components loadings: wood.

	Component			
	1	2	3	4
Warmth	0.388	−0.156	−0.090	**0.743**
Wood feeling	−0.371	0.204	−0.251	**0.767**
Sound absorbing	−0.199	**0.890**	−0.107	0.186
Natural material	−0.105	**0.907**	−0.029	−0.149
Good price	0.179	−0.045	**0.889**	−0.147
Durable	0.082	−0.080	**0.903**	−0.108
Easy cleaning	**0.923**	−0.082	0.103	−0.047
Not getting dirty easily	**0.841**	−0.240	0.197	0.090

The PCA conducted on the data from respondents with experience of laminated flooring (47 observations in all) included the attributes *Warmth*, *Sound absorbing*, *Natural material*, *Authentic wood appearance*, *Good price*, *Durable*, *Easy cleaning*, *Not getting dirty easily*, *Pieces fit together easily*, and *Clear installation instructions*. The number of observations for all variables included is 47, except for *Pieces fit together easily* and *Clear installation instructions*. The number of observations for the latter two variables is 35. The six extracted components (corresponding to the number of assumed benefits) account for 86% of the variance. Eigenvalues for the six extracted components were 2.7, 1.9, 1.5, 1.0, 0.9, and 0.7, respectively.

The pattern from the PCA as to wood flooring users is partly repeated in **Table 4**. Hence, *Easy cleaning* and *Not getting dirty easily*, exhibiting high loadings on the first component, again seem to reflect the benefit Hygiene well, and *Good price* and *Durable*, with high loadings on the fourth component, apparently constitute good reflections of LLCC. However, in the case of laminate users, *Natural material* is apparently associated with *Authentic wood appearance*, both attributes loading high on the third component, thus reflect the benefit Aesthetics. *Pieces fit together easily* and *Clear installation instructions*, both load high on the second component, reflect the benefit DIY. The benefits Nice atmosphere and Nice underfoot are reflected in *Sound absorbing* and *Warmth*, respectively.

Table 4. Principal components loadings: laminate.

	Component					
	1	2	3	4	5	6
Warmth	0.071	0.005	0.147	0.045	−0.022	**0.967**
Sound absorbing	−0.153	0.029	0.149	−0.035	**0.945**	−0.031

Natural material	0.261	−0.121	**0.795**	0.197	0.083	0.071
Authentic wood appearance	−0.205	−0.054	**0.842**	0.026	0.078	0.104
Good price	0.477	0.012	−0.095	**0.686**	−0.016	0.208
Durable	0.094	0.090	0.280	**0.863**	−0.038	−0.061
Easy cleaning	**0.898**	0.013	0.027	0.249	0.046	0.145
Not getting dirty easily	**0.888**	0.126	0.003	0.085	−0.290	−0.072
Pieces fit together easily	0.090	**0.887**	−0.013	0.104	−0.222	−0.083
Clear installation instructions	0.028	**0.828**	−0.180	−0.010	0.348	0.107

The PCA conducted on the data from respondents with experience of carpet included attributes *Warmth*, *Softness*, *Sound absorbing*, *Good price*, *Durable*, *Easy cleaning*, *Not getting dirty easily* and *Nice color and pattern*. *Pieces fit together easily* and *Clear installation instructions* were not included, due to the limited number of observations: only 13 out of 26 respondents with experience of carpet had installed the floorcovering themselves. The number of observations for all variables included is 26. The five extracted components (corresponding to the number of assumed benefits) account for 92% of the variance. Eigenvalues for the five extracted components were 3.0, 1.8, 1.1, 0.9, and 0.6, respectively.

Judging by the pattern of component loadings in **Table 5**, *Easy cleaning* and *Not getting dirty easily* reflect Hygiene well, and LLCC is well seen in *Good Price* and *Durable*. *Softness* and *Warmth*, having high loadings on the second component, plausibly constitute good reflections of Nice underfoot. The benefits Aesthetics and Nice atmosphere are reflected in one attribute each in this instance: *Nice color and pattern* and *Sound absorbing*. respectively.

Table 5. Principal components loadings: carpet.

	Component				
	1	2	3	4	5
Softness	0.017	**0.891**	0.099	0.007	0.248
Warmth	−0.327	**0.785**	0.045	0.336	0.180
Sound absorbing	−0.039	0.371	0.063	0.141	**0.902**
Nice color and pattern	−0.055	0.154	0.119	**0.963**	0.120
Good price	−0.260	0.099	**0.841**	0.250	0.249
Durable	0.485	0.066	**0.793**	−0.074	−0.174
Easy cleaning	**0.875**	−0.369	−0.128	0.145	−0.109
Not getting dirty easily	**0.921**	0.044	0.138	−0.218	0.032

Attribute and Benefit Importance

CSM was conducted to estimate the effect of benefits on satisfaction (regression coefficients for the benefit indices were extracted). Benefits, derived in the PCA presented in **Tables 3 through 5**, were operationalized as weighted linear aggregates of their respective attributes. The weights are the loadings after scaling to make the variance of the benefit indices equal to one. The LVs (the benefit and satisfaction indices) were scaled to unit variance and centered.

Table 6 presents estimates of benefit and attribute importance for wood flooring users (benefits in all capital letters): specifically, the table reports impact scores, significance levels, attribute weights, the product of impact scores, attribute weights (the overall importance of each attribute), and the absolute weight (attribute importance in relation to the other attributes). LLCC is apparently the most crucial benefit for customer satisfaction in this instance, followed by Hygiene and Nice underfoot; the latter two benefits being roughly equal in importance. Except for Nice atmosphere, the impact scores are significant on at least the 10% level (LLCC, Hygiene, and Nice underfoot are all significant explicators of customer satisfaction variance, whereas Nice underfoot is not). The most important attributes for wood users are *Good price* and *Durable*, followed by *Wood feeling* and *Warmth*. The model explains 51% of the variation in satisfaction for wood users.

Table 6. Benefit and attribute importance: wood.

Benefits and attributes	Impact score	Significance	Attribute weight	Impact × weight	Absolute weight
HYGIENE	**0.24**	**0.060**			
Easy cleaning			0.32	0.08	11%
Not getting dirty easily			0.29	0.07	10%
NICE ATMOSPHERE	**0.13**	**0.259**			
Sound absorbing			0.49	0.07	9%
Natural material			0.50	0.07	9%
LLCC	**0.43**	**0.002**			
Good price			0.29	0.12	17%
Durable			0.29	0.12	17%
NICE UNDERFOOT	**0.20**	**0.100**			
Warmth			0.47	0.09	13%
Wood feeling			0.49	0.10	14%

Table 7 reports benefit and attribute importance estimates for laminate users. Again, LLCC has the greatest impact on satisfaction. Hygiene is the second most important benefit, followed by DIY. Aesthetics, Nice atmosphere and Nice underfoot appear to have an insignificant impact on satisfaction for laminate users. The most influential attribute for this group is *Durable*, followed by *Good price*, *Easy cleaning*, and *Not getting dirty easily*. The model explains 59% of the variation in satisfaction for laminate users.

Table 7. Benefit and attribute importance: laminate.

Benefits and attributes	Impact score	Significance	Attribute weight	Impact × weight	Absolute weight
HYGIENE	**0.24**	**0.036**			
Easy cleaning			0.46	0.11	13%
Not getting dirty easily			0.45	0.11	13%
DIY	**0.17**	**0.100**			
Pieces fit together easily			0.53	0.09	10%
Clear installation instructions			0.50	0.08	10%

LLCC	**0.38**	**0.001**			
Good price			0.37	0.14	17%
Durable			0.47	0.18	21%
AESTHETICS	**0.07**	**0.511**			
Natural material			0.30	0.02	3%
Authentic wood appearance			0.32	0.02	3%
NICE ATMOSPHERE	**0.07**	**0.471**			
Sound absorbing			0.65	0.05	6%
NICE UNDERFOOT	**0.07**	**0.486**			
Warmth			0.65	0.05	5%

Benefit and attribute importance estimates for carpet users are presented in **Table 8**. Hygiene and Nice underfoot (roughly equal importance) are the benefits that most impact satisfaction in this instance, followed by LCC. Nice atmosphere and Aesthetics are less important benefits for carpet users. The model explains 66% of the variation in satisfaction for carpet users. The most important attribute is *Softness*, followed by *Not getting dirty easily*, *Easy cleaning*, and *Warmth*.

Table 8. Benefit and attribute importance: carpet.

Benefits and attributes	Impact score	Significance	Attribute weight	Impact × weight	Absolute weight
HYGIENE	**0.35**	**0.001**			
Easy cleaning			0.39	0.14	17%
Not getting dirty easily			0.41	0.15	18%
NICE UNDERFOOT	**0.32**	**0.008**			
Softness			0.49	0.16	19%
Warmth			0.43	0.14	17%
LLCC	**0.18**	**0.054**			
Good price			0.45	0.08	10%
Durable			0.42	0.08	9%
AESTHETICS	**0.03**	**0.750**			
Nice color and pattern			0.66	0.02	2%
NICE ATMOSPHERE	**0.12**	**0.256**			
Sound absorbing			0.65	0.08	9%

Performance

Priority setting for increased competitiveness should consider both the performance and importance/impact information based on the logic that one wants to improve those areas that are important to customers and on which product performance is poor (Gustafsson and Johnson 1997). **Table 9** displays performance levels for wood, laminate, and carpet in terms of satisfaction, the most important benefits, and their respective MVs. Performance values for benefits and satisfaction are calculated as weighted averages of their respective MVs (using loadings after scaling to make the variance of LVs equal to one as weights). For laminate, the benefit Nice underfoot, the performance value is calculated using one attribute only (*Warmth*).

Table 9. Performance levels for wood, laminate, and carpet on satisfaction and satisfaction drivers.

	Wood	Laminate	Carpet
LLCC	**5.2**	**5.7**	**4.9**
Good price	5.0	5.9	5.1
Durable	5.4	5.5	4.7
HYGIENE	**4.9**	**5.5**	**4.0**
Easy cleaning	5.0	6.0	4.3
Not getting dirty easily	4.9	5.0	3.7
NICE UNDERFOOT	**5.4**	**4.5**	**4.4**
Warmth	5.7	4.5	4.8
Wood feeling	5.2	–	-–
Softness	–	–	4.2
SATISFACTION	**6.3**	**5.9**	**5.2**
Overall	6.2	5.9	5.3
Relative expectations	6.3	5.8	5.1

Wood users on average, appear to be quite satisfied. Further, the tactile qualities of wood flooring (Nice underfoot) are highly rated, constituting a competitive strength. However, wood flooring fares less well when compared to laminate, on LLCC and Hygiene. As for LLCC, it is primarily the price of wood flooring that is perceived as less favorable. For Hygiene the attribute *Easy cleaning* is responsible for the low performance of wood compared to laminate.

It should be noted that discriminant analysis revealed some differences in evaluations between solid and engineered wood floor users. Hence, the mean values of the ratings are significantly higher (at the 5% level) for engineered wood on the attributes *Good price*, *Durable*, and *Not getting dirty easily*, as well as for satisfaction relative to expectations. Caution is warranted in interpreting these latter results, however, due to small sample size (15 solid and 12 engineered wood users, respectively).

Conclusions

Methodological

Comparisons occur at more abstract levels the less physically comparable the alternatives. This is imperative to acknowledge when it comes to material substitution, with alternatives differing as to physical or tangible characteristics. From the customer's perspective, the primary drivers of customer satisfaction are the benefits that a product or service provides. Hence, firms focusing on root needs (i.e., benefits or consequences) can develop totally new markets. All in all, assessing customer needs in material substitution with an end-consumer focus should allow analysis on the rather abstract level of customer benefits.

The results of this study suggest that CSM is well suited for extracting the information necessary for prioritizing customer needs: importance and performance data for attributes as well as customer benefits. The measurement part of the model is satisfactory; the MVs used to measure a particular LV

have relatively uniform weights. The theoretical or LV relationships are likewise acceptable, most of the estimated impact scores are significant and all are in the predicted directions. The amount of variance in satisfaction explained is also acceptable (e.g., Gustafsson and Johnson 2004, Johnson and Gustafsson 1997).

The circumstance that importance measures are derived statistically allows for parsimony as only performance data need to be collected, compared to acquiring importance and performance information separately, the normal procedure in QFD applications.

Empirical and Managerial Implications

CSM, with its external focus on customers, should constitute a useful complement to quality function deployment (QFD). Importance and performance data extracted by CSM make the prioritizing of customer benefits and attributes possible, providing valuable input to QFD. The translation of customer requirements into measurable product and process parameters should start with customer benefits. In doing so, the chances of developing innovative product solutions that better meet customer demands should increase significantly as opposed to starting with more concrete attributes.

Results indicate that practical functional benefits exert the greatest impact on customer satisfaction for wood flooring as well as its closest substitutes laminate and carpet. This is noteworthy as the salient evaluative criteria for choosing wood flooring extracted in Jonsson (2004) were mainly of a non-practical nature. This circumstance highlights the necessity of considering substitutes to identify latent needs, i.e., reasons for choosing wood not expressed in interviews with open-ended questions. Results also imply that factors determining customer satisfaction differ from criteria salient for the choice of building application material, an issue that merits additional research.

Customer benefits Low life cycle cost (LLCC) and Hygiene are apparently the most important factors to improve for wood flooring manufacturers, as importance is high and performance relatively low. As for LLCC, it has been shown that the life cycle cost of wood floorings in educational facilities is significantly higher than for other types of floorcovering, and recurring costs are much higher than the initial cost (Moussatche and Languell 2001). Though these results cannot necessarily be extended to residential use, they may suggest manufacturers of wood flooring should prioritize durability. For Hygiene, the attribute *Easy cleaning* is apparently an important focus in quality improvement.

It is surprising that that wood performed poorly on two important benefits, LLCC and Hygiene, yet scored high on satisfaction. This may be due to a number of reasons, one being missing relevant satisfaction drivers, (important drivers of customer satisfaction were not captured in Jonsson 2004). Another possible reason is that neither laminate nor carpet are perfect substitutes to wood flooring, and thus, customers making their final assessment overlook these shortcomings of wood flooring.

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