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Consumer preferences for sustainability and their impact on supply chain management

The case of mobile phones

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Abstract

Purpose – Consumer values increasingly favor sustainable development in products and services, thereby fostering the need to develop new operational and managerial practices that support sustainability in supply chain management. The purpose of this study is to identify relevant product features related to sustainable development in this context, and use the choice of mobile phone as an example in measuring their importance.

Design/methodology/approach – The study used two different methods (qualitative and quantitative) in two phases. First it organized focus-group discussions in order to identify the features of sustainability that affect the choice of a mobile phone. The most significant features served as a starting point for the choice of attributes to be included in the final step, choice-based conjoint analysis (CBC), which assesses respondents' value functions by means of latent class clustering. Between the two major phases it carried out two additional pre-tests in order to reduce the number of attributes.

Findings – The results provide fundamental information concerning the relative importance of sustainability features in the selection of a mobile phone. The study identified four different clusters of purchasers: updaters, budgeters, environmentalists, and long-life users. According to the findings, some consumers are willing to pay a premium for sustainability features. The authors discuss the potential implications of the results in the context of supply chain design.

Originality/value – The literature on supply chain management tends to see the consumers as a "black box". This paper reports the first results of opening this box by linking the supply chain perspective to consumer choice behavior.

Keywords Sustainability, Supply chains, Consumer preferences, Mobile phones, Supply chain management, Consumer behavior, Finland

Paper type Research paper

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1. Introduction

Environmental and social issues have played a prominent role in industrial countries during the last few decades. Various green movements have emerged, and new concepts such as the greenhouse phenomenon, acid rain, and social conscience are commonly used in everyday spoken language. As global awareness of environmental problems has grown, consumers have become the crucial factor in promoting green designs (Schischke *et al.*, 2005). Thus, consumers have become more aware of the consequences of their consumption decisions and their choices are increasingly affecting the product offerings (Andersen and Skjoett-Larsen, 2009; Defee *et al.*, 2009). Consumers are no longer solely interested in the physical product, such as the materials used for production and pacing, but also wish to know, for instance, where the raw materials were produced and purchased. In addition, many consumers take an interest in what happens to the product after its lifetime. In other words they are increasingly interested in the social and environmental impact of the entire supply chain (SC). As for the companies, they have been under increasing pressure to consider the environmental consequences of their products and services during the past 20 years (Kleindorfer *et al.*, 2005). It is becoming more and more important to be aware of the implications of supply-chain decisions for the life cycle of the product.

Concern with sustainable development has also spread within SCs and their management (Fabbe-Costes *et al.*, 2011; Seuring and Muller, 2008). Nowadays, sustainability is seen as a source of competitive advantage, and even as the backbone of innovation (Nidumolu *et al.*, 2009). The political environment has changed in industrial countries, for example, and governments have introduced new and increasingly strict laws and international standards covering environmental aspects (Lee and Kim, 2009). Focal companies therefore need to co-operate with other parties in SC networks, and also with governments and regulatory bodies (Fabbe-Costes *et al.*, 2011). They should know where their suppliers stand on aspects of sustainable development (Seuring and Muller, 2008). Naturally, manufacturers of mobile phones are among those putting great effort into sustainability and associating themselves with its values. The results are visible in the SAM Corporate Sustainability Assessment Report, for example, Nokia being awarded the SAM Silver Class and Motorola the Bronze Class (*The Sustainability Yearbook*, 2012). Moreover, several proactive manufacturers, such as Nokia, Samsung, and Sony Ericsson, comply globally with EU regulations, which are the most comprehensive in existence (Shiloy, 2009). Furthermore, some manufacturers have introduced a variety of green phones (Zadok and Puustinen, 2010; Bask and Kuula, 2011), and openly share information on environmental and social issues that affect the entire SC.

In spite of these efforts aimed at sustainable development, there is a lack of academic literature on how consumers view or value the sustainable features of a product or service, and even fewer studies take a SC perspective on sustainability and link it to consumer choice behavior. Our aim in this paper is to narrow this research gap, focusing on the case of mobile phones, and to study consumer preferences for sustainability features from a SC perspective. We also discuss what, if any, implications our findings on consumer preferences might have for SC design. We had several reasons for choosing the mobile phone as our object of analysis, the prime ones being that it is a modular, high-involvement product (contrary to those most often studied in the "green product" context), it is global in usage with huge volumes, and its role is expected to grow in both Western and developing countries. The number of mobile-phone users is expected

to reach as high as around six billion by the year 2013 (GSMA, 2010): by way of comparison, global sales of mobile phones reached 1.2 billion in 2008, of which 229 million units were sold in the biggest market area, the EMEA region (Gartner, 2009). Moreover, short life cycles are the norm nowadays (Hilletoft *et al.*, 2010), and this is the case with mobile phones, which require repeat-purchase decisions. From the production perspective mobile phones are modular, which facilitates the fast adoption of new innovations. On the global level, their importance is expected to increase in the future as mobile technology develops to embrace numerous services: they will take on the roles of credit cards, online marketing information receivers and browsers, and televisions, for example (Lyytinen *et al.*, 2004). Mobile technology has already showed great promise in addressing health problems in the third world (Lynn, 2010; Kaplan, 2006) and in the area of payment services (e.g. M-PESA in Kenya, Intuit 2020 Report, 2010).

Therefore, at the same time as volumes are growing, sustainability issues are becoming increasingly important with regard to mobile phones and their SCs. Our objective in this study is to measure the relative importance for the consumer of the manifold facets of sustainability in a high-involvement product, taking the whole SC as a starting point: this has thus far not been done in academic studies. The key research question is this: from the consumer's point of view, what are the most important sustainability features in SCs with regard to mobile phones?

The rest of the article is organized as follows. Sections 2 and 3 review the literature on sustainability in SC management, and consumer choice behavior, respectively. Section 4 describes the methods used, Section 5 presents the results of the choice-based conjoint (CBC) analysis, and Section 6 discusses the potential implications for SC management. Section 7 concludes the paper.

2. Sustainability in supply chain management

The holistic view on sustainable supply chain management (SSCM) covers environmental, economic and social aspects. Carter and Rogers (2008) define SSCM as:

> [...] strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key interorganizational business processes for improving the long-term economic performance of the individual company and its supply chains.

According to Carter and Easton (2011), SSCM relates to the long-term improvement of organizations and has implications for companies' economic bottom lines. Arguing that engaging in SSCM is a requirement for successful business, they provide a framework that describes the relationships among these triple bottom-line aspects and assigns supply-chain professionals key roles in terms of implementing sustainable practices. The increasing significance of SSCM has arisen from the need to find new operational and managerial practices to reduce the environmental impact of the operations of individual companies and entire SCs. For example, cost pressures based on frequent changes in commodity prices, limited supplies of critical materials, and long transportation distances have forced companies to question and develop their sourcing and SCM strategies. Therefore, development issues in sustainability involve not only firms but also entire SCs (Fabbe-Costes *et al.*, 2011). It is therefore of high interest to identify environmental and social initiatives that have had the greatest economic impact on SCs (Carter and Jennings, 2002), and research on corporate social responsibility (CSR) is increasingly

linked to SSCM. Thus, the role of CSR has changed in that it also currently encompasses entire SCs rather than individual company domains (Andersen and Skjoett-Larsen, 2009; Spence and Bourlakis, 2009). Furthermore, Lee and Kim (2009) point out that companies embracing corporate responsibility recognize that environmental impacts need to be managed in the same way as financial and commercial performance. They also suggest that if companies wish to be competitive and survive in the markets, they need to extend their CSR activities to the whole SC.

Researchers have used different terms and definitions of environmental sustainability. Shang *et al.* (2010) and Srivastava (2008) adopt the term green supply chain management (GSCM)). Srivastava (2008) defines GSCM as:

> Integrating environmental thinking into supply chain management including product design, material sourcing and selection, manufacturing processes, delivery of the final product to the consumers as well as end-of-life management of the product after its useful life.

Defee *et al.* (2009) use the term closed-loop supply chain orientation (CLSCO), which they define rather similarly: "Recognition of the strategic and environmental implications of activities and processes involved in managing and integrating the forward and reverse flows of closed-loop supply chains". According to Defee *et al.* (2009), CLSCO is a prerequisite for effectively leveraging closed-loop supply chains (CLSC) capabilities. Guide (2000) and Andersen and Skjoett-Larsen (2009) use the term CLSC in the context of shortened product life-cycles and increased needs to recover assets through recycling and reuse of materials and components. According to Kleindorfer *et al.* (2005), closing the loop in SCs should change the business models in use. In short, all the approaches to sustainability discussed above assign SCM a strategic rather than an operational role.

It is obvious from the above that the concepts of sustainable development are increasingly being linked with product design, sourcing and materials management, and with the reduction of resources and waste in SCs (Shang *et al.*, 2010; Dangelio and Pontrandolfo, 2010; Srivastava, 2008; Linton *et al.*, 2007; Fiksel, 2001; Luttropp and Lagerstedt, 2006; Stahel, 2001). A sustainable SC could therefore be built on the following pillars: sustainable product design, sustainable sourcing and manufacturing processes, as well as reverse logistics operations and coordination. From the mobile phone manufacturer's point-of-view there are several aspects that can be used to operationalize SSCM issues. Therefore, for further analysis of SSCM a four-theme framework was developed based on:

(1) sustainable strategy and policy;

(2) sustainable product design;

(3) sustainable sourcing; and

(4) end-of-life management.

We drew up statements to characterize the different facets of these four areas, and they served as a starting point for our semi-structured focus group discussions (users' perspective).

First, the sustainable strategy and policy issue when related to a manufacturer includes such aspects as: the company has a vision/strategy/and/or policy regarding sustainability in use (Angell and Klassen, 1999); it has a structured environmental assessment tool (e.g. life-cycle assessment (LCA)) in place (Hervani *et al.*, 2005); it invests in waste, energy and emissions management; it publishes a CSR report

(Chen and Bouvain, 2009); and it participates in global development initiatives. Life-cycle management is an important part of SSCM, and LCA facilitates the structured evaluation of the total environmental load (Hervani *et al.*, 2005), product life cycles, and supply-chain aspects. The benefit is that the company can direct the focus of green designs to product and process innovations (Angell and Klassen, 1999), and can more easily adopt SSCM principles (Darnall *et al.*, 2008).

Second, given that "a world-class supply chain starts with product design" (Stank *et al.*, 2011), sustainable product design brings sustainability aspects to the whole SC from product and production planning to end-of-life management. In fact, this stage determines 80 percent of the SC's costs (Carter and Ellram, 1998; Stank *et al.*, 2011) and thus affects various stages such as disassembly, reuse, and recycling (Carter and Jennings, 2002). Hilletoft *et al.* (2010) emphasize that new product development (NPD) should be driven by customer expectations, which calls for profound knowledge of them. Customer initiatives, perceptions and opinions could therefore have implications for SCM design, thus there is a need for the continuous collection of information on consumer needs and benefits in order to tailor SCs to target segments (Hilletoft *et al.*, 2010). According to Hilletoft *et al.* (2010), companies should work simultaneously with customer-oriented NPD and SCM design. The sustainable product design in the context of mobile phones include such aspects as: favoring renewable and recyclable resources (Tischner, 2001), incorporating recycling and disassembly (dismantling) options (Defee *et al.*, 2009; Andersen and Skjoett-Larsen, 2009; Kleindorfer *et al.*, 2005), imposing stricter requirements related to environmentally hazardous materials than stipulated in EU regulations for example, and using analysis tools for materials certified by a third party (CSR criteria; Tischner, 2001).

Third with regard to sustainable sourcing, as companies increasingly rely on their suppliers in order to attain competitive advantage (Handfield *et al.*, 2005), in today's globally networked world principles of sustainability should prevail. Given the increasing amount of outsourcing from developing and low-cost countries, concerns about the social and environmental impact have risen (Andersen and Skjoett-Larsen, 2009). Sustainable sourcing includes such aspects as: the extent to which suppliers engage in environmental initiatives (e.g. recycling, hazardous material, and waste processing in production), develop their operations, and ensure safe and ethical working environments at their plants (Carter, 2005; Carter and Jennings, 2002). On the operational level the manufacturer should: have a certified tool for evaluating its suppliers' environmental sustainability (Hervani *et al.*, 2005), systematically monitor and audit its suppliers (Spence and Bourlakis, 2009), train its suppliers in sustainability issues (Lee and Kim, 2009), systematically share information regarding materials that require control (Handfield *et al.*, 2005), and provide clear instructions regarding the use of resources and waste management (Scott, 2008).

Fourth, product recovery and end-of-life management entail the recycling, re-use and remanufacturing of products and materials (Daugherty *et al.*, 2001; Rogers and Tibben-Lembke, 2001; Stock, 1998). End-of-life management policy covers recycling, and developing efficient processes for handling returns and product take-backs, which are examples of putting sustainability-oriented strategy into practice. In the context of mobile phones, aspects of product recovery and end-of-life managements are such as: stricter practices in the reuse and recycling of materials than required under EU regulations, participation in programs aimed at product recycling, re-selling of the

products that have been recycled (Tischner, 2001; Guide and van Wassenhove, 2002), repairing and upgrading products that have been recycled or are outdated (Tischner, 2001; Defee *et al.*, 2009), reselling them, and sharing of information on the use of recycled materials and components.

Several authors point out that the world-class design of a SC starts with the customer (Stank *et al.*, 2011). Nevertheless, very few studies have attempted to decompose customer perceptions of sustainability into an operational set of features. Thus, the SCM literature typically regards the customer as a "black box". The aim in this study, therefore, is to link the features of sustainability as consumers see them with aspects of SCs. Next we briefly review the literature on sustainability and consumer choice.

3. Consumer choice behavior

Chen (2001) acknowledges that "greening itself is not a well-defined concept", meaning that consumers, manufacturers, dealers and governments view the benefits of a product/service in different ways. His list of typical environmental attributes includes recyclability, recycled content, fuel efficiency, toxic content reduction and emission-related performance. He does not discuss matters related to social corporate responsibility, however. It is not at all obvious which facets of sustainable development bring most value to consumers, and the features are very likely to vary across different products/services.

Various studies assess the importance of sustainable development in consumers' purchase decisions. The choice of the attributes included in the analyses is based on experience or previous literature, and the effect of eco-labels, for example, is also considered. The product categories covered are limited mainly to food (Moon *et al.*, 2002; Ubilava *et al.*, 2010; van Doorn and Verhoef, 2011; Rokka and Uusitalo, 2008), other low-involvement groceries (Bjorner *et al.*, 2004; Auger *et al.*, 2003), energy (Roe *et al.*, 2001), and wood-based furniture (Veisten, 2007). Train and tourist services have also been studied (Eggers and Eggers, 2011; Hearne and Salinas, 2002). Among high-involvement products vehicles (Potoglou and Kanaroglou, 2007) and household appliances have been objects of interest (Sammer and Wustenhagen, 2006; Sonnenberg *et al.*, 2011). Potoglou and Kanaroglou (2007) considered preferences for gasoline, alternative fuelled and hybrid cars with regard to one sustainable-development attribute, "pollution level". Sammer and Wustenhagen (2006) exceptionally included three attributes in their study on washing machines: water consumption, energy consumption, and energy-efficiency rating. Sonnenberg *et al.* (2011) used direct questioning in assessing the importance of several types of sustainability information in the purchase of a household appliance.

The most commonly used assessment methods include CBC analysis and discrete choice analysis. Direct questioning has also been employed (Sonnenberg *et al.*, 2011; Veisten, 2007; Moon *et al.*, 2002), as well as the analysis of scanner panel data (Bjorner *et al.*, 2004). Aggregate results or results based on some demographic category such as country or income are commonly reported, but in some cases cluster analysis is used in order to give a more detailed view of various attitudes towards features of sustainable development. Many studies attempt to assess consumers' willingness to pay for a particular feature – and here we mention only some examples: Veisten (2007) found the premium to be in the range of 2-16 percent paid for eco-labeled wood furniture, the premium in eco-food was 28-45 percent (Moon *et al.*, 2002; Ubilava *et al.*, 2010),

and 30 percent in a high-involvement product such as a washing machine (Sammer and Wustenhagen, 2006). These figures were based on conjoint analysis (CA) or direct questioning. The marginal willingness to pay for the Nordic Swan eco-label in toilet paper was found to be 13-18 percent, the calculations being based on the purchases of a household panel in Denmark. A real choice experiment related to the purchase of roses revealed a premium exceeding the rose price by more than 100 percent (Michaud *et al.*, 2012) – here the real choice indicates that real roses and actual transactions against money featured in the experiment.

Thus, the existing research indicates that premiums for sustainable features exist. However, several studies also suggest that even if consumers have positive attitudes toward sustainability, there seems to be a gap between attitudes and actions (Luchs *et al.*, 2010; Hughner *et al.*, 2007). Thus, the results of studies that did not include real transactions and economic consequences should be viewed with care.

Several studies also attempt to identify the determinants of green purchase behavior (Laroche *et al.*, 2001; Chan, 2001; Ubilava *et al.*, 2010) in order to target consumers with the most favorable attitudes towards paying a premium for sustainable-development attributes. We are confident that without a major risk of pro-innovation bias (Rogers, 1976), the number of such consumers will grow as consciousness of the need for sustainable development increases. Today these consumers are the innovators (or early adopters) in the diffusion of innovations life-cycle (Rogers, 1962).

4. Methods

The objective of the study was to find out to what features of sustainable development, covering the whole SC, consumers assign value when choosing a mobile phone. We were also interested in the possible impacts of these features on the design of the chain. The key question is this:

Q1. What are the features of SC sustainability that consumers shopping for mobile phones value most?

We also addressed three additional questions:

Q2. Is it possible to identify consumer groups with different preference structures, and if so, what are they?

Q3. Are consumers willing to pay more for a mobile phone with features promoting sustainable development?

Q4. What are the potential implications of the identified consumer preferences for SC management?

In the absence of previous studies that could be used as a starting point we started by conducting interviews in order to gather information about the features that play a crucial role in consumer choice with regard to mobile phones. The final goal was to measure quantitatively the relative importance of the different features of sustainable development.

The study had two major phases. In the first we decided to use focus groups in order to identify the most significant sustainable features of mobile phones, and in the second phase we assessed the importance of these features by means of CBC analysis. Beginning with focus group discussions is particularly well suited to studies in which

the aim is to discover factors that influence behavior, motivation, opinions, or feelings and ideas that people may have about something (Krueger and Casey, 2000; Morgan, 1996). The strength of the focus-group method lies in the interactive discussions in that participants are free to ask each other questions, and to reconsider and re-evaluate their own understanding of their experiences or opinions as the information generated during the interaction accumulates (Halcomb *et al.*, 2007; Morgan, 1996, 1998; Gibbs, 1997; Kitzinger, 1995). We therefore considered it appropriate in addressing *Q1*.

We chose CA for the measurement as it has a long track record of preference measurement, initially primarily in marketing research but currently also in areas such as health care, food studies, and transportation, and it facilitates the estimation of value functions on the segment or even the individual level. CBC analysis is currently rather extensively applied in the field of operations management and SCs (Karniouchina *et al.*, 2009). Reutterer and Kotzab (2000), for example, used CA to evaluate the expectations and values of SC managers related to the design of the SC.

We interviewed a sample of Finnish university students representing three disciplines. We had one pretest group, and additionally conducted one focus group discussion per discipline. Given the students' high educational level, they could be expected to be conscious innovators or early adopters of sustainable-development aspects in their choices: in fact, the results of our study supported this assumption (see Section 5.1 and the comparison of attitudes towards sustainable development among our sample population compared with a sample representing the Finnish population as a whole). Many employees in Finland receive their mobile phones through their jobs and therefore may never make a purchasing decision. Students, in turn, are likely to lack this benefit, and typically buy their phones themselves. Thus, they are bound to evaluate and rate factors affecting their purchasing decisions. They probably also are better informed and give more attention to sustainability than the average person. Furthermore, they are likely to be decision makers and opinion leaders in the future, and may even influence their future employers in their choice of mobile phone. For these reasons we believe our choice of a student sample was justified.

The focus-group discussions identified various features of sustainable development (Section 4.1), which we further refined and summarized as we deepened our understanding of the major facets of the phenomenon. We then conducted two additional pretests (Section 4.4) in order to further synthesize the features. The final CBC questionnaire thus included five features and the price attribute. We used CBC analysis and subsequently Latent Class clustering in addressing *Q2* and *Q3*. Reviewing these clusters we found we were able to identify potential implications for SC management, thereby answering *Q4*. We then considered these implications in the light of SC design (Section 6). Next we briefly report on the focus-group discussions and then move on to the CA.

4.1 Focus group discussions

The focus group discussions aimed at identifying the potential facets of sustainable development in SCs that might affect consumers' choice of mobile phones. The student sample represented three disciplines, economics and business administration, technology, and art and design. We arranged four semi-structured discussions in which a total of 22 students participated. Each interview lasted between

two and three hours, during which time some snacks were served. The first group (comprising five members) was used as a test group, the aim being to generate a very thorough and holistic discussion about sustainability aspects in mobile phone SCs. The members were therefore doctoral students, who could be expected to be analytical and motivated, capable of improving and refining the elements that made up the four-theme framework (Section 2). The final statements employed in the following three focus groups with graduate students are given in the Appendix.

All the focus group discussions were semi-structured in nature, and followed the same agreed schedule. The students were first requested independently to come up with features of sustainability related to mobile phones. They were given post-its, and were asked to write each feature on a separate paper. There was no limit on the number of features. Thereafter each one was assigned to one of the four issues in the four-theme framework: sustainable strategy and policy, sustainable product design, sustainable sourcing, and sustainable end-of-life management. The respondents were then given the list of statements in the four-theme framework and were asked to accept, delete, redevelop and add new features as appropriate. After that the modified statement lists were printed for each group member. The individual members were asked to mark the statements they found relevant, and then to mark the ten most significant ones. Finally, they rated their chosen ten statements on a scale ranging from 1 (slightly important) to 3 (highly important). The most significant features with the highest total ratings across all the four groups served as a starting point for the choice of attributes to be included in the CA.

4.2 Conjoint analysis

According to multi-attribute utility theory the utility of a product/service is a function of its attributes. In CA the total perceived utility U is a sum of the total value V and a random error term ε present in the valuation of a product: $U = V + \varepsilon$.

The total value V is often considered to be an additive function of product attributes, possibly with interaction terms. Each attribute is assumed to have only a finite set of possible values, called levels. If there are n attributes with levels denoted by $a_1, a_2, \ldots, a_n$ the total utility U is:

$$U = u_1(a_1) + \cdots + u_n(a_n) + \sum_{i,j} u_{ij}(a_i, a_j) + \varepsilon, \tag{1}$$

where u_i is a utility function of an individual attribute i, $i = 1, \ldots, n$, and u_{ij}, for some i and j, is an interaction term. The estimated values of $u_i(a_i)$ are part-worths or partial utilities of the attribute levels, and $u_{ij}(a_i, a_j)$ are attribute interactions. CA uses respondent preferences to estimate the respondents' value functions. In CBC analysis the preferences are elicited so that the respondent faces a number of tasks in which product profiles described in terms of attribute levels are presented, among which the respondent indicates the best one. The value functions can be estimated on the aggregate, segment or individual level.

In CBC analysis the error term ε has a Gumbel distribution (with a location parameter of zero and variance $\Pi/6$). The evaluation of alternative profiles, with independent valuation errors, results in the multinomial logit choice model (McFadden, 1974; Swait and Louviere, 1993): if κ product profiles with total values $V_1, \ldots, V_\kappa$ are compared, the probability p_l that profile l is chosen is:

$$p_l = \frac{e^{V_l}}{\sum_{s=1}^{\kappa} e^{V_s}}.$$

The following phases describe the CA process: choice of relevant product attributes and attribute levels, choice of data-gathering method, choice of utility function, choice of questionnaire parameters, and analysis of the value functions.

4.3 Latent class clustering

The estimation of the segment-wise value functions was carried out using the Latent Class 4.0.8 (Sawtooth Software) clustering for choice data (DeSarbo *et al.*, 1995). In the latent class estimation, given the number of clusters, both the sizes and the cluster-wise value functions were optimized using the maximum likelihood criterion. For each respondent the probability of belonging to each cluster (membership) is also subject to optimization. As the likelihood problem is non-convex each run does not result in a guaranteed global optimum. Therefore, for each pre-set number of clusters, several repetitive runs are made and the best solution (in terms of likelihood) among the alternatives is chosen. The choice of the number of clusters is based upon the CAIC measure defined by:

$$\text{CAIC} = -2(\text{Log Likelihood}) + (tr + r - 1)(\ln N + 1),$$

where r is the number of clusters, t is the number of independent parameters estimated per group and N is the total number of choice tasks in the data set. DeSarbo *et al.* (1995) suggest that the number of clusters with minimum CAIC should be used provided that it is "managerially interpretable". They also suggest using an entropy-based measure (Ramaswamy *et al.*, 1993) as well in order to determine "whether the derived segments are well separated".

4.4 Questionnaire

Next we describe the steps in devising the conjoint questionnaire.

Choice of relevant product attributes and attribute levels. In CA features are always called attributes, and their possible values are referred to as levels. In the following we use the word attribute when we mean features to be included in the CA. On the basis of the focus group results we carried out an additional pre-test in order to reduce the number of attributes. The pre-test was conducted by means of a web-based questionnaire and maximum difference scaling (Finn and Louviere, 1992), on a convenience sample of 72 respondents. The number of attributes pre-tested was 13, and on the basis of the results some were omitted given their relatively minor importance. Moreover, some related features were summarized into one attribute. At this stage price was also included as an attribute in order to assess consumers' willingness to pay for sustainable features. We assumed a 10 percent increase in the current price of the phone, given that the focus-group as well as the first pre-test participants had assessed their willingness to pay (in relative terms) at an average of below 15 percent.

Subsequently, we tested several versions of the questionnaire comprising six sustainable-development features plus the price attribute, and improved it iteratively in line with comments we received. Thus, in the last stage, the research-group members personally interviewed a total of 21 respondents in depth, recorded their feedback in detail and discussed it. At this stage one additional sustainability attribute was

dropped owing to its minor relevance to the respondents compared with the remaining attributes: this was suspected in earlier stages. Moreover, we made some improvements to the text and the appearance before fielding the final version. Each attribute in the final set of five combined several features dealt with in the focus group. The final sustainable-development attributes were:

(1) physical strength and length of life;
(2) updating characteristics: software and hardware;
(3) recycling (plastic and metal parts and phone recycling);
(4) hazardous materials and waste processing in production; and
(5) ethical labor aspects and environmental conditions with suppliers.

Each attribute was chosen to have only two possible levels appearing in the profiles. The reference mobile phone was one that was available at the time of study, of which durability and length of life as well as updating characteristics were on the same level as current mobiles in the stores ("same as current"). There was no information about the recycling, hazardous materials and waste processing in production, or about ethical labor aspects and environmental conditions with suppliers, and the price was the current price. For all the sustainable-development attributes the more preferred level was "improved compared to the current situation". For price the two levels were, "same as the current price" and "10 percent higher than the current price". In the questionnaire the status quo levels of the attributes where linked with the grey color and the improved levels of the sustainable-development attribute were indicated by the green color. The 10 percent increase in price was highlighted in a shade of orange. Please look at Figure 1 for the attributes and their levels.

Choice of data-gathering method and utility function. We used a web-based questionnaire, because it was an efficient and convenient way to reach the respondents in the sample. The additive utility function with interactions was used.

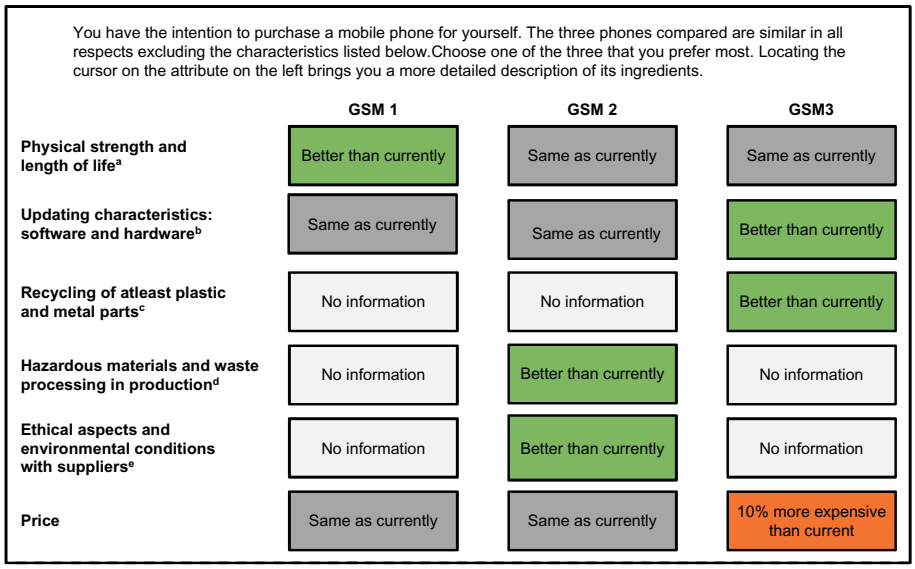
Choice of questionnaire parameters. The questions were thus tasks in which the respondent chose the best one among the product offered. We used ten generated tasks and two fixed tasks for each respondent, the latter being used as holdouts. The number of product profiles displayed in each task was three. We did not use more profiles owing to the relatively large number of attributes. An example of a task in the questionnaire can be seen in the Figure 1.

We used SSI Web 7.0.22 with the option "balanced overlap" in generating the tasks. That resulted in a random experimental question design, which was close to orthogonal (Chrzan and Orme, 2000). There were 999 different versions of the questionnaire.

5. The sample and the results

5.1 The sample of respondents

We sent the questionnaire to a total of 8,592 student e-mail addresses, of which 172 messages could not be delivered. All the students in the School of Economics as well as the University of Art and Design were invited to take part. Systematic sampling was used in recruiting students from the University of Technology due to the large student population. A total 1,398 completed responses were received. Table II gives the sample characteristics. The questionnaire elicited the following information: age class, gender, the price category of the next phone the respondent intended to purchase, and the



Notes: [a]The phone is of solid make and there is no need for its replacement for several years due to it breaking down; [b]the software, operating system and the phone components (e.g. screen or keyboard) are easy to update; [c]the manufacturer is responsible for the collection of the replaced phones for recycling; the metal and plastic parts are recycled at the minimum; possibly part of the replaced mobiles are refurbished for new users; [d]the hazardous materials are handled with special care to guarantee safety and there amount is minimized; the waste is minimized and recycled; [e]the manufacturer supervises its vendor related to the working environment, wage levels and labor rights as well as is responsible that appropriate attention is devoted to environment control

Figure 1.
Example of a task in a conjoint questionnaire

frequency of changing phones. Five additional questions were included from the TNS Atlas survey of Finnish consumers[1]. The Atlas statements were measured on a scale ranging from one to five, with one referring to "I totally disagree" and five to "I totally agree". TNS Gallup confirmed that, according to their representative sample, age and gender affected attitudes towards sustainable development in Finland as follows: females are more concerned and the concern grows with age. Thus, these were natural descriptors in the questionnaire. We also wanted to find out how the frequency of purchasing a new mobile phone and the intended price class of the next phone affected choice preferences. Finally, we asked if the respondents paid for their phones themselves because we were interested in personal choice. The relevant TNS Gallup questions were:

- *Atlas 1.* I would accept a lower standard of living if it contributed to decreasing environmental pollution.
- *Atlas 2.* I would happily pay a somewhat higher price for an environmentally friendly product.
- *Atlas 3.* I am prepared to change my way of life in order to protect the environment.

- *Atlas 4.* I try and avoid the purchase and use of products that pollute the environment.
- *Atlas 5.* There is too much fuss about environmental topics.

Our sample distributions of responses to the five Atlas questions all differed significantly from the distributions of the actual sample of the Atlas survey (risk level = 0.05, χ^2-test). The consumption attitudes in our data clearly favored more sustainable development. The members' education was higher in our sample, and their ages younger on average than in the country-level sample. Thus, the effect of education on attitudes to green consumption were stronger compared with the country-level sample than the effect of the younger age, which worked in the opposite direction (TNS Gallup Finland, 2012, personal communication (9 August)).

We also found that, measured on the Atlas questions, the female respondents in our sample had a more favorable attitude to green consumption ($p < 0.0001$ for all the Atlas questions), as did respondents over the age of 26 ($p < 0.0001$ except for Atlas 5, $p = 0.09$) compared with the younger age groups.

5.2 The segments and their value functions

We estimated the value functions segment-wise using Latent Class clustering. Although in the aggregate model the two attribute interactions were significant, in the chosen cluster model they were not and thus we only used the segment-wise model with the attribute's main effects. The four- and five-cluster solutions had the lowest CAIC measures. We chose the four-cluster solution because it was easy to interpret and each of the clusters was of good size, whereas in the five-cluster solution the size of one of the clusters was only 3.5 percent. To each respondent is attached a probability (membership) of belonging to each cluster, and for each one the maximum membership is the largest membership over all clusters. The average maximum membership in the four-cluster solution was 0.90. The entropy measure, which is used to "assesses the fuzziness in membership" (Ramaswamy *et al.*, 1993), was 0.81 (one being the best and zero the worst value). The two tasks that were the same for all respondents were left for holdout (excluded in the estimation). The segment-wise value functions confirm that 68.5 percent of the respondent choices were actually made in the holdout tasks. All the value-function part-worths in the four estimated clusters were significant ($p < 0.0001$).

Table I shows the importance of the attributes across the clusters as well as the cluster sizes, rather than the part-worths of the attribute levels. For each attribute, the importance is the range of its part-worths divided by the sum of the ranges of all the attributes. We had only two possible levels for each attribute, and thus the importance scores are sufficient to describe the preferences in terms of a value function. The cluster size is the sum of the respondents' membership probabilities in the cluster.

We called the clusters updater, budgeter, environmentalist, and long-life user. Actually, physical strength and length of life is clearly the only attribute exceeding an importance of 10 percent in all of the clusters, and in other attributes the preferences differ a great deal across the clusters.

The updater appreciates software-updating possibilities in particular, but also values hardware updating more highly than the rest of the clusters. Males are more strongly represented in this cluster ($p < 0.001$), and relatively more members are under 27 than in the rest of the sample. Updaters are more willing to spend in excess of 300 euros on their

Attribute importance	Updater	Budgeter	Environ-mentalist	Long-life user
Physical strength and length of life	20.2	21.4	14.9	44.3
Updating characteristics: software	30.5	8.5	6.1	10.6
Updating characteristics: hardware	9.7	5.1	3.5	4.5
Recycling (plastic and metal parts and phone recycling)	11.1	7.4	17.6	8.9
Hazardous materials and waste processing in production	8.3	8.7	24.6	8.7
Ethical aspects and environmental conditions among the suppliers	8.4	7.2	27.6	8.9
Price	11.8	41.7	5.7	14.1
Total	100	100	100	100
Cluster size	22.1	10.9	40.8	26.2

Table I.
Attribute importance across the clusters (%) and the cluster sizes (%)

new mobiles ($p < 0.001$), and show a stronger tendency to replace them at intervals of 18 months at the most than the rest of the sample.

The budgeter sets a high priority on the current price (with no 10 percent premium) in his or her choice of mobile phone. Measured on the Atlas questions, attitudes toward green consumption are clearly less positive than among the other remaining clusters (all questions $p < 0.001$). The cluster members are more often males ($p = 0.029$), and they are more likely to buy phones costing 300 euros or less than the rest of the sample. Again on the Atlas questions, budgeters have fewer green values ($p < 0.001$) than the rest of the sample.

The environmentalist especially values suppliers that take ethical labor aspects and environmental effects into account, and attaches significance to the usage of hazardous materials in manufacturing as well as waste-processing practices. Likewise, this cluster emphasizes recycling more heavily than the rest of the sample. Environmentalists are more often females than males ($p < 0.001$), and more often 27 or older ($p < 0.001$), and they intend to buy phones priced at 300 euros or less ($p = 0.006$) than the rest of the clusters. Measured on the Atlas questions and compared with the rest of the sample, they also have greener values ($p < 0.001$).

The long-life user places high importance on the durability and long life of the phone (44.3 percent). A possible price increase of 10 percent is also unpleasant for this cluster, but much less so than for the budgeter: the long-life user is more often under 27 years of age ($p = 0.041$), has more often intentions to buy phones costing 300 euros or less ($p < 0.001$) than the others (Table II).

Note that the time interval for changing phones in this data exceeds 24 months for the great majority of the respondents: only 13 percent keep the same phone for 18 months or less.

5.3 The validity, reliability, and limitations of the study

The focus group discussions followed a detailed but flexible schedule and incorporated free idea generation and discussion as well as evaluation of the statements in the four-theme framework. The following measures were taken in order to ensure the reliability of the results: all the discussions were recorded and transcribed (verbatim), with the permission of the interviewees; the same postdoctoral researcher was the moderator; and the same schedule was followed. The question of sustainable

Question	Updater	Budgeter	Environ-mentalist	Long-life user	All
Gender (%)					
Male	30.4	11.0	32.4	26.2	60.7
Female	11.3	7.5	55.6	25.6	39.3
Age (%) (years)					
15-23	46.3	33.2	43.3	45.5	40.0
24-26	27.5	24.4	27.0	25.4	25.9
27-29	9.1	14.5	12.4	9.0	12.2
30-49	16.6	24.3	16.5	15.7	19.7
50-69	0.6	3.4	0.8	4.5	2.2
Atlas questions					
Atlas 1, mean	3.0	2.1	2.7	3.1	2.6
Atlas 2, mean	2.5	1.8	2.4	3.1	2.2
Atlas 3, mean	2.5	1.8	2.2	2.8	2.1
Atlas 4, mean	2.8	2.2	2.5	3.0	2.5
Atlas 5, mean	3.8	4.4	4.0	3.5	4.1
Next phone: intended price class (%) (€)					
Below 100	4.1	15.7	16.3	17.9	13.4
101-200	15.3	29.4	32.0	28.4	26.8
201-300	18.1	17.6	18.5	20.9	18.2
301-400	18.8	13.3	14.3	9.7	14.5
More than 400	43.75	24.1	19.01	23.13	27.18
Time interval for changing phones (%) (months)					
1-12	3.8	1.6	2.2	2.2	2.3
13-18	13.1	10.2	9.1	11.9	10.7
19-24	28.4	19.1	21.5	20.9	22.0
More than 24	54.7	69.2	67.2	64.9	65.0

Table II.
Descriptors across the clusters

development in the context of mobile phones attracted considerable interest in the groups and was dealt with thoroughly, thereby enhancing the validity of the results.

The reliability of the CA is discussed in Section 5.2. The fit of the cluster results was very good, and even the holdout tasks were predicted with high probability. Starting from the focus-group results the elaboration towards the final determination of the attributes and levels proceeded via two additional pretests (quantitatively by means of a questionnaire, and qualitatively in further individual interviews). The final choice of design was thus a lengthy process in which the features of sustainability were reduced to five in order to keep the conjoint-analysis tasks cognitively simple enough. Several steps were taken in order to guarantee a conjoint design with the most significant attributes and thereby ensure validity. We have already acknowledged the need to view the price attribute with special care. Additionally, the anonymity of the web questionnaire helped to minimize social pressures and thus to encourage genuine responses.

As already pointed out, the attitudes of the sample population were much more positive towards green consumption as measured on the Atlas questions compared with the general Finnish population. Throughout we would at least expect the environmentalist cluster to be smaller, and the budgeter cluster to be larger in a representative sample of our target group.

Our results indicate that there are mobile-phone users who are prepared to pay at least 10 percent more for improved sustainability features. This finding is in harmony with the quantitative pre-tests and the focus-group discussions. However, hypothetical

methods such as CBC and open-ended questioning have been criticized on the grounds that their reliability in the measurement of willingness to pay is biased. Miller *et al.* (2011) include an excellent list of references and find evidence of an upwards bias in CBC purchase-probability results. We refer in Section 3 to some studies employing scanner panel data, and others involving real transactions against money, suggesting that there is a willingness to pay premiums for sustainable features.

6. Potential implications for supply chains and supply chain management

It is likely that sustainability issues will carry more and more weight in customers' product-choice decisions in the future (Schischke *et al.*, 2005). Market studies have already provided evidence that values are shifting towards sustainability: the majority of consumers prefer brands that are environmentally and socially responsible (Kleanthous and Peck, 2006). Earlier research also confirms that there is a group of consumers who are willing to pay a premium for environmentally friendly products (Laroche *et al.*, 2001). Our focus in this section is on the potential implications of these developments for SCs and SCM as evidenced in our results. The implications extend to sustainable product design, also called eco-design, one of the benefits of which is that it changes the perspective on the product and could trigger new, highly innovative concepts (Schischke *et al.*, 2005). In order to survive in today's competitive business environment, companies need to provide highly innovative and value added products of high quality, and bring them to market quickly and effectively (Hilletoft *et al.*, 2010).

Our findings highlight at least four significant issues. The first is related to the prolonged expected lifecycle of the mobile phone; the second and third concern the effects of improved updating characteristics on product design and manufacturing, and on sales channels, and the fourth is related to the environmental and social aspects in the whole SC.

First, the issue of a prolonged expected lifecycle for mobile phones arose in all the focus-group discussions and was considered important. In the conjoint study we also found a respondent cluster that emphasized the importance of durability and a longer life. This is a highly significant finding, seemingly directly opposing current trends in the market that clearly promote shorter life cycles. According to Zadok and Puustinen (2010), the average mobile-phone replacement rate is about 18 months, which is the highest so far in the history of consumer electronic devices. The trend of shortening life cycles is evident across the whole market for such devices, which affects their end-of-life management. We could therefore ask what problematic effects the shortening life cycles would have on sustainable development. Durability and the longer life cycle that were highlighted in our results have market and product-design implications, potentially leading to a re-shaping of the mobile-phone product portfolio. The market implication is the potential effect on the growth in sales volumes. This could lead to reductions in raw-material consumption, manufacturing volumes, and the number of phones to be recycled. Manufacturers may thus need to consider designs that have more timeless features, and to find materials, either new or currently available, that support a longer life cycle and end-of-life recycling. This, in turn, could lead to new innovative design and materials solutions.

The second issue is related to the potential effects of updating characteristics on the design and manufacturing of mobile phones, and also to their durability and longer life cycles. We asked the respondents to rate the relative importance of updating software

and hardware, of which the updating of software was considered more important on average. The possible implication here is that manufacturers could consider the feasibility of updating and loading new software applications to a mobile phone over a longer time frame than is currently possible. The updating of hardware, on the other hand, might affect the product-design phase and could even radically change customer offerings in the market, extending the component-modularity aspect from manufacturing to the customer. Consumers currently choose their mobile phone from a set of available models, and in most cases there is no opportunity to (mass)customize the final product. If consumers value updating possibilities, manufacturers seeking competitive advantage should develop more modular product designs. It is possible that customized modular mobile phones will be available in the coming years. Moreover, mobile services carry great promise for the future (Lyytinen *et al.*, 2004), thereby assigning mobile phones an increasingly essential role in everyday life regardless of whether they are closer to tablets or are more traditional in design. The customer could build up his or her phone from modules as if they were Lego bricks, and later on replace some elements such as the screen or camera with more modern versions.

The third issue concerns the effects of the improved updating characteristics on sales channels. Modularity is an accepted feature of mobile phones, and thus is familiar in the upstream supply-chain phases such as product manufacturing. Modular products are typically constituted of different parts, and many companies seek opportunities for "mixing and matching", i.e. using the same modules (standard or of their own design) in products within the same product family, or even across families. This is also the case with mobile phones. However, in its current form, from the users' perspective this means offering exclusively fixed products, and there are virtually almost no customization options at the customer interface (downstream of the SC). Service modularity is a new and emerging research approach (Voss and Hsuan, 2009; Starr, 2010), the starting phase being at the customer interface (Bask *et al.*, 2011). In the case of mobile phones we take two examples of modularity and customization that affect the offering at the customer interface. First, modularity there could be predetermined options allowing slight customization ("mix and match"; see, e.g. NikeID, Smart car) in the form of sustainable and non-sustainable modules, for example. Thus, customers could decide on the degree of sustainability in their choice of mobile phone. Second, modularity and customization could be exploited after the sale, during the usage stage. The life cycle of the phone could be extended through the upgrading of modules during the usage cycle. Thus, a modular structure enables product upgrading through the life-cycle (Brusoni and Prencipe, 2001). The effect will be to increase modular choice options in retailing channels, and therefore the implications are significant.

The focus in the fourth issue is on the environmental and social implications in the whole SC. It is worth remembering that about 80 percent of all product-related environmental impacts and life-cycle costs are determined during the product-design phase (Schischke *et al.*, 2005). The first step towards sustainable design could be to consider the manufacturing costs. Minimizing the material throughput per product unit will reduce costs and make the product "greener" (Schischke *et al.*, 2005). Current challenges in green designs include the lack of global sustainability standards and cost-effective manufacturing processes (Zadok and Puustinen, 2010). The next step is to integrate thoroughly the life-cycle design, including recycling aspects, into the product design. Members of the environmentalist cluster valued the recycling of plastic and metal parts and used phones, for example. They also felt strongly that hazardous

materials should not be used in the production process, and supported efforts to increase waste processing. Furthermore, their concern about ethical and environmental matters among suppliers was strong. The question remains of how to make these sustainability efforts of mobile phone companies visible to consumers.

Finally, our results show that there are consumers who are willing to pay more for a sustainable product, although we only accounted for a price increase of as low as 10 percent in our conjoint questionnaire. The willingness to pay more also has implications for SCs related to the use of more sustainable (and possibly more expensive) materials in mobile-phone production, for example. If companies were convinced that there was a consumer segment willing to pay a premium for a green phone they would be prepared to promote such a product.

7. Conclusions

Using customer-focus-group discussions we identified the most important attributes related to the sustainability of mobile phones. These discussions were effective in defining the perceived key features, some of which turned out to be unexpected. By means of CBC analysis we measured the preferences related to the product attributes as well as to the price attribute. On the basis of the CBC results we found segments with different preferences, which we named updater, budgeter, environmentalist, and long-life user. These segments enabled us to identify several potential classes of SCM implications. The first of these concerned the prolonged expected lifecycle of the mobile phone. The second emerged from the preference for improved updating characteristics, and the third was related to how such features could induce changes in sales channels. The fourth and final segment focused on the environmental and social aspects of the SC. All the implications seemed to affect sustainable product design, also called product eco-design. Moreover, we found that some consumers were willing to pay a premium for phones with improved sustainable features. We would like to emphasize the fact that physical strength and length of life constituted the only attribute that exceeded the importance rating of 10 percent across all of the clusters (being 14.9 percent at its lowest). This finding, combined with the perceived importance of updating characteristics, is highly interesting. Such preferences among consumers are in conflict with current market trends in which both a rapid increase in the number of mobile phones and a shortening life cycle are highly visible phenomena.

We also included in the CBC questionnaire five questions measuring attitudes towards sustainable development employed in TNS Atlas, a major survey of Finnish consumers. Comparison of the country level and our sample results led us to conclude that our respondents had a significantly more positive attitude towards green consumption. This could undoubtedly be attributed to their higher education, and we would expect at least a subset of the respondents to be innovators and early adopters of products and services with sustainable features. We also acknowledge that the segments we identified, although assumed generally valid among Finnish consumers paying for their phones form their own pockets, would differ in relative size from the segments in the target population.

In this study, we have brought to light some fundamental and perhaps unanticipated observations on customer attitudes towards the sustainability features of mobile phones, and have gauged customer preferences for these features. There seem to be no other studies that have attempted to identify the most relevant sustainable development

features related to the whole SC from the consumer's point of view. We believe our results are of interest to manufacturers of mobile phones in the development of products and services. This has been confirmed by discussions with a major manufacturer that does consider the role of sustainability among other features, including price, in a consumer's choice of mobile phone. Our aim was rather to identify the different facets of sustainable development as well as to evaluate their relative importance – a task not undertaken in any other studies. More precisely, companies could use our results in their product development by designing phones with a better match to consumer preferences, customizing advertisement messages, and finding improved and novel ways of managing their SCs. We have noticed that several companies have strengthened their positions on issues related to sustainability, although consumers do not seem to be very conscious of this yet.

The results of this study and the potential implications for SCs and their management offer several future research avenues. First, our study takes the first steps in opening up the "black box" of customer preferences regarding sustainability features in a SC offering a choice of mobile phones. The preliminary results are promising and therefore it would be worthwhile extending the study to include other groups of mobile phone users, as well as other types of products and services. Second, the study identified a need for more in-depth research into the triple bottom line of SSCM, as Carter and Rogers (2008) and Carter and Easton (2011) suggest. In addition to pursuing environmental and social development goals, sustainable development should focus on improving companies' and SCs' long-term economic performance. Thus, efforts should be made to mass-market sustainable products in order to achieve commercial success and environmental sustainability (Dangelico and Pujari, 2010).

Moreover, there are strong signs that in the near future mobile phones will be intelligent consumer devices that are essential for accessing everyday services and are constantly updated with new applications. The entire ecosystem of marketing could change. For instance, companies could send fully customized marketing messages on the basis of geographical location, one could check the availability and prices of products and services in alternative retail locations, and the phone could be used as a paying device in everyday transactions. Thus, innovative technological modules could be available for the mobile phone.

Note

1. TNS Atlas is a major survey concerning Finnish consumer consumption, brand relationship and media use. The data gathering is continuous and its different parts have 4,000-20,000 respondents annually aged between 15 and 69 years. The sample is representative of Finnish inhabitants and the data gathering takes place on the internet.

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(The Appendix follows overleaf.)

Appendix. Statements regarding four-theme sustainability framework

	Sustainable strategy and policy	**1**	**2**	**3**
1	I find it important that the mobile phone manufacturer has defined and published sustainability strategy			
2	I find it important that the mobile phone manufacturer regularly publishes a corporate social responsibility (CSR) report			
3	I find it important that the mobile phone manufacturer can be trusted to provide information about the sustainability of the mobile phone during its life cycle: for example, that the manufacturer has an environmental life-cycle-management tool in place (such as EMS, LCA). This would imply that the information covered, for example; • the product's energy and material use as well as emissions • evaluations of possible effects on the environment • plans for utilizing the results in decisions related to product design			
4	I find it important that the mobile phone manufacturer's environmental strategy includes waste, energy and emission issues.			
5	I find it important that the manufacturer is interested in societal development and participates actively in international programs promoting sustainable development			
6	I find it important that the manufacturer supports mobile services focused on society as a whole			

	Sustainable product design	**1**	**2**	**3**
1	I find it important that renewable resources are favored in the design of mobile phones			
2	I find it important that recycling and disassembly (dismantling) are taken into account in the design process in order to facilitate recycling and the reuse of recyclable materials and components.			
3	I find it important that in the design of mobile phones the manufacturer imposes more strict requirements related to environmentally hazardous materials than EU regulations demand, for example.			
4	I find it important that the mobile phone manufacturer uses a third-party certified analytical tool in the product-design phase			
5	I find it important that mobile phone has a long life. For example, that it is possible to upgrade or update the phone (hardware and software) as well as to modify it according to the user's needs.			

(*continued*)

	Sustainable sourcing	1	2	3
1	I find it important that the mobile phone manufacturer can reliably evaluate (e.g., by means of a certification tool) its suppliers in terms of sustainability.			
2	I find it important that the mobile phone manufacturer gives clear instructions for its own and its suppliers' use of resources and waste, and that it regularly monitors its suppliers.			
3	I find it important that the mobile phone manufacturer regularly audits that its first-tier suppliers (those with a direct contract with the manufacturer) follow the environmental policies, procedures and practices to which they have committed, and develop these actions if required.			
4	I find it important that the mobile phone manufacturers trains its suppliers in environmental issues			
5	I find it important that the mobile phone manufacturer systematically shares information about materials that require control (including high-risk and hazardous materials)			
6	I find it important that the mobile phone manufacturer aims at minimizing transportation, and pays attention to sustainability in transportation and packaging. For example, sustainability should be taken into account in the selection of transportation mode and materials. On the other hand, the product's packaging (manuals etc.) should be as efficient as possible.			
7	I find it important that the mobile phone manufacturer's working conditions follow common ethical principles.			

	Product recovery and en-of-life managementd	1	2	3
1	I find it important that the mobile phone manufacturer follows more strict practices in its reuse and recycling of materials than required by the EU			
2	I find it important that the mobile phone manufacturer actively participates in programs promoting product recycling			
3	I find it important that the mobile phone manufacturer re-sells returned and unsold products, or repairs and up-grades them.			
4	I find it important that the recycling of mobile phones follows the principles of sustainable development. For example the manufacturer should clearly indicate how recycled materials and components are intended to be re-used			

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