# Perceived Environmental Quality of Wood Products: The UK Market

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## ABSTRACT

Using wood products as a case study, this paper explores whether customer perceptions of environmental product attributes are structured as one or several dimensions, the importance of environmental quality, and how environmental quality relates to other product attributes from the customer perspective. Empirical data reflect perceptions of 40 UK-based companies trading in wood products and other building materials. The results show that in addition to sustainable forest management, the investigated companies find health impacts important to their customers. Environmental quality is considered as a two-dimensional and information-related matter. Do-it-yourself companies consider their customers more environmentally sensitive than other companies. Larger companies, and companies focusing on end-user markets, emphasize the importance of total product quality and environmental quality more than smaller companies and companies focusing on merchants and the processing industry. For the wood industry, the results emphasize the importance of endowing products with detailed environmental information, particularly if environmental quality is intended to differentiate the product in the marketplace.

*Keywords:* total product quality, health and social impacts, sustainable forest management, product information

## Introduction

### Background and Purpose

Environmental considerations and concerns have been of interest to society for decades, increasing among consumers particularly during the 1990s (Bhate and Lawler 1997). With regard to forestry, substantial attention was initially paid to the depletion of tropical rainforests, but concern has spread to forests in general and underlined sustainable forest management. With regard to the forest industry, issues such as recycling and waste management have been addressed, as well as pollution from industry processes (Handfield et al. 1997, Lambert 1996). In addition to consumer concerns, regulation by society has driven the forest industry toward emphasizing the environment in business development (Handfield et al. 1997).

This paper focuses on the wood industry and wood products. Wood products are physical goods. In the case of tangible products, even though the features of physical goods usually fulfill the basic needs of customers, these features and the related services together form the total product offered to

customers, which fulfill the needs and wants of customers (Kotler and Keller 2005). Therefore, total product quality is judged with reference to all dimensions of the total product.

Environmental attributes of a product contribute to its environmental quality and can be considered contributors to total product quality (Anderson et al. 2002, Toivonen and Hansen 2003, Vlosky et al. 1999). Previous research has not yet provided a clear understanding of the specific attributes which contribute to environmental quality of wood products from the customer's viewpoint or which other product attributes are related to environmental quality.

Product quality may be defined from several viewpoints. It can be seen as an objective quality, based on standardized measurements, or as a perceived quality, based, for example, on customers' subjective judgment. If the goal is to improve market success, quality should be assessed specifically from the customer perspective because the customer's judgment of quality is critical in buying decisions (Kotler and Keller 2005, Shetty 1987, Zairi 2002). This approach was adopted for this study.

Benefitting from high environmental quality requires that wood product producers can identify the customer segments that emphasize environmental quality in their wood product buying decisions. Additionally, both wood product manufacturers and the intermediary marketing channel members trading in wood products need to be aware of how the end-users of wood products perceive environmental quality and how to efficiently communicate this quality to their customers.

Environmental awareness has been assumed to be strong in Europe. The United Kingdom (UK), in particular, may be considered one of the most environmentally sensitive countries. The UK is a major net importer of wood products, and therefore, provides an interesting market for studying the importance of environmental quality of wood products from the customer perspective. Intermediary marketing channel members, i.e., wholesale/retail companies trading in wood products, constitute important direct markets for wood industry companies exporting their products to the UK. These intermediary marketing channel members are the focus of this study, and their perceptions of the environmental quality of wood products are investigated.[1]

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(1) In a marketing channel, both retailers and wholesalers, but particularly retailers, are closer to the consumers of wood products than the producer. Thus, it can be assumed that they have a broad understanding of the context and situations where products are used and of consumer perceptions (e.g., Lautamäki 2000). This can be reflected in how the companies emphasize product attributes when selecting products for their product range. Nevertheless, in this paper it is not assumed that retailers have identical perceptions to their consumers of the importance of various attributes contributing to product quality, nor that retail companies have comprehensive knowledge of the needs of their customers.

The purpose of this study was to explore in the case of wood products which product attributes contribute to perceived environmental quality and how important environmental quality is from the

customer perspective. Exploring how environmental attributes are related to other product attributes is also of interest. The empirical analysis focuses on wholesale/retail companies trading wood and other building materials in the UK markets (hereafter referred as UK companies trading in wood products or UK wholesale/retail companies or simply UK companies). The analysis addresses the following specific questions:

1. *Which product attributes contribute to the environmental quality of products from the perspective of the customers of UK wholesale/retail companies, as assessed by the companies themselves? Are the perceptions of these attributes structured as one or several broader dimensions of environmental quality? This question is investigated in the section on Perceived Environmental Quality.*

2. *What media do UK wholesale/retail companies trading in wood products find most effective in communicating environmental quality of products to their customers? This question is investigated in the section on Perceived Environmental Quality.*

3. *How important is environmental quality and how is it related to other attributes contributing to total product quality in the case of wood products from the perspective of UK wholesale/retail companies? These questions are investigated in the section on Product Quality and Environmental Quality.*

4. *Do UK wholesale/retail companies trading in wood products differ with regard to how they emphasize total product quality and environmental quality of wood products? Is there a connection with the expected demands of their customers regarding environmental quality, and how do UK companies themselves emphasize environmental quality or the total product quality in their buying decisions? These questions are investigated in the section on Product Quality and Environmental Quality.*

## Literature Review

### *Product concept*

A product is anything that can be offered to a market to satisfy a customer's want or need (Kotler and Keller 2005). Traditionally, a product has been visualized as a molecular offering, which includes the core (or generic) product. It is augmented by tangible and intangible attributes and is described as developing through various stages toward a potential product, which includes even the potential and latent wants of customers (Kotler and Keller 2005; Levitt 1980, 1981). The customer will judge the product based not only on the tangible good and its quality, but also on services and service quality and the relationship between quality and price. This paper, however, excludes the latter and concentrates on quality. Price is seen as an indicator or a result of total product quality rather than a part of quality.

Saren and Tzokas (1998) argue that the total product is an outcome of a signification process between the producer, the buyer, and the physical or immaterial product. The product attributes providing benefits to the buyer are thus related to the object or good and also to the producer/supplier (i.e., the meaning the buyer associates with the product and producer/supplier). Therefore, supplier attributes, such as credibility, service capability, and image, become a part of the total product from the customer perspective (Bou-Lljusar et al. 2001). These are particularly relevant to industrial and mature

markets such as wood product markets. In summary, from the customer perspective the total product can be understood as including the tangible and intangible attributes of the physical good, services, and information related to the product and producers, and other producer related attributes. Environmental product attributes may emphasize the product's significance in reflecting personal ethical values important to consumers, such as choosing an ecological way of life. Environmental product attributes are increasingly relevant for wood products and other building materials and deserve, therefore, to be included in the attributes contributing to perceived total product.

### *Product quality*

Total quality management (TQM) is an approach to continuously improve the quality of all aspects of an organization's processes, products, and services. The definition and measurement of quality, however, is complicated and no universally accepted definition exists (Sebastianelli and Tamimi 2002). Nevertheless, product quality is related to the product concept. For example, Sebastianelli and Tamimi (2002) suggest that understanding quality in terms of product dimensions may enhance the development of successful TQM programs in firms.

There are several approaches to determining quality that do not necessarily depend on how the product is defined. These approaches can be divided into at least five categories (e.g., Kozak and Maness 2001, Sebastianelli and Tamimi 2002): transcendent, product-based, user-based (or customer-based), manufacturing-based, and value-based. These multiple approaches have been developed in different contexts and for different purposes. In this study, the approach to quality is the customer's subjective perception and understanding of perceived total product quality as being multi-dimensional (e.g., Bou-Llusar et al. 2001; Brucks et al. 2000; Garvin 1984, 1987; Madu et al. 1996; Curkovic et al. 2000). According to the approach originally outlined by Garvin (1984, 1987), product quality comprises eight dimensions:

1. durability,

2. product performance,

3. aesthetics,

4. features,

5. serviceability (repair service),

6. conformance,

7. reliability, and

8. perceived quality.

Not all of the dimensions are necessarily important for all products or in all contexts (Waller and Ahire 1996); but, when each are related to customer perception, these involve some level of subjectivity (Sebastianelli and Tamimi 2002). This is why the customer-based quality definition is most applicable when employing TQM within a company.

The quality dimensions determined by Garvin have been considered the most comprehensive definition of product quality (Waller and Ahire 1996) and have served as the basis for an abundance of subsequent research. Empirical research has confirmed the multi-dimensionality of perceived total product quality to some degree (e.g., Curkovic et al. 2000, Sebastianelli and Tamimi 2002, Stone-Romero et al. 1997), including the case of wood products (e.g., Hansen and Bush 1996, 1999; Kozak and Maness 2001; Pakarinen 1999; Sinclair et al. 1993; Toivonen and Hansen 2003; Toivonen et al. 2005). The quality dimensions and critical attributes of wood products resulting from empirical research include dimensions, such as supplier characteristics and behavior, services, delivery, supplier willingness to tailoring or customizing products, product performance/characteristics, packaging, appearance, and safety (e.g., Anderson et al. 2002; Hansen and Bush 1996, 1999; Pakarinen 1999; Toivonen and Hansen 2003). These are generally apparent in research on other industrial markets as well (e.g., Bou-Llusar et al. 2001, Hultink et al. 1999, Sebastianelli and Tamimi 2002). Based on earlier research, it can generally be concluded that perceived total product quality consists of tangible and intangible dimensions, which consist of more specific dimensions and attributes.

### Environmental quality

In the case of wood products, several studies have investigated environmental quality from the customer perspective. Anderson et al. (2002) determined a five-dimensional model for studying perceived quality of wood products (window frames), where they determined one dimension was environmental quality. But, they did not test whether environmental attributes formed one separable dimension of total product quality. Nevertheless, empirical results suggest that environmental quality was less important than some other dimensions of total product quality in the UK market (performance and characteristics).

Pakarinen (1999) analyzed consumers' perceptions of wood furniture in Finland. He observed an environmental dimension without a clear correlation with other product attributes. Pakarinen and Asikainen (2001) later performed the analysis separately for solid wood furniture and upholstered furniture and observed linkages between environmental attributes and other product quality attributes (solid wood furniture: employment, domestic; upholstered: finishing). Research from German wood product markets indicated that environmental attributes were related to product information instead of being a separable quality dimension (Toivonen and Hansen 2003, Toivonen et al. 2005).

Environmental quality has also been discussed in other studies focusing on wood materials or wood products (e.g., Bigsby and Ozanne 2002, Wagner and Hansen 2004a, Vlosky et al. 1999). But studies have not provided a uniform picture of the existence of a particular environmental quality dimension in the case of wood products or how environmental quality is related to other product attributes. It remains unclear whether environmental quality is a uni- or multi-dimensional construct. Samdahl and Robertson (1989), for example, argued that environmental concern itself is multi-dimensional. This indicates that the perceived environmental quality is a multi-dimensional concept.

### Operationalizing environmental quality

Traditionally, the environmental attributes of wood products may have been understood as referring to ecological aspects of forestry providing the wood raw material for the wood industry and to the ecological impacts from industry operations. Attributes such as the sustainability of forest

management, the origin and type of round wood, harvesting practices, emissions from the manufacturing processes, waste management, and recycling have been addressed. In particular, the concept of sustainability has attracted increasing attention since the 1980s. Accordingly, the issue of certification of sustainable forest management or environmental certification of forest products has been addressed in a number of studies during the 1990s and 2000s (e.g., Bigsby and Ozanne 2002; Forsyth et al. 1999; Hansen 1997; Hansmann et al. 2004; Humphries et al. 2001; Hubbard and Bowe 2005; Kozak et al. 2004; Kärnä et al. 2003; Ozanne and Smith 1998; Ozanne and Vlosky 1997, 2003; Ruddell and Stevens 1997; Stevens et al. 1998; Vlosky and Ozanne 1997, 1998; Vlosky et al. 1999).

The product attributes contributing to environmental quality of wood products may also be approached through aspects pointed out in advertising. Wagner and Hansen (2002) analyzed environmental advertising for forest products in the United States between 1995 and 2000 (see also Kärnä et al. 2001). They revealed that major issues addressed in advertisements often included the raw material (wood), manufacturing processes, and consumption/disposal (recycling) issues. The authors concluded that the ultimate driving forces behind the advertisements were commonly planet preservation, i.e., ecological concerns, and sometimes animal and personal health.

Health issues or impacts on personal well-being are becoming increasingly important for consumers and are being included in the marketing of wood products (e.g., Lambert 1996). Concerns such as outdoor and indoor air quality, which are related for example to surface treatments of wood, are relevant from both health and environmental perspectives. These concerns have become issues in the wood and building industry (Grönroos and Bowyer 1999, Handfield et al. 1997). Safety in general or "safety to health" has been used in operationalizing the perceived quality of wood products in some studies (Järvinen et al. 2001, Pakarinen 1999).

Another potential avenue to broaden the concept of environmental quality and its operationalization in the case of wood products has arisen due to growing interest in social issues (Lambert 1996). For example, O'Brien and Teisl (2004) included workers' rights in the set of attributes describing environmental labelling related to forest industry products and noticed this was important to consumers. Overall, empirical research does not yet provide a precise set of attributes to operationalize the environmental quality of wood products or understanding of the relationship between these and other product attributes contributing to the total product quality from a customer perspective. The literature, however, indicates that environmental quality can be understood to incorporate ecological, health, and social attributes.

### *Segmenting markets based on perceived environmental quality*

One product rarely satisfies all customers in a market, as customers vary in their needs and wants. Therefore, marketers seek to identify distinct groups of customers, i.e., market segments, whose preferences are close to or equal within the segment but distinct from those of other segments. This information helps in developing and providing products and services that satisfy the needs of certain types of customer better than an "average" product. Being able to recognize different segments is important in becoming and remaining competitive in a marketplace.

Rao and Wang (1995) divide market segmentation techniques into two main categories:

1. traditional segmentation, where the buyer categories are defined *a priori*, and

2. clustering-based segmentation, where segments are identified *a posterior*, by cluster analysis (benefit segmentation). They argue that industrial marketers should employ a combination of traditional and clustering approaches in segmenting markets. This is particularly relevant when the goal is to segment markets based on environmental, ethical or visual product attributes. The benefits these attributes provide are at least partly subjective, and their importance to buyers may be difficult to judge from buyer background characteristics.

Even though environmental awareness has increased in society in general, certain consumer segments are particularly concerned about the environment (Bhate and Lawler 1997, Samdahl and Robertson 1989). This also applies to the consumer and intermediary markets for forest products (Anderson and Hansen 2004b, Bigsby and Ozanne 2002, Grönroos and Bowyer 1999, Ozanne and Smith 1998, Pakarinen and Asikainen 2001). Not only consumers but also intermediary customers trading in wood products can be assumed to differ with regard to their concern over environmental quality. Firstly, the environmentally oriented organizational customers may seek to fulfil the needs and preferences of their targeted customers. Secondly, organizational customers may also pursue values that are reflected in the emphasis on environmental quality in buying decisions (Bhate and Lawler 1997, Humphries et al. 2001). These companies may even choose to trade in environmentally high-quality products and possibly pay a price premium, even if no respective premium is available on end-user markets (Humphries et al. 2001). Thirdly, companies may also choose to emphasize environmental quality due to pressure from environmental groups (Anderson and Hansen 2004a).

The most common assumption seems to be that consumers are interested in environmentally high-quality products merely or mainly because of their concern about the environment in ecological or societal terms. Consumer motives and behavior related to the environment and product choices, however, may not yet be fully understood (e.g., Anderson and Hansen 2004a, 2004b). For example, consumers may buy "green" products in order to improve their personal lives in terms of health and well-being instead of primarily wanting to preserve nature (Lambert 1996).

### *Incorporating environmental quality in marketing planning*

The environmental quality of products provides a basis for customer segmentation and may create marketing opportunities, even a competitive advantage to producers performing strongly on the issue (Bigsby and Ozanne 2002, Porter and van der Linde 1995, Zairi 2002). Kotler and Keller (2005, p. 21) call for "societal marketing" to incorporate societal and ethical considerations in marketing planning and practices, including environmental considerations. Pursuing societal marketing may finally be manifested in the purchasing decisions of socially and environmentally oriented consumer segments. Empirical research has identified a positive association between consumers' ecological concern and their intentions of buying environmentally labelled products (e.g., Hansmann et al. 2004, Ozanne and Smith 1998). Environmental motivations should also be reflected in the willingness to pay for environmental quality, at least among the most interested consumer segments (e.g., Vlosky et al. 1999).

In the case of the forest industry, Handfield et al. (1997) describe the evolution in business strategies incorporating environmental issues as a change from resistant adaptation to proactive assessment of market/customer needs. Proactive companies consider environmental quality of their

products to be a part of total quality management and aim at meeting customer needs with regard to environmental quality. Despite the potential for competitive advantage and economic benefits that environmental quality is argued to provide, scepticism also exists (Irland 1993). A true proactive strategy was uncommon in the U.S. forest industry in the mid-1990s (Handfield et al. 1997). In Europe, the situation seemed to be the same, and the forest industry may have seen environmental concerns and responsibilities, or social corporate responsibility, more as a necessity than as a source of competitive advantage. Yet, it is acknowledged that these provide potential for competitive advantage (Kärnä 2003).

The reason for the cautiousness of the forest industry may be the fact that the environment is usually not the most critical matter from the perspective of wood product buyers or designers (Anderson et al. 2005b; Anderson and Hansen 2004b; Anderson et al. 2002; Pakarinen and Asikainen 2001; Wagner and Hansen 2004a, 2004b). For most industrial buyers, product attributes, such as the performance of the tangible physical product and supplier reliability, are more important (Anderson et al. 2002, Lambert 1996, Järvinen et al. 2001).

An additional source of scepticism may be that research paints a rather confusing picture of the potential size of markets and of the kind of price premium achievable for environmentally highly qualified products. It seems that developing substantial markets for environmentally certified forest products is not easy (Kärnä 2003), especially if these are to be based on a clear price premium (e.g., Anderson et al. 2005b, Humphries et al. 2002). In contrast, a number of research reports indicate that in the United States there would be a fairly substantial willingness to pay a premium for environmentally certified forest products, but the observed share of interested consumers has also varied considerably among these studies (e.g., Ozanne and Smith 1998; Ozanne and Vlosky 1997, 2003). Research, however, has not been able to verify the true willingness to pay for environmental quality of wood products in real buying situations with the exception of a few studies. These examples do not indicate a high actual willingness to pay a premium for certified wood products (e.g., Anderson and Hansen 2004a, 2004b; Anderson et al. 2005b). The link between environmental concern and willingness to pay for environmental quality may not be straightforward (Anderson et al. 2005b). One reason may be too narrow information about the environmental product attributes, or simply the inverse relation between price and willingness-to-buy (Anderson et al. 2005a), or that quality of the environment is perceived as being a public good (Uusitalo 1990).

Nevertheless, providing environmentally highly qualified products may provide other benefits for the wood industry besides price premiums. Gaining market shares among environmentally concerned consumers may be the most important long-term advantage of an environmental orientation (Handfield et al. 1997). Some efficiency gains may also arise through high environmental performance. For example, materials may be used more effectively and even increased innovativeness may be forced by society regulations (Porter and van der Linde 1995).

### *Communicating environmental quality in the marketplace*

If environmental quality is a cornerstone of marketing planning, and if the goal is to contribute to improved company performance, then customers need to be made aware of the environmental performance of products. But, environmental quality cannot be easily observed from the physical product (Ehrich and Irwin 2005, Vlosky et al. 1999). Therefore, availability and credibility of

information are key issues if environmental quality is to create a competitive advantage (Hansmann et al. 2004, O'Brien and Teisl 2004). Sufficient availability of information may activate the buying decisions of at least the most environmentally concerned consumers. Hansmann et al. (2004) showed that an increased availability of information about environmental attributes increased the willingness of consumers to buy the products. Availability of information may also be connected to the degree of willingness among consumers to pay for high environmental product quality (O'Brien and Teisl 2004, Teisl 2003). In other words, information is a necessary tool in realizing the profits from investments in environmental quality (Ehrich and Irwin 2005, Kozak et al. 2004, Lambert 1996, Wagner and Hansen 2004a).

Eco-labels are commonly argued as being a simple and efficient way of manifesting the environmental quality of products. Hansmann et al. (2004), however, emphasize that a precondition for a reasonable preference for environmentally labelled wood products is that consumers know about the label's criteria. Many consumers are probably not truly familiar with the criteria upon which various eco-labels are based (Kozak et al. 2004, Teisl 2003). Therefore, simple labels may not be effective or sufficient in informing consumers about environmental quality of wood products. Thus, the communication of the label's standards and contents in detail is necessary for its effectiveness in the marketplace. The availability of information also reduces the potential bias that may result if consumers know one label better than another. The more detailed the available information, the more credible the environmental quality it manifests from the customer perspective. Therefore, information availability and objectivity play a role in how consumers rank the environmental quality of a product (O'Brien and Teisl 2004, Teisl 2003) or how they use this as a buying criterion. Availability of detailed environmental information is also important for organizational customers, since they need to be able to deliver the information to their clients.

## *A priori* Propositions Based on the Literature

The theoretical framework guiding the empirical part of this study is presented in **Figure 1**. The product as seen from the customer perspective is understood to include the physical good, producer/supplier attributes relevant to the customer, supplier behavior, information, and services including delivery service (e.g., Toivonen and Hansen 2003). Environmental attributes also contribute to the total product perceived by customers. These product attributes can be understood as forming dimensions of the total product. The view of a product is somewhere between utilitarian and symbolic (e.g., Lautamäki 2000), but closer to utilitarian, because the organizational markets and wood products analyzed are relatively concrete products with a clear utilitarian "nature".

**Figure 1.** The framework guiding the conduct of the empirical part of the study.
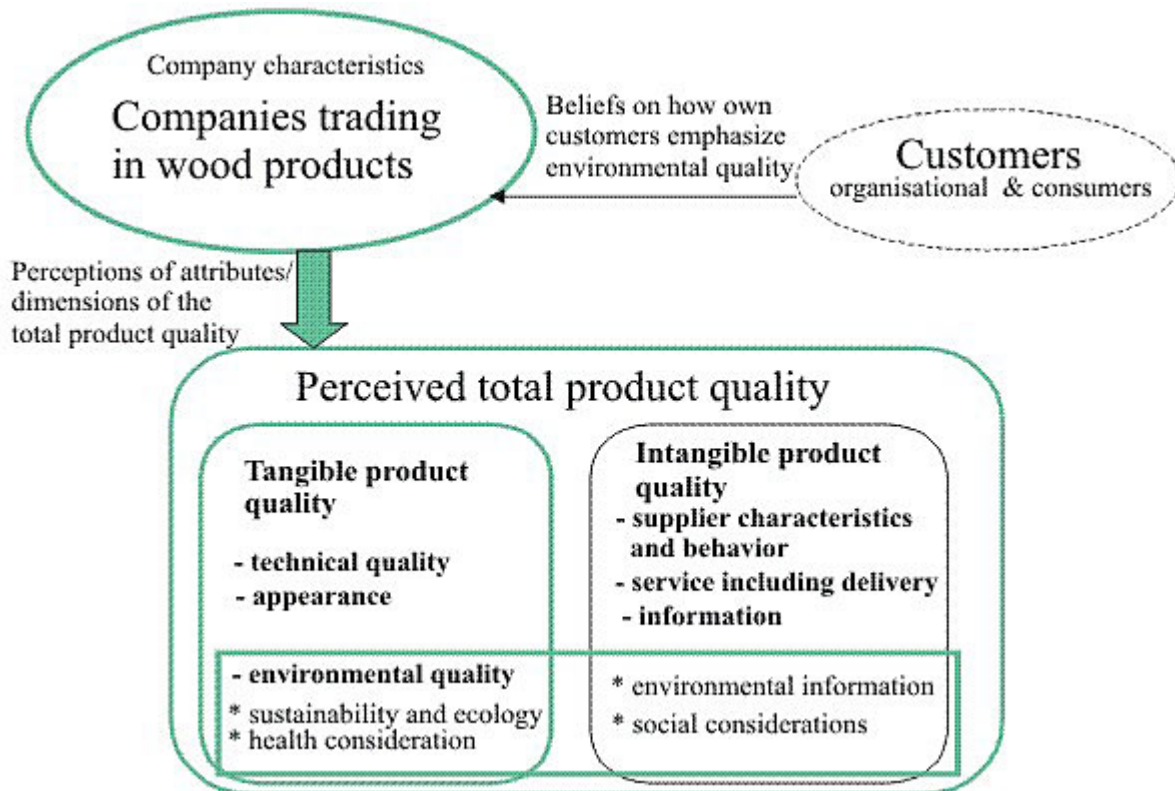


In this study, perceived total product quality is viewed as multi-dimensional and as being the customer judgment of quality of all relevant product dimensions. The approach to perceived total product quality has its roots in the early work of Garvin (1984, 1987) and was later applied to wood products (e.g., Hansen and Bush 1996, 1999; Sinclair et al. 1993). It was then augmented with environmental attributes and information (e.g., Anderson et al. 2002, Järvinen et al. 2001, Toivonen and Hansen 2003). The definition of perceived total product quality of this study is thus a broader concept than the "perceived product quality" determined by Garvin (1987), who viewed it as "reputation and intangibles." Environmental quality is considered to be a broad concept comprising product attributes related to social and health concerns, sustainable forest management, and ecological issues, such as emissions from manufacturing processes and recycling. From the customer perspective, the environmental quality of products is related and manifested in environmental product information. Therefore, the perceived environmental quality may comprise both tangible and intangible attributes. Even though this study is exploratory by nature, a few *a priori* propositions were drawn from the existing literature (**Fig. 1**). The propositions, however, were not such that they could be tested statistically with a precise hypothesis and counter-hypothesis. The propositions were:

1. *Total product quality, as perceived by UK wholesale/retail companies trading in wood products, is a multi-dimensional concept. Each dimension may consist of perceptions of more specific product attributes.*

2. *Environmental quality is one dimension of perceived total product quality. It consists of more specific attributes which may be tangible and intangible. Environmental product quality may be a multi-dimensional construct itself, as perceived by UK wholesale/retail companies trading in wood products.*

3. *Different segments exist among UK wholesale/retail companies trading in wood products with regard to their emphasis on total product quality and environmental quality:*

   a. *Companies differ in how they consider their customers emphasize environmental quality of products.*

   b. *Companies differ in how they emphasize total product quality and environmental quality as a dimension of it in their wood product buying decisions.*

   c. *The two above segmentations overlap (i.e., emphasis on total product quality among companies is linked to how the companies expect their customers emphasize environmental quality).*

Companies trading in wood products differ from each other based on their emphasis on environmental quality. The differences among segments are assumed to originate from the background of these companies, such as the type of business and how the companies consider their customers emphasize environmental quality.

## Materials and Methods

### The Data

The targeted population of the study consisted of all building material traders and Do-it-yourself (DIY) companies in the UK (Britain). These companies are intermediary marketing channel members buying wood products from foreign producer companies and selling to British industrial customers and consumers. Comprehensive statistics on the number of these companies or the value of the market were not available. The target companies for this study were selected from two sources: the contact list of Finpro, which is a Finnish sales promotion organization and the member list of BMF (Builders Merchant Federation in the UK). Finpro's list included 55 companies and BMF included 325 companies. Those companies trading wood products were selected as the final population, which resulted in 195 companies.

Empirical data was collected through personal interviews and via a structured questionnaire during 2004. The target companies were approached by sending a letter explaining the objective of the study and asking for an interview with the person in charge of product purchasing. After sending the letter, the companies were contacted by telephone or e-mail. Forty companies agreed to be interviewed (21%). In almost all cases, refusals were based on full schedules. Test interviews were carried out in 2003 with 12 companies located in Wales and the eastern part of England. The test interviews resulted in some minor modifications to the questionnaire and are not included in the data of this paper.

### Operationalization

The product attributes were operationalized to create measurable questions allowing comparison with similar data collected earlier in Germany (Järvinen et al. 2001). The operationalization is presented in detail in **Table 13 (Appendix)**. Environmental quality was operationalized based on attributes used or mentioned in earlier studies focusing on wood products (identified earlier). More sensorial than symbolic attributes were used in operationalizing perceived total product quality due to the focus being on wood products that are utilitarian in nature.

Perceptions of environmental quality were measured twice using two sets of attributes. First, respondents provided assumptions of how their customers emphasize environmental product attributes. Second, they estimated how they themselves emphasize environmental quality when choosing wood products for their product assortment. All attributes were measured using a five-step interval scale (1 = "very important" to 5 = "not important at all") and assuming equal distances between these alternatives, which was explained to the interviewed persons. This is used as the justification for treating the variables as continuous when performing multivariate data analysis.

Company background was described through turnover, share of wood products from the total turnover, type of products traded, and their most important customer groups, which were named freely by the respondents and then categorized. The perceptions of the respondent companies about their customers' interest in the environmental quality of wood products was clarified by asking for the proportion of customers showing an interest in environmental issues, and how large a proportion of customers would be (assumingly) willing to pay a green price premium varying in size (0%, 1% to 5%, 6% to 10%, 11% to 20%, 21% to 30%, over 30%).

## Methods

Statistical analysis was applied to the data. The results, however, need to be treated as indicative due to the small number of observations, particularly regarding multivariate analysis (Hair et al. 1995). Another limitation was the large non-response. This study is preliminary in nature, and further research is needed to validate the generalization of the findings. Correlation analysis was applied when the goal was to analyze environmental and total product quality structures. Exploratory factor analysis was also used to examine the dimensionality of environmental quality. Varimax rotation was performed, since the objective was to identify dimensions as independent of each other (i.e., non-correlating) as possible. Variables with a communality of at least 0.2 were included in the analyses. The suitability of factor analysis for the data set was analyzed with Bartlett's test for sphericity. The internal reliability and consistency of dimensions of product quality structures resulting from correlation analyzes and from the factor analysis were studied using Cronbach's coefficient alpha ($\alpha$). Values of 0.6 or higher were considered as indicating sufficient scale consistency (e.g., Hair et al. 1995, Waller and Ahire 1996).

According to the approach suggested by Rao and Wang (1995), different groups regarding perceptions of product quality were first explored using cluster analysis (k-means clustering). Cluster analysis has been previously applied to small data sets in the case of forest industry products, for example by Wagner and Hansen (2004b). The characteristics of the resulting segments were then studied using analysis of variance (ANOVA) and cross-tabulations. For all statistical tests, except correlation coefficients, an uncommonly high $p$-value of 0.10 was considered as the criterion for significance due to the small sample size. This was regarded as justifiable, since an important goal was to reveal new information rather than test hypotheses.

# Results

## The Respondent Companies

Wood played an important role for the studied companies in their business: 60 percent of the companies/businesses realized over 50 percent of their total turnover from wood products (**Table 1**). On average, the annual turnover of interviewed companies was 242 million pounds (£), the range between the smallest and largest was from 3.4 million to about 1.6 billion £. The average wood product sales value was 72.8 million £ (range 3.4 to 400). The share of wood in the total value of sales varied from 4 to 100 percent (average 67%). The 40 respondent companies were classified into three groups based on their type of business (average turnover/average wood product turnover/average share of wood in the total turnover, see **Table 2**):

1.  Wood product traders    (17)    (53.9£ / 52.8£ / 99%)

2.  Construction material retailers    (13)    (203.2£ / 87.4£ / 48%)

3.  DIY companies    (10)    (601.9£ / 90.7£ / 32%)

**Table 1.** Relationship between the type of company and of the importance of wood products in business.

| | Share of wood products in the total annual turnover | | Total % (no.) |
|---|---|---|---|
| | ≤ 50% | >50% | |
| Wood product traders | 0 | **100** | 100 (17) |
| Construction material retailers | **64** | 36 | 100 (11) |
| DIY companies | **80** | 20 | 100 (10) |
| Total % (no.) | 39 (15) | 61 (23) | 100 (**38**) |
| $\chi^2$ = 0.000, two cells count less than five observations. | | | |

**Table 2.** Turnover in different types of companies.

| Company groups | Turnover groups of respondent companies/businesses | | | Total % (no.) |
|---|---|---|---|---|
| | < 50 mill. £ Small (%) | 50 to 100 mill. £ Average (%) | > 100 mill £ Large (%) | |
| Wood product traders | **53** | 35 | 12 | 100 (17) |
| Construction material retailers | **54** | 8 | 38 | 100 (13) |
| DIY companies | 20 | 20 | **60** | 100 (10) |
| Total % (no.) | 45 (18) | 23 (9) | 32 (13) | 100 (40) |
| $\chi^2$ = 0.059, six cells count less than five observations. | | | | |

Logically, wood products are the most important product group for companies classified as "wood product traders." With an average share of just less than half of turnover, wood products also constitute an important product group for companies classified as "construction material retailers." "DIY

companies" receive about one-third of their sales from wood products. From here on, all of the respondent companies/businesses will be referred to as "companies." DIY companies and construction material retailers were almost equally large traders of wood products based on the average value of wood product sales per company. An average company of both groups annually sold wood products for almost twice the average value compared to that of the wood product traders.

Construction material retailers can be described as intermediate between wood product traders and DIY companies. Construction material retailers are, on average, larger companies than wood product traders but smaller than DIY companies. Construction material retailers concentrate more on wood products than DIY companies but less than wood product traders. Overall, the classification must be regarded as somewhat artificial, but it still provides a useful way of analyzing differences between companies and was, therefore, applied in this study.

The product range differed among the types of companies. For wood product traders and construction material retailers, at least half of all wood product sales were based on sawn timber. For DIY companies, sawn timber made up less than one-third of the wood product sales value, and value-added wood products were clearly more important. The three company groups also differed with regard to their most important customer groups. Generally, wood product traders concentrate on serving merchants and industries that further process wood. Of the 17 wood product traders, 15 (88%) defined further processing companies and merchants as their most important customer groups. Construction material retailers defined end-users (building and construction companies) as their most important customer groups (85% or 11 out of 13 companies), while DIY companies considered both private consumers and building and construction companies as their most important customer groups (90% or 9 out of 10 companies). In summary, for the majority of the companies, the most important customer groups were other companies and organizations rather than private consumers. The differences between company type and the most important customer groups were statistically significant in cross-tabulations ($\chi^2$-test). The wood product share and turnover are significantly related to company type. Therefore, these variables were also linked to the most important customer groups (cross-tabulations not reported).

The companies estimated that interest in environmental issues was modest among their customers: approximately one-fifth of the customers (21%) were assumed to be actively interested in environmental issues when buying products. The median was even lower: half of the companies assumed that the proportion of environmentally interested customers was at most 10 percent. Two-thirds of the companies (68%) assumed that the proportion of interested customers is below 20 percent, and only 15 percent (six companies) expected that the proportion would be over 40 percent. Differences among the company types were analyzed in several ways, revealing that the clearest difference exists between DIY companies and other companies. This is shown in **Tables 3 and 4**. When compared with other companies, a larger proportion of the DIY companies estimated that their customers were interested in environmental issues (**Table 3**) and were also willing to pay a price premium for environmental quality (**Table 4**).

**Table 3.** Interest in environmental impacts when buying wood products among the customers of the companies trading in wood products.

| Company type | Customers interested in environmental impacts, % of all companies | | | 
|---|---|---|---|
| | At most 10% of customers | Over 10% of customers | Total, % (no.) |
| Wood product traders and construction material retailers | 60% | 40% | 100% (30) |
| DIY companies | 30% | 70% | 100% (10) |
| Total % (no.) | 53% (21) | 47% (19) | 100% (40) |
| $\chi^2$ = 0.100, one cell counts less than five observations. | | | |

**Table 4.** Expected willingness to pay a price premium for environmentally friendly products among the customers of the companies trading in wood products.

| Company type | Expected percentage of customers willing to pay a premium, share of companies (%) | | Total, % (no. of companies) |
|---|---|---|---|
| | 0 to 5 % of customers | > 5% of customers | |
| Wood product traders and construction material retailers | 73 | 27 | 100% (30) |
| DIY companies | 40 | 60 | 100% (10) |
| Total % (no.) | 65% (26) | 35% (14) | 100% (40) |
| $\chi^2$ = 0.056, one cell counts less than five observations. | | | |

The companies assumed that the proportion of customers willing to pay a price premium for "green" products was clearly smaller than the proportion of environmentally interested customers. A typical (mode value 40% or 16 companies) respondent company estimated that 1 to 5 percent of their customers would be ready to pay a price premium for environmental quality. Every fourth company (25%) assumed that none of their customers would be willing to pay any premium. DIY companies expected that their customers would more often be willing to pay a "green" price premium for environmentally friendly products than the other companies (**Table 4**). The groups of wood product traders and construction material retailers did not differ significantly and, therefore, are combined in **Tables 3 and 4**.

The companies were also asked to describe what types of products would, according to their expectations and experiences, hypothetically receive a "green" price premium. The named products could be classified into two broad categories: 1) tropical wood and products made of tropical wood and 2) joinery products including (garden) furniture. Several companies thought that there is no wood product for which their customers would be willing to pay a green price premium. To summarize, it appears that environmental quality is believed to matter most with regard to products made of tropical wood or products that are purchased or chosen by consumers.

## Perceived Environmental Quality

### Importance of environmental product attributes

Environmental quality was proposed as being a higher abstract concept that is reflected in the perceived importance of more specific environmental product attributes. It was also proposed that these attributes may be structured as several sub-dimensions of environmental quality. In order to investigate these propositions, the environmental quality was first analyzed using eight product attributes, which measured how important the companies assumed these to be for their customers. These attributes were:

1. respect for social aspects,

2. safety of surface treatment,

3. safety to health,

4. impacts of production processes on environment,

5. recyclable product,

6. recyclable packaging materials,

7. wood originates from sustainable managed forests, and

8. availability of information about environmental impacts and factors (measurement on a five-point scale ranging from 1 = "very important" to 5 = "not important at all").

On average, companies ranked sustainability of forestry and safety to health as "important" for their customers. The producer's attention to social aspects, impacts of production process on the environment, the availability of information about environmental factors and impacts, and recycling issues were regarded as moderately important (**Table 5**). Correlations and exploratory factor analysis were applied to analyze how the attributes were related to each other and whether these reflect some latent broader dimensions of environmental quality. Correlation analysis was performed first to analyze the structure of environmental quality attributes and the feasibility of applying factor analysis (**Table 6**). The analysis shows that sustainable forest management and the availability of information are clearly interrelated. The correlation with other variables was not significant, except that sustainability also correlated with environmental impacts. All of the other variables are related to each other, albeit recyclability correlates with social and health issues only modestly. Correlations indicated that the attributes contributing to the perceived environmental quality can be divided into two blocks of interrelated attributes, except for impacts of production processes on environment, which correlates with variables in both blocks.

**Table 5**. Environmental quality dimensions resulting from factor analysis (Maximum Likelihood method with Varimax rotation).

| Variables | Average importance | Factor I | Factor II | Communality |
|---|---|---|---|---|

|  | Mean (SD)[a] | "Social and health impacts" | "Sustainability and information" |  |
|---|---|---|---|---|
| Social aspects are respected | 2.5 (0.8) | 0.791 | *[b] | 0.501 |
| Safe surface treatment | 2.3 (0.9) | 0.759 | * | 0.479 |
| Safe (for health) | 2.3 (1.1) | 0.660 | * | 0.380 |
| Impacts of production processes on environment | 2.7 (0.9) | 0.475 | 0.410 | 0.449 |
| The product is recyclable | 2.8 (0.8) | 0.412 | * | 0.233 |
| Wood originates from sustainable managed forests | 1.7 (0.9) | * | 0.999 | 0.532 |
| Availability of information about environmental factors and impacts | 2.7 (0.9) | * | 0.594 | 0.423 |
| Eigenvalue |  | 2.047 | 1.581 |  |
| % of total variance |  | 29.24% | 22.58% | 51.82% |
| Cronbach's α Bartlett's test p = 0.000 |  | 0.764 | 0.744 |  |

[a] 1 = "very important" to 5 = "not at all important." SD = standard deviation.
[b] * loading between ± 0.2.

**Table 6.** Correlation matrix of attributes contributing to environmental product quality.[a]

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| 1. Wood originates from sustainable managed forests | -- |  |  |  |  |  |  |
| 2. Impacts of production processes on environment | 0.403 | -- |  |  |  |  |  |
| 3. The product is recyclable | * | 0.425 | -- |  |  |  |  |
| 4. The package is recyclable | * | * | * | -- |  |  |  |
| 5. Safe (for health) | * | 0.283 | 0.311 | 0.305 | -- |  |  |
| 6. Social aspects are respected | * | 0.410 | 0.309 | * | 0.508 | -- |  |
| 7. Availability of information about environmental factors and impacts | 0.592 | * | * | * | * | - | -- |
| 8. Safe surface treatment | * | 0.421 | * | 0.328 | 0.465 | 0.648 | * |

[a] Only significant correlations at the 0.05 level are displayed; * = nonsignificant correlation.

The factor analysis seemed feasible based on correlations and alternative solutions of one, two, and three factors were calculated. Based on the eigenvalues of factors in different solutions, the two-factor solution was deemed to be the best (**Table 5**).[2] The first dimension (factor) is characterized by social and health attributes, environmental impacts, and recycling. This factor is named "Social and health impacts." The other dimension is dominated by the sustainability of forestry, but the availability of environmental information also loads fairly high on this dimension. This factor is named as "Sustainability and environmental information." The results suggest that perceived environmental quality of a product is a two-dimensional construct. The two factors, however, capture only 52 percent of the variance of the attributes, which indicates that some attributes related to environmental quality of wood products may be missing from the pre-defined variable set.

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(2) Recyclability of packages was closely and positively related to recyclability of the product. Therefore, the first of these two attributes were dropped from the final factor analysis in

order to reduce the number of variables. The interpretation of the results remained the same for both alternatives.

### *Differences in perceptions about environmental quality*

One of the propositions in this paper is that companies differ in how they expect their customers to emphasize environmental quality of products. Cluster analysis of the original environmental product attributes was used to investigate whether the companies can be allocated into groups on this basis (k-means clustering). The analysis resulted in a two-cluster solution (**Table 7**). Companies in cluster one consider both environmental quality dimensions to be less important to their customers than companies in cluster two. The groups were named "Less environmentally oriented – LESS" and "More environmentally oriented – MORE." In practice, the clusters are interpreted to represent two company segments, one of which perceives a higher emphasis on environmental quality among its customers than the other.

**Table 7**. Company clusters based on environmental quality.

| Factor score variables representing latent dimensions of environmental quality | Mean scores for two company clusters | | ANOVA (F test) *p* value |
|---|---|---|---|
| | LESS environmentally oriented companies | MORE environmentally oriented companies | |
| Wood originates from sustainable managed forests | 2 | 1 | 0.014 |
| Impacts of production processes on environment | 3 | 2 | 0.000 |
| The product is recyclable | 3 | 2 | 0.002 |
| The package is recyclable | 3 | 2 | 0.000 |
| Safe (for health) | 3 | 2 | 0.001 |
| Social aspects are respected | 3 | 2 | 0.001 |
| Availability of information about environmental factors and impacts | 3 | 2 | 0.022 |
| Safe surface treatment | 3 | 2 | 0.004 |
| Number of companies (total 40) | 25 | 15 | |

The background characteristics of the two segments were examined in order to retrieve information that would help recognize MORE and LESS environmentally sensitive companies. Few characteristics, however, could be detected that clearly differed between the two clusters. Cross-tabulations with company background characteristics did result in two statistically significant differences between the two clusters. Firstly, the DIY companies were more likely to belong to the more environmentally oriented segment than to the less environmentally oriented segment, whereas other companies belong more often to the less environmentally oriented segment (**Table 8**). Secondly, cross-tabulations (not reported, $\chi^2$ *p* = 0.060) also revealed that the MORE environmentally oriented companies more often believed that they would receive a higher price premium from environmentally highly qualifying products: one-third (33%) of the companies of this group believed that their customers would be ready to pay a price premium higher than 5 percent. The LESS environmentally oriented companies generally believed (88%) their customers would only pay a green price premium of 5 percent or less or not at all. The DIY companies also expected their customers to emphasize

environmental issues in buying decisions more often than other companies (**Tables 3 and 4**), which is logically reflected by these results.

**Table 8.** Relationship between company type and clusters based on environmental quality.

| | Group: LESS environmentally oriented | Group: MORE environmentally oriented | Total % (no.) |
|---|---|---|---|
| Wood product traders, % | 71 | 29 | 100 (17) |
| Construction material retailers, % | 77 | 23 | 100 (13) |
| DIY companies,% | 30 | 70 | 100 (10) |
| Total % (no.) | 62 (25) | 38 (15) | 100 (40) |
| $\chi^2$ $p$ = 0.047, two cells have less than five observations. | | | |

### Communicating environmental quality to UK markets

One objective of this paper was to investigate which channels and means the UK wholesale/retail companies trading in wood products find most efficient when communicating environmental quality of products to their customers. Overall, environmental information that is concretely attached to the physical products is seen as the most effective.

**The perceived efficiency of communication media for informing customers about environmental quality of products**
*(scale 1 = "very efficient" to 5 = "not efficient at all", mean value of perceived efficiency)*

– eco-labels attached to the products (mean 2.1)

– product information tags with environmental information (mean 2.2)

– press campaigns (mean 2.3)

– television campaigns (mean 2.4)

– a certificate of origin (mean 2.5)

– environmental information leaflets separate from the physical products (mean 2.6)

## Total Product Quality and Environmental Quality

The questions of how important the UK companies consider environmental quality themselves in the case of wood products as well as how environmental quality is related to other dimensions of the total product quality from the company perspective will now be discussed. It was proposed that the perceived total product quality is multi-dimensional and that environmental quality is one of these dimensions. This issue was approached using correlation analysis of the attributes contributing to perceived total product quality.[3] Whether UK companies trading in wood products can be segmented based on emphasis given to the perceived total product quality and environmental quality as part of that is also discussed. Importance of attributes when choosing wood products were measured using a pre-defined set of 19 variables with a five-point scale ranging from 1= "very important" to 5 = "not important at all." This variable set was different from the one used to operationalize the contents and dimensionality of environmental quality. In this variable set, environmental quality was referred to by two attributes, and the companies estimated the importance of the attributes to themselves (in their buying decisions), not from the standpoint of their customers.

(3) The appropriate method for studying the structure of quality attributes would be factor analysis. Therefore, Maximum-likelihood factoring with Varimax rotation was applied. The results provided a well-interpretable three-factor solution. But, due to the large number of variables and the small sample size, the result is not included in this paper.

The "reliability of the supplier" was perceived to be the most important attribute and was ranked very important (**Table 9**). The "technical quality of physical products", "ease of contacting the supplier", and "fast deliveries" as well as "willingness to supply various sizes and quantities" were also perceived as important (an average rating of 2.4 or less). "Product appearance" and "environmental attributes" were also ranked as important and were among the most important attributes.

**Table 9**. Attributes contributing to total product quality in order of importance.

| Product attribute | Mean importance[a] | Standard deviation |
|---|---|---|
| Reliability of the supplier | 1.3 | 0.5 |
| Technical quality of physical products | 1.6 | 0.7 |
| Ease of contacting the supplier | 1.7 | 0.6 |
| Fast delivery schedules | 1.8 | 0.7 |
| General customer orientation (described by willingness to supply various sizes and quantities) | 1.8 | 0.7 |
| Respect for the environment in operations | 2.0 | 0.8 |
| Environmentally friendly (products) | 2.1 | 0.8 |
| Product appearance | 2.1 | 0.7 |
| E-mail connection with the supplier | 2.2 | 0.8 |
| The sales persons respect customers | 2.3 | 0.9 |
| Payment arrangements | 2.3 | 0.9 |
| Image and reputation of the supplier | 2.4 | 0.9 |
| Friendliness of the sales personnel | 2.5 | 0.9 |
| Wide product range | 2.6 | 1.0 |
| Possibility to order via e-mail | 2.6 | 0.9 |
| Product information | 2.9 | 0.9 |
| Well-known supplier | 2.9 | 0.8 |
| Country of origin | 2.9 | 0.9 |
| Scale of 1 to 5: 1 = "very important" to 5 = "not important at all." | | |

The dimensionality of the perceived total product quality and the relationship between environmental and other product attributes was analyzed next. The correlations of the 19 attributes were calculated first (the initial correlation matrix is not reported due to the large space needed), and then attributes were manually divided into four groups, each consisting of attributes correlating significantly with each other. "Payment arrangements" and "country-of-origin" had fairly low correlations with any other attribute and were left out of the grouping. The four groups of attributes were considered to represent dimensions of total product quality, and were named accordingly: "Tangibles and appearance", "Information and environment", "Services", and "Supplier characteristics". The alpha value for the scale "Services", however, was lower than critical (0.542). Since

most of the attributes grouped as the "Services" dimension also correlated at least somewhat with attributes grouped as the "Supplier characteristics" dimension, the two dimensions were combined. "Wide product range" was omitted due to the fairly low correlation with other attributes in the "Supplier characteristics" dimension. Thus, finally, these three groups of inter-related attributes were interpreted as the quality dimensions of the total product (**Table 10**). Correlations between the attributes are shown in **Table 14 (Appendix)**.

**Table 10.** Total product quality dimensions: correlation-based grouping.

| Tangibles and appearance | Information and environment | Supplier characteristics and services |
|---|---|---|
| Technical quality of the physical product | Respect for the environment in company operations | Image and reputation of the supplier |
| Product appearance | Environmentally friendly products | Well-known supplier |
| | Supplier information | Friendliness of sales personnel |
| | Product information | Respect for customers by sales personnel |
| | E-mail connection | Reliability of the supplier |
| | Internet-ordering/communication | Ease of contacting the supplier |
| | | Fast deliveries |
| | | Customer orientation (willingness to provide customized sizes, dimensions etc.) |
| α = 0.695 | α = 0.795 | α = 0.801 |

Quality-based segments were identified among the UK companies trading in wood products using cluster analysis (k-means clustering). Several combinations of attributes representing the three dimensions were tried, and the final analysis included six attributes (**Table 11**). The analysis revealed three groups. Almost all of the companies strongly emphasized tangible product quality and, therefore, this dimension was not used in describing the segments. Companies of the middle (second) group considered all quality dimensions important. Companies of the first group emphasized environmental quality more than companies in the third group but perceived supplier characteristics except reliability as less important than companies of the third group. Group one was named "Environment-oriented", group two "Generalists", and group three "Supplier-oriented."[4]

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(4) Naming the segments: The Generalists strongly emphasized all the attributes included in the analysis. The segment Environment-oriented emphasized environmental quality equally to (but not more than) the Generalists group. The companies of the Environment-oriented group emphasized supplier attributes less than companies of the two other groups. Thus, rating environmental quality high in importance in relation to supplier attributes was the basis for naming the segment. Companies of the third group emphasized product information and environmental product quality less than other companies but rated supplier attributes as important, which was the basis for naming this group.

**Table 11.** Clusters (k-means clustering) based on attributes representing the dimensions of the total product quality.

| | Quality attributes (centers) within the clusters | | | ANOVA, $p$ value (F) |
|---|---|---|---|---|
| | Group 1 Environment-oriented | Group 2 Generalists | Group 3 Supplier-oriented | |
| Technical product quality | 2 | 1 | 2 | 0.003 |
| Product information | 3 | 2 | 4 | 0.000 |
| Environmentally friendly products | 2 | 2 | 3 | 0.000 |
| Reliability of the supplier | 2 | 1 | 1 | 0.000 |
| Respect for customers by sales personnel | 3 | 2 | 2 | 0.000 |
| Image and reputation of the supplier | 3 | 2 | 2 | 0.000 |
| No. of cases (40) | 13 | 17 | 10 | |

The background characteristics of the companies in the three groups were compared using group mean values and cross-tabulations in order to create a profile of the company segments with different quality orientations. The observed statistically significant differences between the segments were related to company size and the type of customers. The size of business (both wood product sales value and overall company turnover) differentiated the Environment-oriented and the Generalists from the Supplier-oriented group (t-test, $p$ = 0.033 and $p$ = 0.029 / $p$ = 0.051 and $p$ = 0.042, respectively). The total turnover and the wood product sales value were larger in companies of the first two groups than in companies of the Supplier-oriented group. Companies of the Generalists group were also larger than companies of the Environment-oriented group, but the difference was not significant.

**Table 12.** The most important customer groups among the clusters with different quality emphasis.

| Clusters | The most important customer groups | | Total % (no.) |
|---|---|---|---|
| | Industrial (builders) and private end-users | Merchants, further industrial processing | |
| Environment-oriented | 46 | 54 | 100% (13) |
| Generalists | 77 | 23 | 100% (17) |
| Supplier-oriented | 30 | 70 | 100% (10) |
| Total % (no. of companies) | 55 (22) | 45 (18) | 100% (40) |
| $\chi^2$ $p$ = 0.047, one cell has less than five observations. | | | |

It seems that companies of the Supplier-oriented group may be more often wood product traders than DIY or construction material retailer companies. In contrast, the companies of the Environment-oriented group and of the Generalists group are more typically in the DIY or construction material retail business than purely in wood product trading. But, the difference remained above the borderline of being statistically significant (the results from cross-tabulation are not reported). Company type did not differentiate the Generalists group from the Environment-oriented group. In contrast, it seems that companies directly serving either industrial end-users or private consumers have the highest requirements regarding total product quality (**Table 12**).

The three segments were further compared regarding how the companies expected their customers to emphasize environmental quality of products (shown in **Table 5**). The Generalists and the Environment-oriented companies did not differ from each other but the Supplier-oriented group differs from the Generalists and the Environment-oriented groups with respect to how they view their customers' environmental perceptions. The Supplier-oriented companies assume that their customers emphasize the social and health impacts dimension more than the companies of the Environment-oriented group (t-test, $p$ = 0.029). However, the Supplier-oriented companies assume that their customers emphasize the sustainability and information dimension less than companies of the Generalists group (t-test, $p$ = 0.071). The overall implication is that the UK wholesale/retail companies trading in wood products can be segmented based on how they emphasize total product quality including environmental quality. It should be noted that the observed segments are based on different locations on a continuum of environmental quality importance. Companies classified as Supplier-oriented also emphasize environmental quality of products, but relatively less than companies classified into the Environment-oriented or the Generalists groups.

Finally, whether companies can be segmented based purely on their emphasis on environmental quality as measured by the two attributes representing environmental quality ("environmental friendliness of the product" and "respect for the environment in company operations") was analyzed. To simplify the analysis, the variables were first recoded into two categories instead of five: 1 = "high importance" and 2 = "moderate to low importance." Then background characteristics of the companies were cross-tabulated with the re-coded attributes. The result indicates that companies directly serving end-users as their most important customer group place high emphasis on environmental quality more often (82%) than companies targeting merchants and processing industry (56%) ($\chi^2$ $p$ = 0.071, cross-tabulations not reported). Also, the larger the company turnover, the higher the emphasis on environmental quality and vice versa ($\chi^2$ $p$ = 0.086, cross-tabulations not reported).

## Summary and Discussion

This paper explored the contents and importance of the environmental quality of wood products as perceived by companies trading wood products and other building materials in UK markets. The survey data include interviews with 40 companies. The fairly small number of companies limits the generalizability of the results, which should be treated as indicative of the UK markets and need to be verified in future research. Nevertheless, the findings provide new insights into the environmental quality of wood products from the customer perspective.

Perceptions of environmental quality of products were studied in two ways:

1. How UK companies trading in wood products estimate their customers' emphasize on environmental quality, and

2. how the companies emphasize environmental quality themselves.

The results add knowledge about perceived environmental quality by revealing that environmental quality of wood products may be understood as two-dimensional: sustainable forest management and environmental information being one dimension and social and health impacts another. This observation is in accordance with the argument by Samdahl and Robertson (1989) about multi-

dimensionality of environmental concern. In other words, the results indicate that perceived environmental quality of wood products is an information-related matter and can be understood by incorporating not only ecological/environmental attributes but also health and social attributes related to products.

The UK wholesale/retail companies trading in wood products assume that for their customers sustainable forest management is the most important attribute contributing to environmental quality of products, but health related attributes are also clearly important. Other environmental attributes are considered moderately important. The companies do not see a large overall interest in environmental quality among their customers, however, particularly regarding potential for a "green" price premium for environmentally high-quality products.

The managerial implication is that producers of wood products should focus not only on the sustainability of forest management but also place emphasis on health and social attributes in product development and marketing. The latter attributes may also be important for those companies and consumers that are less sensitive to traditional environmental attributes, which our results also indicate. Despite moderate interest in environmental issues among their customers, the UK wholesale/retail companies trading in wood products consider environmental quality important themselves when choosing wood products for their product assortment. But, environmental quality is not the most critical issue for the companies either: reliability of the supplier, technical product quality, customer orientation, and fast delivery service are given priority.

The relationship between environmental quality and other product attributes was studied in the context of how the UK wholesale/retail companies trading in wood products emphasize these attributes themselves. The results indicate that the perceived total product quality can be understood as three-dimensional, and the environmental and information-related attributes together form one of these dimensions. The other two dimensions are product tangibles and appearance, and supplier characteristics and services. This is in accordance with earlier research understanding the perceived total product quality as multi-dimensional. The contents of the dimensions are, broadly speaking, logical when compared with Garvin's (1987) typology and earlier research applying these.

Environmental quality did not form a clearly separate dimension of the total product quality but was linked with information and communication-related attributes. This contrasts the *a priori* proposition of this paper and the empirical observation by Pakarinen (1999), who revealed an environmental dimension when analyzing consumer perceptions about wood furniture. Instead, the result is similar to that on German organizational customers trading in wood products (Toivonen and Hansen 2003). An explanation for the linkages between environmental and information-related attributes may be due to the fact that environmental quality is difficult to evaluate from the product without information. Therefore, providing information for customers plays an important role in supporting business strategies based on high environmental quality. Here, wood product suppliers might benefit from complementing eco-labels with more detailed environmental information. This may help customers make unbiased rankings of products based on their preferences.

It was possible to identify company segments with less and more environmental emphasis, which was assumed. DIY companies consider their customers more sensitive to environmental quality of

products than wood product wholesale companies and construction material retailers. Companies considering end-users as their most important customer group emphasize environmental quality more than companies considering merchants and processing industry as their most important customer group. In addition, larger companies emphasize environmental quality more than smaller companies.

Three segments were identified based on how the companies themselves emphasized the total product quality and environmental quality as a part of that: Supplier-oriented (companies emphasizing particularly supplier characteristics but placing only moderate to low emphasis on environmental and information related attributes); Generalists (companies emphasizing strongly all attributes contributing to total product quality); and Environment-oriented (companies emphasizing environmental and other attributes except supplier and information related attributes). Technical product quality and supplier reliability were emphasized strongly among all segments. Company size and the most important customer groups characterized these segments: Generalists mostly focus on end-users as their most important customer group. The companies representing the two other segments, which are more selective in how they emphasize product quality, most often focus on merchants and processing companies. Those in the Supplier-oriented group are generally smaller than other companies.

Developing a more detailed measurement of customer perception of environmental quality of wood products is an avenue for further research. Investigating company profiles with a different emphasis on environmental and the total product quality is another avenue. The benefits that environmental quality provides are at least partly subjective; therefore, companies pursuing different needs regarding environmental quality of wood products may not be clearly identifiable based on only such company background characteristics, which are traditionally used in describing organizational customers. This addresses both qualitative and quantitative approaches in the research on perceived environmental quality. Finally, companies trading in wood products may not have a complete understanding of their customers' needs and perceptions regarding environmental quality of products. This underlines the need for analyzing the whole value chain, including consumers, when the wood industry plans to incorporate environmental quality into business strategy.

## Acknowledgments

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## Appendix

**Table 13**. Operationalization of the framework guiding the empirical research.

| Phenomenon/object | Operationalization = original variables measured | Constructed variables from the original variables |
|---|---|---|
| Companies trading in wood products and other building materials in the UK markets | Background: turnover (in £): total and based on wood products | Categories based on original variables |
| | Type of business/company (wood product wholesale, construction material retail, Do-It-Yourself) | |
| | Own customers: most important customer groups named freely by the companies | |
| Environmental awareness of the customers of the target companies | Proportion of customers considering environmental impacts when purchasing products: Percentage of all customers, proportion of customers willing to pay a green price premium of various sizes as percentage of the "normal" market price of an otherwise similar product, categorized: 0%, 1% to 5%, 6% to 10%, 11% to 20%, 21% to 30%, >30% | Classified variables from the original variables |

| Environmentally sensitive products on the markets | Open question, respondents named the products freely | Qualitative classification into a few broader groups |
|---|---|---|
| Contents, importance, and structure of perceived environmental quality of products: importance of various attributes to the customers of the respondent companies (as assessed by the respondent companies) | 8 original variables: respect for social aspects (needs of local people considered, no child labor, etc.), safe (for health) surface treatment, (generally) safe for health, impacts from production processes on environment, recyclable, recyclable packaging materials, wood originates from sustainably-managed forests, availability of information about environmental factors and impacts. Assumed importance to customers, a scale from very important to not important at all. Uniform distances between alternatives assumed. Dimensionality/structure of environmental quality: factor score variables from the original variables | Cluster (segment) variable based on how environmental quality dimensions are emphasized (factor score variables) |
| Contents, importance and structure of perceived total product quality, including supplier characteristics and product tangibles and intangibles, determined through how the respondents emphasize various attributes when choosing suppliers of wood products | 19 original variables: payment arrangements, fast deliveries, well-known supplier, country of origin, high technical product quality, appearance, environmental friendliness of the product, product information, supplier information, wide product range, customer orientation, image and reputation of the supplier, reliability of the supplier, ease of contacting, friendliness of sales personnel, respect of sales personnel for customers, e-mail connection, e-mail ordering possible, respect for the environment in (supplier) company operations, a scale from very important to not important at all, uniform distances between alternatives assumed | Cluster (segment) variable based on how total product quality dimensions (attributes representing the quality dimensions) are emphasized

Reclassification of the two environmental product attributes into two categories: strong emphasis and moderate to low emphasis. |
| Media for communicating environmental quality of products on the UK markets | 6 original variables: Efficiency of eco-labels, product information tags, separate information leaflets, certificates of origin, press and TV campaigns, measured using a five-point scale from very efficient to not efficient at all, equal distances between alternatives assumed | |

**Table 14.** Correlation matrix of the attributes contributing to the total product quali~

| | FD | WK | TQ | A | EF | PI | SI | CO | IR | R | EC | FP | RP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fast deliveries (FD) | -- | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Well-known (WK) | * | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Technical quality (TQ) | 0.282 | * | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Appearance (A) | 0.387 | * | 0.535 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Environmental friendliness of the product (EF) | * | * | 0.394 | * | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Product information (PI) | * | * | 0.390 | * | 0.644 | -- | -- | -- | -- | -- | -- | -- | -- |
| Supplier information (SI) | * | 0.260 | * | * | 0.345 | 0.641 | -- | -- | -- | -- | -- | -- | -- |
| Customer orientation (CO) | * | * | * | * | * | 0.413 | * | -- | -- | -- | -- | -- | -- |
| Image and reputation (IR) | 0.363 | 0.406 | 0.296 | * | * | 0.332 | 0.375 | * | -- | -- | -- | -- | -- |
| Reliability ( E) | 0.414 | * | 0.399 | * | 0.430 | * | * | * | 0.325 | -- | -- | -- | -- |
| Ease of contacting (EC) | * | * | 0.593 | * | 0.336 | 0.475 | 0.391 | * | 0.386 | 0.635 | -- | -- | -- |
| Friendliness of personnel (FP) | * | 0.569 | * | * | * | * | * | 0.336 | 0.631 | 0.368 | 0.276 | -- | -- |
| Respectful personnel (RP) | 0.327 | 0.362 | * | * | * | * | 0.324 | 0.288 | 0.635 | 0.513 | 0.406 | 0.619 | -- |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E-mail connection (EM) | 0.286 | * | 0.314 | * | 0.514 | 0.430 | 0.359 | * | * | 0.620 | 0.495 | * | 0.336 |
| Internet (IC) ordering/connection | 0.402 | * | * | * | 0.528 | * | * | * | - | 0.499 | * | * | * |
| Respect for the environment in company operations | * | * | 0.403 | * | 0.835 | 0.526 | 0.40 | * | 0.345 | 0.345 | * | * | * |

Significant correlations are displayed (significance level 0.05), * = nonsignificant correlation