Empowering Consumers

The potential of product-related environmental information for ICT consumer products to trigger sustainable consumption

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Abstract

Nowadays consumers are becoming more aware of the environmental impacts caused by their consumption habits. As a result their consumption patterns and information needs have changed. Currently, product-related environmental information for ICT consumer products is not easily available. In addition, the general perception of ICT practitioners is that private consumers are not asking for environmental information and do not consider environmental features when purchasing ICT products.

The focus of this thesis is to examine the current state of knowledge as refers to consumers' interest in environmental information for ICT products and to identify the opportunities and risks of providing such information, as well as to provide recommendations to shape future strategies.

Findings suggest that providing environmental information for ICT consumer products can be considered a win-win-win solution for consumers, industry and the environment all together. It allows consumers to make more informed choices and manufacturers to position their products on the market and gain more market share, as well as to promote sustainable consumption.

Keywords: consumer behavior, sustainable consumption, ICT, consumer products, environmental information

Executive Summary

The growing interest in sustainable consumption, demand from consumers for greener products and information about the environmental impacts of consumer products are all key driving forces to improve product performance throughout the whole life cycle. However, such demand is still very low for ICT consumer products. The general assumption of the ICT industry is that consumers are not interested in the environmental aspects of ICT consumer products. Consumers, on the other hand, need to learn and reinforce their consumer power to influence companies to continuously improve and communicate the environmental characteristics of their products. At the same time companies have to realize that providing information about the environmental characteristics of their consumer products may enable them to gain larger market shares and indirectly promote sustainable consumption.

Currently product-related information is available in various forms. The information tools used, including self declared claims, eco-labels, and environmental product declarations, have different target audience and usability. Moreover, currently, relevant environmental information for ICT consumer products may not be easily available, and consumers do not always know where to find such information or how to interpret it. Therefore, a main challenge for companies within the ICT industry is to provide information in an easily understandable way.

The thesis investigates the current state of knowledge as refers to consumers' interest in environmental information and identifies the advantages and disadvantages of providing such information for ICT consumer products. The thesis was conducted in collaboration with the Swedish IT & Telecom Association with the approach of providing the practitioners' perspective and elaborates suggestions for how IT & Telecom companies can better communicate product-related environmental information to private consumers.

The research was guided by the following research questions:

RQ1: What are the opportunities and risks of providing environmental information for ICT consumer products?

RQ2: What types of environmental information are useful for consumers while purchasing ICT products?

Method

Primary data was collected through semi-structured interviews conducted with members of the Swedish IT & Telecom Association and other relevant organizations, as well as through informal interviews with a number of sales representatives from major consumer electronics retail chains operating on the Swedish market.

The analytical framework used to organize the findings of the study consisted of, first, a SWOT analysis to identify critical areas that needs to be addressed by the ICT companies and, secondly, a perception gap analysis in order to identify current gaps in type of information provided and expectations between consumers and ICT manufacturers. The SWOT analysis was employed in order to analyze the current situation following the approach of identifying strengths and addressing weaknesses, as well as exploring opportunities and avoiding threats.

Findings & Reflections

One of the key opportunities, as identified in the SWOT analysis, consists in the early introduction of environmental information for ICT products allowing companies to position themselves ahead of future legislation, and possibly ahead of competitors. Other advantages

identified involve increasing the environmental knowledge among consumers with the potential to promote sustainable development and sustainable consumption.

One of the main weaknesses, supported by the perception gap analysis, is the relative lack of consumers' knowledge and different perception about consumers' wants and needs. Even though a lot of product-related information is made available by the ICT companies, consumers do not always know where to find this information or how to interpret it.

Based on the assumption that consumers appear not to be interested and not asking for environmental information for ICT consumer products, businesses take a *no demand – no change* approach. If demand from private consumers is not perceived, businesses appear less likely to initiate change. However, it is relevant to point out that this perception may be erroneous, as from the consumers' perspective the lack of demand might be due to the fact that the information has not been communicated in a way that consumers can understand.

It was found that in order to help consumers make more informed purchasing decisions the information communicated should be simple, straightforward, easy to find and understand, and available when most needed. Consequently, based on the common criteria used for eco-labels and eco declarations, and in order not to confuse the consumers, five environmental impact aspects were identified that should be communicated to private consumers. These include: information about the energy consumption, content of hazardous substances, noise emissions, use of recycled material, disposal and information about the take-back system.

The findings of the research can also be used to provide practical suggestions for businesses within the ICT sector and shape their future strategies to gain a competitive edge.

- Simplification of the ECMA 370 Eco Declaration, providing simple, understandable information to private consumers.

- Harmonization of different eco-labeling schemes

- Development of a single label covering major environmental areas

Lastly, it is relevant to point out that information alone will not drive change. Information provision is just one approach aiming to influence consumers' behavior and it is not effective unless applied in combination with other approaches such as economic instruments, legislation and various marketing strategies. Hence, much broader recommendations are provided which entails the involvement of the ICT industry as whole.

Table of Contents

List of Figures

List of Tables

Abbreviations

B2B   Business-to-Business

B2C   Business-to-Consumer

CE   Consumer Electronics

EC   European Commission

ECMA   European Computer Manufacturers Association

EPD   Environmental Product Declaration (ISO Type III)

EU   European Union

GPP   Green Public Procurement

ICT   Information and Communication Technology

ISO   International Organization for Standardization

IT   Information Technology

LCA   Life Cycle Assessment

PC   Personal Computer

TCO   Swedish Confederation of Professional Employees (Tjänstemännens CentralOrganisation)

TED   The Eco Declaration

WEEE   Waste Electrical and Electronic Equipment

1 Introduction

1.1 Problem statement

In recent years there has been a growing interest concerning sustainable consumption and a consensus that moving consumption patterns to more sustainable ones requires greater understanding of consumer behavior (Michaud & Llerena, 2008). Consumption patterns are very much influenced by social structures, technology, infrastructure, markets and cultural norms (Reisch, 2004).

Conversely with the growing product focus, individuals are becoming more environmentally conscious (Thidell, 2009) and the environmental performance of a product is becoming an important criterion when purchasing certain product types (McDonald et al., 2009). If consumers are influenced by the environmental information provided about products, consequently, insights regarding how consumers base their decision are needed for companies to respond in the right way, that is, among other measures, to design and produce more environmentally conscious products, provide relevant information at point of sale and continuously align and connect the product development and marketing strategies.

Nowadays the market is becoming oversaturated with different product information, logos, ads and environmental claims. This is why it is important to consider the amount and type of information supplied, which can be empowering or overwhelming in some cases (Reisch, 2004). It is generally accepted that multiple information sources make the decision making process complex and have the tendency to confuse the consumer. Research shows that consumers will more likely rely on simpler information sources (McDonald et al., 2009). In this sense, eco-labels have great potential to become successful tools to support decision making (Thøgersen, Haugaard, & Olesen, 2010). Nevertheless, the overall aim is to provide clear and concise useful information to consumers when most needed.

Currently, product-related environmental information is not easily available for private consumers, yet the general assumption of ICT practitioners is that consumers do not consider environmental characteristics when purchasing ICT products and services. Moreover, the rapid development of the Information and Communication Technology (ICT) poses some serious negative impacts on the environment, as large amounts of resources are involved through the life cycle of the products along with the use of hazardous substances.

Studies show that while various types of product information are available, sustainability criteria are not used consistently in the purchasing decision making process. For example, environmental criteria have a considerable influence on decision making when purchasing white goods (refrigerators, washing machines, etc.), food and household products, while this is not the case when purchasing small electrical products (computers, TVs, mobile phones), for which the brand is considered the most important factor (McDonald et al., 2009).

Until now little research has been done in the field of green purchasing patterns of small electrical appliances (McDonald et al., 2009). Even though companies have a broader understanding of environmental requirements for ICT products for professional users, there is still little knowledge when it comes to private consumers' interest. Therefore, in order to meet consumer demand both governments and companies need to assess the value consumers place on products' environmental features in order to develop the right policy, as well as to design and launch the right product (Michaud & Llerena, 2008).

1.2 Research focus

With the growing interest for sustainable consumption, understanding consumer behavior and purchasing patterns is essential for businesses to shape their future strategies with regards to consumer products. The thesis was conducted in collaboration with the Swedish IT & Telecom Association and by taking the ICT practitioners' perspective the thesis seeks to gain an understanding of the current knowledge regarding consumers' interest in environmental information for ICT products, and how companies can respond to such interest.

1.3 Research objectives and questions

The study has two main objectives and two related research questions. The first objective of this research is to assess the current state of knowledge as refers to private consumers and environmental information for ICT products. This requires understanding what factors influence the consumer decision making process and purchasing patterns on a general level and what kind of information is processed and noticed by private consumers. It also requires an assessment of how much environmental information is available for products within the IT & Telecom sector and where this information can be found.

The second objective is to identify the advantages and disadvantages of providing environmental information for ICT consumer products. Moreover, it requires looking into what product-related information would enable consumers to make more informed decisions and elaborate suggestions for how IT & Telecom companies can communicate such environmental information to private consumers.

In order to address the above-stated objectives the following research questions were formulated:

RQ1: What are the opportunities and risks of providing environmental information for ICT consumer products?

RQ2: What types of environmental information are useful for consumers while purchasing ICT consumer products?

1.4 Methodology & Data Collection

In order to understand consumers' interest in environmental information for ICT products a qualitative approach was deemed suitable for conducting the study.

In the first phase of the research an extensive literature review was conducted in order to define the theoretical background of the study and to provide an overview of the existing knowledge on the topic. Peer reviewed academic papers and books were used to study the topics of consumer behavior, sustainable consumption and purchasing patterns on a general level. Literature and data was identified using a variety of data sources, such as Lund University's online library, EBSCO and SciVerse Hub databases, reports published by actors within the IT & Telecom sector and websites of other relevant organizations.

Primary data was collected through semi-structured interviews conducted with members of the Swedish IT & Telecom Association and other relevant organizations, and also through informal interviews with a number of retail representatives. The selection of interviewees began with a stakeholder mapping process and with the assistance of the Swedish IT & Telecom Association.

The interviewees were contacted by email or telephone. A list of questions was sent beforehand to the majority of interviewees. In total twelve interviews were conducted, out of which five personal interviews with members of the Swedish IT & Telecom Association, four informal interviews with salespersons from major consumer electronics retail chains operating on the Swedish market and three email interviews, with representatives from the Swedish Consumer Agency, the Nordic Swan and TCO Development.

Additionally a questionnaire was sent out to all members of the Environmental Council of the Swedish IT & Telecom Association in order to facilitate a greater data collection. However, only two responses were received out of a possible ten member companies producing or selling consumer products.

1.4.1 Analytical framework

The framework chosen for this study consists of two steps. Firstly, a SWOT analysis was conducted to arrive at critical areas that need to be addressed by the ICT companies. Secondly, a perception gap analysis was employed to identify current gaps in type of information provided and expectations between consumers and providers. The two analyses are complementary to each other as output from one can be used as input in the other and vice versa.

SWOT analysis

SWOT stands for strengths, weaknesses, opportunities and threats. Strengths and weaknesses are seen as internal factors of the organization, while opportunities and threats are perceived as external factors (See Figure 1). SWOT analysis is commonly used in various research areas, such as strategic planning, business marketing, product development, etc. The purpose is to analyze the current situation by identifying strengths and address weaknesses, as well as to exploit opportunities and avoid threats for the future. The analysis is a simple and useful framework for assessing current organizational strategy and development of future strategies for companies (Helmes & Nixon, 2010).
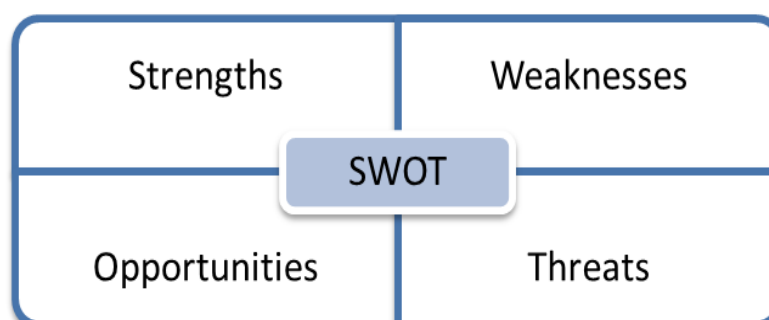
Figure 1SWOT matrix

Source: Author

For the purpose of this research, the SWOT analysis allows identifying critical areas that are the risks versus opportunities of providing environmental product information and indicates possible directions for competitive advantage. One SWOT analysis was conducted to analyze the strengths and weaknesses, opportunities and threats of the ICT manufacturers and a separate one for the private consumers.

One of the weaknesses of the SWOT analysis is that it produces a simplified, non-prioritized list of bullet points without providing sufficient context for alternative decisions and solutions. Another limitation of the analysis is that it provides a "snapshot" at a certain point in time. As the internal and external environment is constantly changing, strengths and weaknesses, as well as new threats are appearing constantly, therefore, regular update of the SWOT analysis is required (Helmes & Nixon, 2010).

Perception gap analysis

Perception gap analysis is a simple tool used to identify gaps between two different perceptions. The analysis helps to map out the ICT industry's perception concerning consumers' wants and needs as opposed to consumers' expectations. The analysis helps in identifying what type of environmental information should be provided in order to be useful for consumers when purchasing ICT products.

As a final point, the conclusions summarize the key findings in connection with the initial research questions and according to the SWOT and perception gap analysis and recommendations are provided. Finally, suggestions for further research are also highlighted.

1.5 Scope and limitations

The scope of the study is limited to products within the IT & Telecom sector. The primary approach of the research is to provide the practitioners' perspective in order to frame the assessment of the current state of knowledge with regards to consumers and environmental information for ICT products. Though this approach may not be considered the first choice when investigating consumers' behavior, it was decided not to conduct a consumer survey and rely more on the practitioners' view and understand the industry's perception of consumer behavior.

It is known that a number of surveys appear every year with the intent to capture the public opinion; however, they often provide conflicting results. When conducting surveys, especially with regards to pro-environmental behavior, it has been observed that the general tendency is to reveal the "correct" or the socially "expected" behavior (Devinney, Auger, & Eckhardt, 2010). Nevertheless there is a major difference between the stated preference and the final action. For example, consumers who tend to call themselves environmentalists state that they would buy "green" products, but only a small percentage of those consumers will actually do so when faced with the actual situation. Therefore surveys are more likely not to reveal anything but the true preferences of consumers in unconstrained situations (Devinney, Auger, & Eckhardt, 2010).

Therefore, at this phase of the research it was decided to take a different approach in order to gain a holistic perspective from different actors in the industry and to exclude the probable results of a consumer survey. This, however, does not mean that surveys are not valuable in the view of the author. In fact, it may be highly probable that the next phase of research on this issue would require a comprehensive consumer survey.

The findings of the study are mainly based on an extensive literature review and interviews with practitioners and other relevant organizations. The study did not seek to approach a wider public due to time limitations. Thus, semi-structured interviews were conducted with practitioners from the Swedish ICT sector and relevant eco-labeling and consumer organizations. The interviewed practitioners are members of the Swedish IT & Telecom Association fulfilling different functions for companies within the ICT industry, such as HP, Lenovo and Samsung.

At the same time a few salespersons from major retail chains active on the Swedish market were interviewed. Since retailers are the first point of contact for the private consumers, including their perspective in the study was considered essential.

The research is further limited to the Swedish market as a result of the stated interest of the Swedish IT & Telecom Association on this topic. The empirical data was collected in Sweden. Sweden along with the Nordic countries have been working with environmental matters for years, as concern towards environmental issues is much higher in these countries than in most other countries (Thidell, 2009). Likewise consumers in Sweden have been exposed to eco-labeling schemes for a longer time and are known as committed environmentalists. However, experiences from the Swedish case can be valuable and transferable to other international markets as well.

Since this topic is relatively new, little research has been done in the field, and the availability of relevant literature for the specified product sector was restricted to some degree. On the other hand challenges in data collection occurred due to companies' confidentiality policies. This was encountered mainly when interviewing members of the IT & Telecom Association and some retailers.

In addition, a major limitation of the study was the actors' willingness to participate in the study, probably largely due to the summer holiday period. A number of additional retail chains and Swedish and European consumer organizations were contacted, but unfortunately declined to take part in the study.

The primary focus of the paper is on ICT consumer products, for example PCs, laptops, printers, mobile devices and monitors, thus little attention have been placed on ICT services. Furthermore, related EU policies are discussed throughout the study; however, the thesis did not seek to provide an in-depth analysis of these policy instruments.

1.6 Intended audience

The intended audiences are business practitioners within the ICT sector, producers and retailers who want to deepen their knowledge in order to meet consumers' expectations in the marketplace. Moreover, consumer organizations, eco-labeling practitioners, policy makers involved in decision making on product policies as well as academia with an interest in understanding consumers' interest in environmental information for IT & Telecom products can benefit from the study.

1.7 Thesis outline

The thesis is structured into the following chapters:

> *Chapter 2* – provides an overview of the theoretical background in the context of sustainable consumption, green consumer behavior and the role of information in purchasing decision making.

> *Chapter 3* – provides an overview of the ICT industry, current practices in communicating environmental information to professional and private users, as well as various environmental information sources relevant for ICT products.

> *Chapter 4* – outlines key findings from the literature review and data gathered through interviews and questionnaires.

Chapter 5 – provides the analysis of findings outlined in Chapter 4 using the SWOT analysis and the perception gap analysis.

Chapter 6 – discusses the findings and highlights the implications for ICT practitioners.

Chapter 7 – provides the conclusions and recommendations for ICT companies, followed by suggestions for future research.

2 Theoretical background

2.1 Sustainable consumption

Over the past decades demand for natural resources has increased considerably. This continuous conversion of resources into goods and services is a result of a growing consumption that sets tremendous pressure on the environment (European Environment Agency, 2012). Consequently, changing consumption behavior and moving to a more sustainable one is becoming more vital than ever (European Commission, 2008a).

The importance of sustainability has been discussed by governments in the past few years, in fact the EU has developed a Sustainable Consumption and Production Industrial Policy Action Plan, adopted in 2008, with the aim to improve the environmental performance of products and promoting sustainable consumption (European Commission, 2008a). The document includes a series of proposals with regards to cleaner production, ecodesign requirements, as well as promoting green public procurement and reinforcing information for consumers[1] through a more clear labeling system (e.g. EU eco-label and the EU energy label) (European Commission, 2008a).

In general terms consumption refers to the attempt to satisfy individual wants and desires by acquiring goods and services with the goal of improving well being (Jackson, 2005). Faced with continuous and confusing information streams, consumers face difficult decisions more or less every day, in most cases the complexity of the purchasing process is amplified by the overwhelming information or by the lack of it. Nevertheless, Jackson (2005) argues that sustainable development depends on understanding behavior change, especially by understanding how, why and where behavior change occurs.

2.2 Green consumer behavior

Nowadays consumers are becoming more and more aware of the environmental impacts caused by their consumption habits (PSI, 2009). However, various studies show that consumers in certain regions are more likely to act pro-environmentally than in others. In fact it was found that overall the level of concern towards environmental issues is much higher in the Nordic countries than in the European Union (EU) (Ekström, 2010). There are several reasons for that. Pro-environmental behavior depends very much on the individual value priorities and motivation (Ekström, 2010), and consumers have different reasons to act pro-environmentally.

By looking at consumer typology two extremes can be identified. At one end we find the conventional consumers with little interest in the environment, known as '*grey*' consumers and at the other end the 'consistent' environmentalists, also known as '*green*' consumers, whose consumption habits are influenced by environmental concerns. The green consumers are those who are willing to pay a premium price for green products and ask for or search for further information related to the products' environmental attributes (D'Souza, 2004). Furthermore, between grey and green, the in-betweeners, are consumers with different levels of environmental consciousness (Peattie, 2001). As shown in Figure 2 in the consumer segmentation model developed by D'Souza (2004) these consumers are identified as the 'emerging consumers' and 'price sensitive' consumers. The emerging consumers are those

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[1] Throughout the paper when using the expression "consumer" it refers to private consumers only, not professional consumers. As well, the term consumer behavior will refer to the practices associated with the purchase, use and disposal of products and services.

types of consumers who do not have any special motivation to buy environmentally friendly products, yet they are aware of the benefits of the green products. Whereas the price sensitive consumers are aware of environmental issues and labels, but they are not willing to pay a premium price for the green brands (D'Souza, 2004).
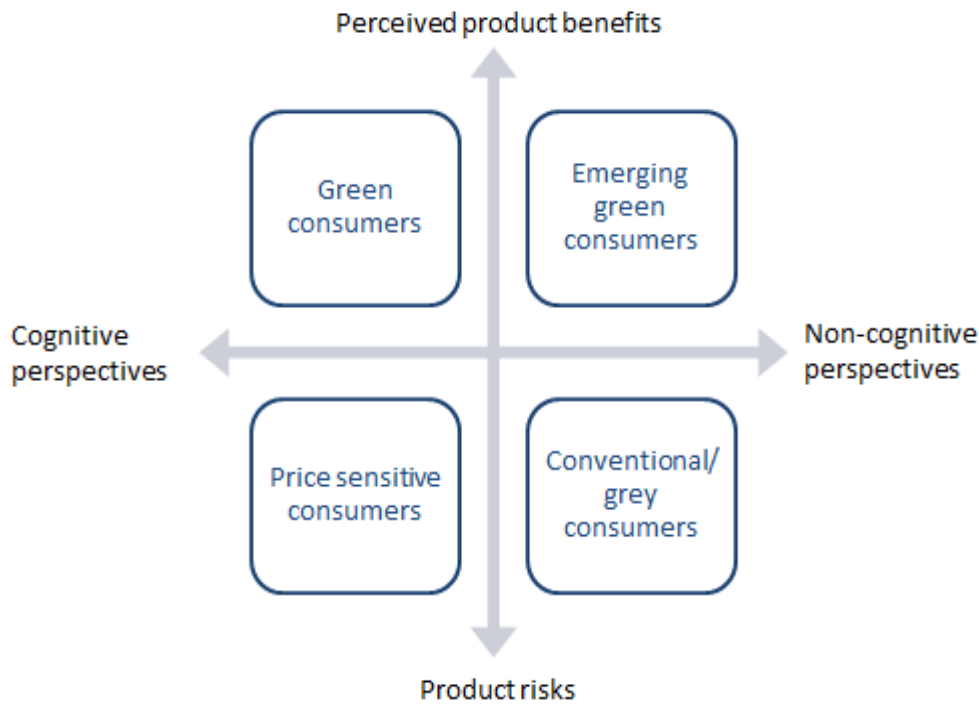
Figure 2 Types of consumer

Source: D'Souza, 2004

Many consumer studies reveal the fact that the general attitude towards green products is positive and that the common assumption about green consumers is that consumers are rational actors, defined as actors who act in line with their values and base their choices on expert environmental information (Salmela, & Varho, 2006).

It is believed that environmental values have a great influence in developing pro-environmental behavior, though this is not guaranteed in all cases. Studies show that individuals concerned about the environment do not always act in a pro-environmental way (Pickett-Baker & Ozaki, 2008). In fact, consumers often tend to reveal the 'correct' or socially 'expected' behavior; however, when confronted with the actual situation they act differently regardless their initial intentions (Devinney, Auger, & Eckhardt, 2010).

Furthermore Jackson (2005) argues that most of the times consumers are 'locked in' unsustainable consumption patterns, influenced by social, institutional or cultural norms, markets and technology. As pointed out in the Swedish Consumer Agency's report (Palm, & Windahl, 1998) environmental factors become more significant when they are linked with aspects to which consumers can directly relate, for example individual health (food, toxicity) and personal finance (energy and fuel consumption).

On the other hand, as McDonald et al. (2009) argue, if consumers are willing to pay premium prices for environmental products, they are expected to do the same for all products and

services from different sectors. However, this is not always the case. Contrary to much research and various behavior models, consumers do not have a clear-cut behavior. As noted before, behavior patterns change constantly (Ekström, 2010). In fact, consumers make different choices when it comes to particular product categories (Devinney, Auger, & Eckhardt, 2010). Respectively, studies show that consumer behavior is product-specific (PSI, 2009), thus consumers' behavior changes when purchasing different products (e.g. food and drink, white goods, consumer electronics, and cars). Different product-related aspects are taken into consideration.

2.3 Sustainability criteria

Studies show that sustainability criteria are used inconsistently during the purchasing process. Moreover, environmental features of products have lower priority when shopping, while price and quality remain the main criteria used in decision making (Palm, & Windahl, 1998). As McDonald et al. (2009) argue consumers are more likely to take into account environmental criteria when purchasing fast moving goods (food and household products) and white goods (refrigerators, washing machines, etc.). In fact, in the case of white goods, one of the main criteria used is the energy efficiency and consumers tend to purchase products with the highest energy rating. In case of small electrical products (computers, TVs, mobile phones) sustainability criteria are rarely taken into consideration, even by the green consumers. It was found that for this product group the brand is the most important criteria (McDonald et al., 2009). However, little research has been done in the field of green purchasing patterns of small electrical appliances. The attention has been focused mainly on the disposal of goods in line with the EU Directive on Waste Electrical and Electronic Equipment (McDonald et al., 2009).

On the other hand, nowadays more and more similar products competing with each other are being launched on the market. Ekström (2010) claims that the attention shifted from the functional characteristics of products to the increasing consumption of brands, where brand names are associated with certain lifestyles, identities and ideologies. Furthermore, the choice of products, particularly brands, express something about us and our own identity. Ekström (2010) further asserts that brands are created by companies associated with very attractive stories and emotions. Then again, the significance of brand is not solely controlled by corporations since consumers are not just passive receivers. They pick up cues and transpose them into their every day life, associating new emotions to the brand, giving a whole meaning to it (Ekström, 2010).

In fact brand names are the centerpiece of product knowledge. Each brand is likely to be associated with other bits of information, these may be associated with the brand's attributes or the benefits and feelings triggered when consuming these products (Engel, Blackwell, & Miniard, 1995).

2.4 Understanding consumer behavior

During the past decades various disciplines, such as psychology, economics, sociology, marketing, neuroscience and evolutionary biology, have contributed to the understanding of the complexity of consumer behavior (PSI, 2009). Understanding how consumers act in certain situations and how decisions are being made when buying products or services is essential for private and public organizations (Ekström, 2010). As Blackwell, Engel and Miniard (1995) suggest, it is necessary for companies to understand what consumers want, what, when and where they buy, as well as how much they are willing to pay for certain products or services. Understanding consumers' purchasing process and identifying gaps in

consumer knowledge (Engel, Blackwell, & Miniard, 1995) are essential for the success of businesses.

However, consumer patterns are changing constantly as consumers have a wide variety of alternatives to choose from. At the same time, consumers are becoming more concerned about the ethical issues and environmental aspects. It is believed that nowadays consumers require more product-related information, concerning the production, transportation and end-of-life (Ekström, 2010).

Consumer behavior is a very complex process. As Jackson (2005) argues, consumer decision making is never a *straightforward process*, as situational, social, cognitive and cultural factors have a strong influence on consumers. It is considered that individuals are often driven automatically by habits in spite of their good intentions to act differently. As such individual preference, intentions and emotions come in conflict with the social norms, situational circumstances and moral concerns (Jackson, 2005).

Habits have a major influence on consumer behavior. According to Biel, Dahlstrand & Grankvist (2005), everyday behaviors are guided by habits. In other words, habits are repeated actions with often minimal conscious awareness (Jackson, 2005). For that reason, consumers may be driven by routinized purchasing behavior as most of the times a familiar sign, label or brand can trigger an automatic reaction (Biel, Dahlstrand, & Grankvist, 2005). By bringing in another dimension, the concept of values, it can be noted that in some cases value driven habits may play an important role in an individual's behavior. For example, individuals driven by environmental values are more likely to exercise pro-environmental behavior and understand the importance of environmental information when making decisions or buying products (Biel, Dahlstrand, & Grankvist, 2005).

Though, it is obvious that often habitual behavior is very difficult to change, various behavioral change theories and models were developed in the attempt to understand this process. One of these models developed by Biel, Dahlstrand & Grankvist (2005) for changing old habits into new ones consists of three key phases.
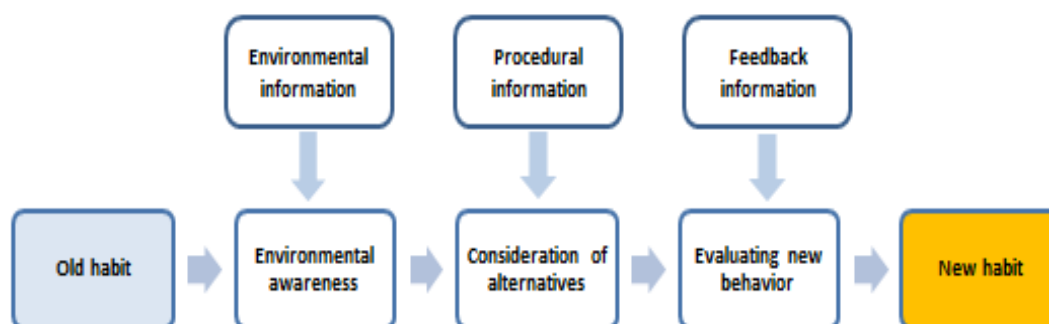
Figure 3 Model of changing habits

Source: Biel, Dahlstrand, & Grankvist, 2005

As shown in Figure 3 factors such as environmental information intervene in the first stage of the model, raising the environmental awareness. In the second phase, attitudes and beliefs linked to a new behavior are being analyzed, whereas individuals examine the new behavior. The third phase includes the testing and evaluation of new behavior resulting in a new habit.

Consequently, changing behaviors may be a long process and requires a conscious decision. Biel, Dahlstrand & Grankvist (2005) note the importance of different types of information used in the three phases as presented in Figure 3.

2.5 Search for information

Various models of information behavior have been developed describing different aspects of the phenomena or different stages of the information seeking activity (Wilson, 1999). A relatively complex model developed by Wilson (1999) attempts to provide a macro-view of information behavior (See Figure 4).
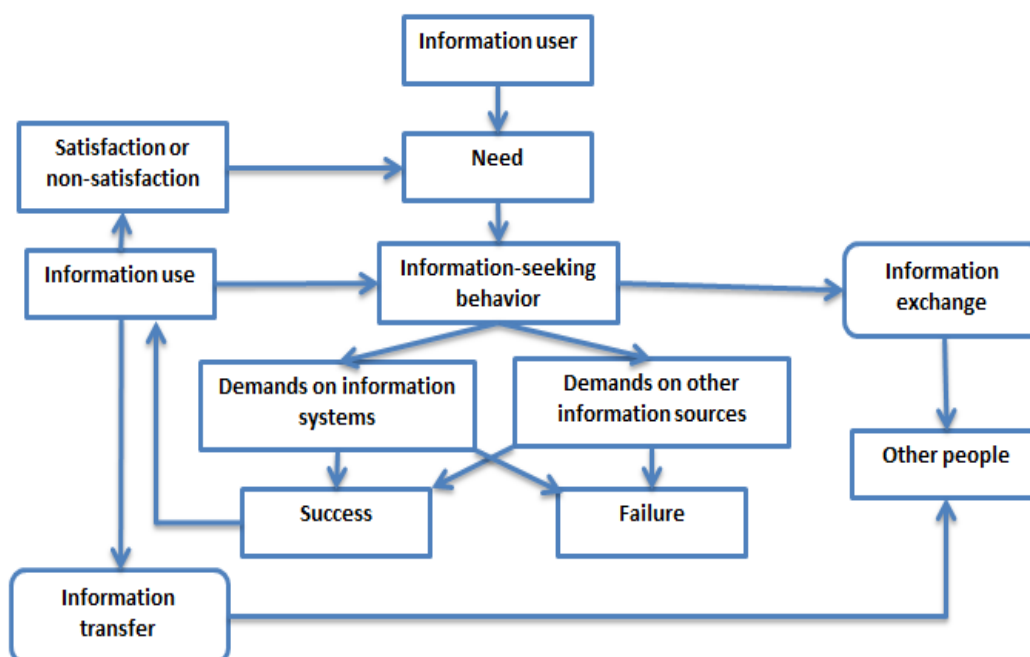
Figure 4 Information seeking behavior model

Source: Wilson, 1999

With this model Wilson seeks to introduce the information-seeking behavior as a need of the information user eager to satisfy its needs by making use of various information sources. If the information is found, the user may use it. In case of failure a new search process has to be restated. The model goes further and also includes an information transfer step, suggesting that the perceived useful information may be transferred between individuals.

However, along with information-seeking behavior another essential process intervenes in consumer decision making, namely the information processing. Nevertheless, Engel, Blackwell, & Miniard (1995) described five stages of information processing: exposure, attention, comprehension, acceptance and retention (See Figure 5).
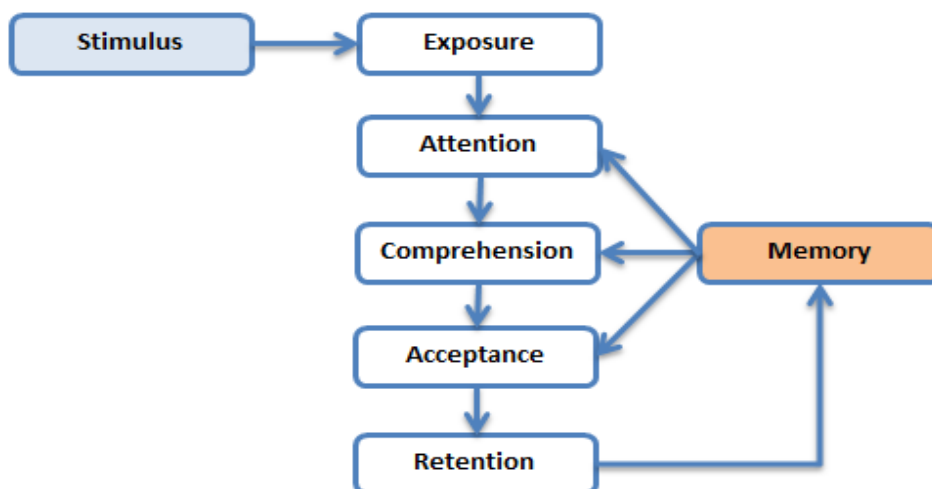
Figure 5 Stages of information processing

Source: Engel, Blackwell, & Miniard, 1995

Taking into account that individuals' capacity of absorbing information is limited (Hansen, 2005), complete understanding of the information is essential in order to guide the decision making. This is also revealed in Engel, Blackwell, & Miniard's (1995) model, namely after exposure and attention the information is further examined (comprehension step), whereas if the information is acknowledged it can trigger the change of existing attitudes or beliefs. The final stage is the retention step, which consist of storing the information into the long term memory so it can be accesible in the future (Engel, Blackwell, & Miniard, 1995).

The downside of this model is that consumers may exercise their selective information processing, therefore only bits and pieces of information will be further accepted and stored in memory. Therefore consumers will only retain information that is in line with their needs and motivations (Engel, Blackwell, & Miniard, 1995). In other words, consumers will more likely process information from which they gain a personal benefit, for example, for non-environmentally concious consumers the personal benefit would translate into the perceived savings from energy consumption when purchasing an energy-efficient product (PSI, 2009).

As noted before, information plays a significant role in decision making. However, product-related features, especially environmental features, are not always available. As a result, consumers need to search for different information sources in order to gather the missing information, generally these sources include: Internet, TV, radio, magazines and specialized articles, salespersons and informal conversations with friends and family (Engel, Blackwell, & Miniard, 1995).

During the last years Internet has become an essential part of current lifestyles, becoming one of the most commonly used information sources. Internet has introduced new forms of services, enabling consumers to obtain more information at any time and make comparisons about products which in turn help them to make more informed decision. At the same time, consumers became more active, they are able to participate in specialized forums and get advice from experts and from other consumers, as well as to share information and provide feedback about products and services. In addition businesses offer the opportunity to interact

with their customers by making personalized offers in line with different consumer needs (Ekström, 2010).

Table 1 shows the information sources most commonly used by consumers, classified according to their source (personal or impersonal) and type (commercial or noncommercial).

Table 1 Information sources

	Impersonal	**Personal**
Commercial	Advertising (TV & radio ads, magazines, Internet)	Salesperson
Noncommercial	In-store information (labels) General purpose media	Social others (friends and family, word-of-mouth)

Source: Adapted from Engel, Blackwell, & Miniard (1995)

Ehrich & Irwin (2005) argue that if the information is available, the consumers will more likely use it. However, if the manufacturers are not providing information related to product features, the consumers will be pushed further into ignorance. Ehrich & Irwin's study on the role of ethical attributes in consumer decision making suggests that consumers are unlikely to seek for ethical attribute information when this may have stressful emotional consequences. They called this aspect of consumer behavior as "willful ignorance", which allows consumers to stay in status quo. As such, in status quo, decision is made using only the available information (Ehrich, & Irwin 2005). Ethical aspects listed by the authors refer to natural resource protection, child labor and animal welfare. However, social aspects are not the main focus of the present study. Ehrich & Irwin's study on avoidance mechanism affecting consumer decision making can easily be adapted to the case of consumers' interest in environmental information. Therefore, consumers remain ignorant to certain kind of information if this is not readily available. At the same time, two possibilities can be questioned, consumers do not seek for information because they simply do not care about it or on the other hand they do not understand the provided information (Ehrich, & Irwin, 2005).

When looking into how consumers assimilate environmental information, research on how Swedish consumers interpret and use environmental information (Palm, & Windahl, 1998) shows the fact that women and young people are influenced and use to greater degree product-related environmental information as compared to men and older people. On the other hand, men prefer to have more detailed information, irrespective the fact whether it is easily understandable or not.

Thus, communicating environmental information is not so much about how much as it is about how it is provided in order to be used in decision making. As such environmental information should be available to consumers when they need it, especially at the moment of purchase, and in an easily understandable form.

Understanding what consumers know, buy, when and where, how much they are willing to pay, as well as identifying gaps in consumer knowledge may help businesses to rule out misunderstandings which may interfere with the product's attractiveness. According to Engel,

Blackwell, & Miniard (1995) *consumer knowledge* refers to the collection of information relevant to consumers to make a decision in the marketplace.

Increasing consumer knowledge is essential for businesses, as consumers are unlikely to purchase a product that they do not know how to use or faced with incomplete product-related information (Engel, Blackwell, & Miniard, 1995).

3 Current practices in communicating environmental information for ICT consumer products

3.1 ICT innovations and the environment

As noted before, consumers often appear to be locked in their routines. At the same time Jackson (2005) argues that behavior change does occur. In fact the fast pace of technological advances can trigger major changes over short periods of time. For example, the introduction of mobile phones, plasma TVs, standby modes of electronic appliances, as well as the introduction of the energy efficiency labeling scheme are all examples of behavior change driven by innovations in the last decade (Jackson, 2005).

The Information and Communication Technology (ICT) is one of the fastest growing sectors having a significant effect on the economy. But the rapid technology development has some serious negative impacts on the environment, as large amounts of resources are involved all through the life cycle of the products along with the use of hazardous substances. Over the last 50 years the ICT sector has experienced dramatic changes, while in the 1950-60s computers were used as calculators and data storage devices, followed by the introduction of personal computer (PC) in the late seventies and the internet during the 1990s, nowadays computers become an everyday necessity. Over the years IT has become an important tool of communication being part of consumers every day activity (Ekström, 2010). At the same time, significant improvements have been accomplished by reducing the size and weight of products (e.g. desktop computers, laptops) and improving energy efficiency (Plepys, 2002).

As Plepys (2002) noted, by looking into the life cycle of electronics, major impact areas are identified, such as global warming, natural resource depletion and human toxicity. Although, ICT's overall greenhouse gas emissions are relatively small compared to the sector's influence on the global economy, it is estimated that the ICT sector contributes with about two percent to global CO_2 emissions (UNEP, 2012), roughly as much as the aviation industry (Shah, Christian, Patel, Bash, & Sharma, 2009).

In terms of resource use the manufacturing phase of electronic products is highly material-intensive (Plepys, 2002). For example, over 240 kilograms of fossil fuels are used to manufacture one desktop computer, approximately ten times the computer's weight. While in case of refrigerators or automobiles, for example, the amount of fossil fuels used is approximately the same as the finished product's weight (UNEP, 2012).

Furthermore, due to rapid technological advances older electronics are being replaced with new ones at a fast pace while the life span of products is becoming shorter. As a result major concerns are being raised due to the environmental effects at the end-of-life of electronics (Plepys, 2002). Safe disposal of e-waste is not always ensured due to undeveloped or even the absence of an appropriate recycling infrastructure. In order to address this growing issue, nowadays policies are being introduced at national and international level requiring producers to take responsibility for their products by collecting and safely disposing them. An example of policy intervention is the EU Directive on Waste Electric and Electronic Equipment (WEEE). At the same time, as Plepys (2002) argues, these policies have the potential to influence producers in designing more resource-efficient products.

More efficient use of natural resources and improvements in energy efficiency may reduce the manufacturing costs and the final product or service price. However, as Plepys (2002) argues, a more energy-efficient product does not necessary reduce the overall consumption. In fact, rapid technological developments and constant price decreases of ICT products and services

all contribute to a growing demand. The concept describing this situation is known as the *rebound effect* (Plepys, 2002). The rebound effect refers to the fact that the development of a more energy-efficient product leads to price decrease as less energy is needed for the production of the same product, which in turn enables a higher demand of the product or service (Plepys, 2002). In other words, net savings from a more energy-efficient product may be used by consumers to purchase other products or services, leading to an overall growing consumption (Herring, & Sorrell, 2008).

Even though, the growing use of ICT products has a major impact on the environment, overall the ICT sector has great potential to promote a more sustainable development by enabling carbon reduction and developing more energy-efficient and environmentally friendly products, known as "Green IT" (UNEP, 2012). Furthermore, the ICT sector can enable significant improvements in other sectors as well reaching economic growth at the same time, for example, by increasing e-commerce and reducing transportation, increasing energy efficiency and introducing smart electricity meters, increasing the consumption of virtual goods (digital music, e-books), introducing virtual meetings and teleconferencing to reduce work-related travel costs and cutting CO_2 emissions (UNEP, 2012).

3.2 Sustainable product design making products smarter

Another approach used to promote sustainable development is to encourage producers to adopt life cycle thinking and integrating the environment into the design process.

Ecodesign is described as an approach to design products taking into account the environmental impacts of a product throughout its whole life cycle (See Figure 6) from raw material extraction, production, use, disposal and recycling (European Commission, 2012e). The aim of ecodesign is not only to extend the lifetime of a product, more importantly it is to integrate environmental aspects in the product planning, development and design phase in order to minimize the negative environmental impacts and ensuring an environmentally friendly product during the whole life cycle (Yang, 2011).
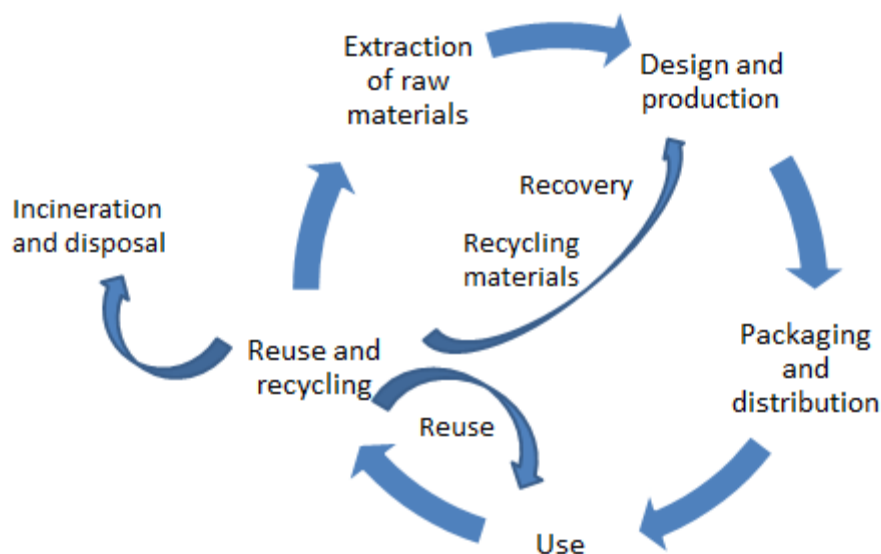

Figure 6 Life cycle stages of a product

Source: Estate Management – University of Cambridge, 2011

Some important directives and regulations impacting product and service design of ICT products, introduced in Europe but with worldwide implications, are as follows (Harmon, Demirkan & Raffo, 2012):

- European Directive on Waste Electrical and Electronic Equipment – aiming to encourage improved product design of electrical and electronic equipment in order to ease dismantling and recovery (EC, 2003)
- European Directive on the Restriction of Hazardous Substances (RoHS) – restricts the use of lead, mercury, cadmium and other substances in the manufacturing of electronics (Harmon, Demirkan & Raffo, 2012)
- Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) – regulates the production and use of chemicals, with the aim to ensure the protection of human health and the environment (European Commission, 2012h)
- Electronic Product Environmental Assessment Tool (EPEAT) – environmental rating system for electronics

Since 2006, according to the WEEE Directive, producers of electrical and electronic equipment have been responsible for collecting and recycling their products when sold in the European Union. This in turn encouraged the integration of various ecodesign measures in order to improve the environmental performance of products (Yang, 2011). Studies show that lately there has been growing interest in the energy efficiency of electronic products when homeowners are trying to reduce their overall energy costs. Because of this growing demand manufacturers are being encouraged to design more energy-efficient technology products (PSI, 2009).

The European Ecodesign Directive provides ecodesign requirements for certain products in order to improve the environmental performance of the product, for example, by lowering the energy consumption during standby mode of electronic appliances (European Commission, 2012e). The Ecodesign Directive of 2009 covers firstly all energy-using products, for example, consumer goods such as computers, TVs, washing machines, boilers, light bulbs, etc., as well as industrial products and secondly energy-related products which do not use energy but can save energy, such as windows, shower heads, taps, insulation material (European Commission, 2012e). The Directive is intended to be used with other policy instruments, especially with the Energy Labeling Directive (EU Energy label), as well as with other schemes such as the EU Eco-labeling scheme and Green Public Procurement (European Commission, n.d.).

3.3 Professional users versus private users

Nowadays many companies are integrating environmental aspects into their business practices. Studies claim that the introduction of "green products" and "green advertising" suggests that some companies are becoming aware of the green advantages and by the fact that consumers are willing to pay for environmentally friendly products (Bjørner, Hansen, & Russell, 2004). As a result well known names within the ICT sector, for example Lenovo, Samsung, and Nokia, are starting to promote green products, energy-efficient televisions and computers, as well as actively support take-back programs and recycling of electronic products.

Usually sustainability efforts are reported in the companies' annual sustainability reports, or/and on their websites (Comas & Seifert, 2012). However, discussions with practitioners from the ICT sector revealed the fact that consumers have little knowledge about the company's "green" achievements.

Companies are frequently making efforts in implementing Green ICT solutions at the workplace. Businesses pay more attention on making operations more environmentally sound, by adopting eco-friendly procurement, use of energy-efficient office equipment, as well as ensuring environmentally sound disposal and recycling. At the same time companies concerned in improving their image and brand place a high importance on the outcomes of sustainability rankings that have been developed by various organizations, among others, Greenpeace's Guide to Greener Electronics, and Sustainable Brands.

In addition, companies' Green ICT policies have the potential to drive change by encouraging employees to change their habits. Consumers as users at the workplace and at home have the ability to apply green practices. At the same time, employees themselves have the ability to enable change, by expressing their views and preferences.

It is well known that consumers tend to choose the more familiar option whether it is a familiar brand or an already used product, and therefore companies are facing challenges when selling unfamiliar products (Engel, Blackwell, & Miniard, 1995). For this reason, companies are making huge efforts in creating knowledge about new or unknown products. In parallel, a number of different claims, logos and environmental statements are making their way into the marketplace. These in turn may often be too overwhelming or even misleading for the consumer. Such concerns raised the need to standardize environmental statements and regulate ambiguous or misleading statements. The introduction of eco-labeling schemes is one example attempting to standardize the environmental claims (Thidell, 2009).

On the other hand, it is also well known that the average user allocates less time for purchasing decisions, whereas procurement in companies is conducted by trained professionals, who take more time to evaluate the products' features and performance by analyzing detailed product declarations. It is important to note that there are significant differences between private and institutional purchases, hence different formats for information provision. One key difference is that professional purchasers buy larger volumes and have different relation with the whole supply chain, as well as higher accountability, as such their information needs differ greatly from the private consumers' needs (Leire, 2009).

As noted before, sustainability criteria do not play a major role in private consumers' purchasing decision making, whereas it is more frequently used in public and private procurement (Comas & Seifert, 2012) as their purchasing processes are more strict and formalized. Moreover, various guidelines and manuals have been developed for professional users as well as for the public and private organizations to help them make more environmentally conscious choices (Thidell, 2009). In the following sections environmental criteria used by public organizations in their procurement activities and different eco-labeling schemes relevant for ICT products will be presented.

3.4 Green Public Procurement practices

The European public authorities are major consumers; nearly 2 trillion Euros are being spent each year on goods and services (European Commission, 2012b). The Green Public Procurement (GPP), introduced by the European Commission, is a voluntary instrument defined as:

> *[..]a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured (European Commission, 2008b, p. 4).*

By promoting GPP, public authorities have great potential to influence industries to develop green products and technologies lowering the environmental impacts, thus leading to a more sustainable production and consumption (European Commission, 2012b). Under GPP mandatory obligations have been introduced for IT office equipment. All IT equipment (for example computers, monitors, copiers, printers, scanners, fax) purchased by public authorities must comply with the minimum energy efficiency requirements according to the Energy Star requirements (European Commission, 2011). Other aspects in the GPP criteria for office IT equipment include: noise emissions, use of mercury in LCD monitors, use of certain flame retardants, disassembly of the equipment, recycled content and recyclability (European Commission, 2012c).

Figure 7 shows an example of GPP purchasing recommendations for office IT equipment based on key environmental impacts.

Key environmental impacts
- Energy consumption and CO_2 emissions
- Air, soil, water pollution
- Negative impact on health of employees due to noise
- Use of energy, finite resources and harmful emissions related to the production of IT products
- Generation of waste, final disposal

GPP approach
- Purchase energy efficient models
- Purchase products with restricted amount of hazardous content
- Purchase products with restricted noise level
- Design for recycling, extended life and promote take back options
- Ensure recyclability of the packaging used
- Safe disposal of final product

Figure 7 GPP purchasing recommendations for office IT equipment

Source: Adapted from European Commission, 2012c

3.5 Establishing business-to-consumer relationship

Business-to-consumer (B2C) relationship refers to a relationship that occurs after a transaction between a company and a consumer. In today's marketplace understanding consumers is more crucial than ever before. In order to better meet consumer demand, it is essential for companies to understand and establish long-term relationships with their consumers, as a buyer-seller relationship hardly ends after the sale is finalized. In fact this relationship may influence the buyer's next choice. That is why building long lasting relationships in consumer markets is crucial in the marketplace (Vesel & Zabkar, 2010).

At the same time consumers develop and maintain strong relationships with brands. In contrast to brand loyalty, consumer-brand relationship is a much more profound relationship. Therefore brand relationship is based on a strong emotional connection with the brand, which lasts even after the sale, resulting in the determination to repurchase the specific brand (Huner, Vollhardt, Matthes & Vogel, 2010).

Different consumer relationships and influential powers can be distinguished between the Telecom and IT actors. Mobile service operators have a unique relationship with their end-users. As they hold detailed data about their subscribers they can directly reach their consumers through various mobile solutions. The multichannel approach enables mobile operators to build strong relationships with their customers by offering information about products and services through various channels. Moreover their influence is much more targeted than other IT actors' approaches. Hence their marketing opportunities differ from other IT actors' business strategies. Other IT actors selling consumer products rely more on developing consumer-brand relationship in order to strengthen their position on the market.

3.6 Environmental labels and standards as information sources

Eco-labels are informative and voluntary policy tools with the goal to help consumers make more environmentally conscious choices (Thøgersen, Haugaard, & Olesen, 2010). With the growing interest for greener products, the number of eco-labeling schemes increased in the last decades. The increasing number of eco-labels makes it challenging for both consumers and professional users, as not all of labeling schemes use the same criteria (Case, 2009). Some of them focus on particular environmental aspects such as recyclability, energy efficiency, etc., while others assess the product's entire environmental impact from extraction to disposal. Various efforts are under way in the EU to harmonize the existing numerous labeling schemes, with a special focus on the energy consumption criteria (European Commission, 2011c).

Eco-labels as consumer-oriented instruments allow producers to communicate their products' environmental characteristics. At the same time, they influence producers to continuously improve their products' performance by decreasing the negative environmental impact (Thidell, 2009). In addition, labeling is frequently perceived as a guarantee of quality, as consumers most often are inclined to trust the certifying organization (Palm, & Windahl, 1998).

The International Organization for Standardization (ISO) defined three types of voluntary environmental labels:

- Type I labels (ISO 14024) – Voluntary, third party certified eco-labels, based on multiple criteria

- Type II labels (ISO 14021) – Informative environmental self-declared claims

- Type III labels (ISO 14025) – Voluntary, environmental product declarations, provide quantified environmental data based on lifecycle assessment

The eco-labels cover a wide range of products and services. As a result of the high demand for green products, eco-label criteria were developed for the consumer electronics sector as well, covering for example personal computers, televisions, laptops, monitors, etc. Examples of labels covering the environmental impacts of ICT are as follows: EU Flower, Nordic Swan, Blue Angel (Germany), Energy Star, and TCO Development. However, the majority of labels in the consumer electronics sector deal with energy efficiency. In the following sections the most commonly used eco-labels and standards relevant for the ICT sector in the Nordic region will be briefly presented.

3.6.1 The Nordic Swan

Established in 1989 by the Nordic Council of Ministers, the Nordic Swan is the official eco-label of the Nordic countries (Thidell, 2009). As a type I label, it is a practical tool supporting consumers to make more environmentally conscious decisions, whereas at the same time contributing to sustainable consumption. Until now criteria for 63 product groups were developed covering a wide range of product and service categories such as: textiles, transport and vehicles, energy, cleaning, buildings, office stationery, gardening, furniture and ICT (Ecolabelling Sweden, 2012).

For example, in case of computers the criteria for meeting the Nordic eco-label requirements, as indicated in the criteria document, focus on the following aspects (Nordic Ecolabelling, 2011):

- Power consumption
- Design
- Plastics and their additives
- Heavy metals

- Recycling of discarded products
- Noise emissions
- Ergonomics

The Nordic Swan is a well known trademark in the Nordic region. In fact, representatives from the Nordic Swan organization claim that approximately 98% of the consumers recognize and understand it. As a result companies may use the label in their marketing strategies (Nordic Ecolabelling, 2011), as well as to strenghten the company's credibility and build market shares.

According to the Nordic Eco-labeled products database several ICT products are Swan certified. Wellknown brand names, among others, within the IT & Telecom sector having Nordic Swan certified products are as follows: Lenovo, Toshiba, Fujitsu (desktop computers, laptops, and monitors), Brother, Sharp (printers) and Samsung (TVs) (Ecolabelling Sweden, n.d.).

3.6.2 EU Eco-label

Established in 1992, the EU Eco-label scheme is a voluntary tool that promotes environmentally friendly products and services. Recognized in the EU member states as well as in Norway, Iceland and Liechtenstein, the label is accepted as the EU's official eco-label. Currently the scheme covers 23 types of products and services, except food, drinks and medicines. Criteria are also developed for electronic equipment covering personal computers, laptops and televisions. Moreover, the products and services granted the EU Eco-label is easily recognizable by most of the consumers as they carry the Flower logo (European Commission, 2012d).

The criteria developed for electronic equipment aims to promote products that use less energy, use less natural resources and hazardous substances, have low noise levels, are more durable and easy to recycle (Kougoulis, Kaps & Wolf, 2011).

Currently, out of the three ICT products included in the EU eco-labeling scheme, according to the Eco-label catalogue, only TVs from some manufacturers (for example Samsung, Sharp, Toshiba, Philips, LG) are certified (European Commission, 2012g).

3.6.3 TCO label

The TCO label, introduced by the Swedish Confederation of Professional Employees, is a third party, voluntary certification scheme for IT office equipment (Thidell, 2009). The TCO certification includes a wide range of IT products such as displays, printers, PCs, laptops, tablets, projectors and headsets. In addition, the TCO certification criteria include several environmental aspects, for example energy consumption, hazardous substances, product lifetime, recycling, and social aspects such as ergonomics, emissions and electrical safety. The TCO certification is intended to be used by professional users in their IT purchases (TCO Development, 2012a).

Based on the TCO-certified product database available on the TCO Development website, displays are by far the most commonly TCO-certified IT products. A wide range of brand names appear to have TCO-certified display types. Discussions with representatives from TCO Development revealed the fact that approximately fifty percent of displays sold around the world fulfill the TCO criteria. However, in case of other product types (printers, PCs, laptops, tablets, projectors and headsets) only a few of brand names appear to have TCO certification (TCO Development, 2012b).

3.6.4 ENERGY STAR label

The ENERGY STAR is a program created by the U.S. Environmental Protection Agency and the U.S. Department of Energy promoting energy-efficient products by marking them with the ENERGY STAR label. Perceived as an energy efficiency symbol, the label helps consumers to make more conscious purchasing decisions (Energy Star, 2012).

The ENERGY STAR label is voluntary and can be awarded to a wide range of products. Today, the ENERGY STAR logo is widely accepted and recognized on home cooling and heating systems, home electronics and office equipments, for example refrigerators, dishwashers, washing machines, air conditioners, televisions, personal computers, monitors, laptops and printers.

The ENERGY STAR label is the most commonly used label. Many ICT products, TVs, monitors, mobile phones, notebooks, PCs, printers, among others, are ENERGY STAR certified. In fact discussions with practitioners revealed the fact that the label is frequently recognized by consumers.

3.6.5 EU energy label

The European energy labeling of household appliances was introduced to provide standardized information to consumers about the energy consumption and performance. The goal is to provide accurate, relevant and comparable information that will influence the consumers' choice, as well to stimulate manufacturers to produce more energy-efficient products. The introduction of the Energy label contributes indirectly to reach the EU's 2020 target of 20% increase of energy efficiency (European Commission, 2012).

In 2010 a new framework Directive was adopted with the introduction of the new energy label layout with uniform and simpler design features for different product categories. The EU energy label gives information about the energy efficiency of the product, total energy consumption, as well as other product relevant information such as water consumption and noise level for washing machines and the screen size for televisions (Defra, 2011). The label rates products from A (the most efficient) to G (least efficient). Lately the scale was extended

with the A+, A++ and A+++ classes for certain appliances. The label is mandatory for all white goods, home appliances and light bulbs placed on the EU market, for example refrigerators, freezers, washing machines, dishwashers, wine appliances, air conditioners, electric ovens and televisions (Europe's Energy Portal, 2012). Displaying this information at the point of sale allows consumers to compare the energy consumption of products and make more informed purchasing decisions.

Discussions with salespersons from consumer electronics retail stores revealed the fact that in case of white goods the main criterion is the energy efficiency, a common pattern of consumers purchasing white goods is the selection of products with the highest energy rating. The experience is that consumers find the label simple and easy to understand. The success of the EU Energy label in case of white goods, according to McDonald et al. (2009), suggests that consumers are looking for simple information from trustworthy sources. However, in the absence of easily understandable information consumers will likely ignore the sustainability criteria as noticed in the case of small electrical goods (McDonald et al., 2009).

3.6.6 Environmental product declarations

The environmental product declaration (EPD), (Type III) is a tool to communicate quantitative information about the environmental performance of a product or a system. Based on the framework developed by the Swedish Environmental Management Council, an EPD includes detailed information based on lifecycle assessment considering all stages of the product's life (Thidell, 2009). The EPD contains information for professional users (companies and organizations) about material use, energy use, energy efficiency, chemical content, emissions to air, soil and water, and waste generation (EPD, 2010). The EPD is developed to meet information needs for green procurement.

The first part of an EPD includes the product and manufacturer description. Furthermore the EPD describes the environmental performance of the product based on the lifecycle assessment, providing comparable information about the environmental performance of products and services (EPD, 2010).

The EPD is used mainly in business-to-business communication (European Commission, 2001). The potential users of EPDs are companies, government agencies, non-governmental organizations, investors, but then again individual consumers are not exluded according to the proponents. Criteria of EPD submission may be included in the purchasing policies of companies using an Environmental Management System. Consequently companies may require their suppliers to comply with measures that are traceable in the EPD in order to reduce the environmental impact of the supply chain. Accessible on the internet, the EPD can be used by private consumers, however, as it provides very detailed information it is not easily understandable and it may require some environmental knowledge (Bolon & Fujihira, 2006).

3.6.7 The Eco Declaration Standard

The Ecma-370 self-declared standard, introduced in 2006, is a new tool for providing comparable environmental information for ICT and Consumer Electronics (CE) products to professional buyers. The Eco Declaration (TED) contains information about the company's environmental profile as well as environmental product attributes covering the following areas (ECMA, 2009):

- hazardous substances   - batteries

- electrical safety
- consumable materials
- packaging materials
- treatment information
- ecodesign (disassembly, recycling, product lifetime)

- energy consumption
- emissions (noise, chemical)
- ergonomics
- documentation

TED is widely used by professional users in their purchasing decision making. Moreover eco declarations for some consumer products are also available on some IT companies' website. However, because of the detailed product-related information provided, the eco declarations may be too difficult to understand for the private users and perhaps for professional users as well.

Table 2 Characteristics of labels and standards relevant for ICT products

Label/Standard	Communication approach	Product groups	Readability
Nordic Swan	Information for end consumers. Product requirements are publicly available	All kinds of consumer goods	Easy
EU Eco-label	Information for consumers. Product requirements are publicly available	All types of consumer goods; Three ICT product types: personal computers, laptops and televisions	Easy
TCO label	Information for professional users	IT office equipment (displays, notebooks, tablets, desktops, all-in-one PCs, projectors, headsets	Easy
Energy Star	Information for consumers	Wide range of energy using products e.g. refrigerators, dishwashers, washing machines, air conditioners, televisions, personal computers, monitors	Easy
EU Energy label	Recognizable and comparable information for consumers	Electrical appliances mainly white goods (refrigerators, freezers, washing machines, dishwashers, wine appliances, air conditioners, electric ovens and televisions)	Easy
Environmental product declarations (EPD)	Detailed information mainly for business-to-business communication, however, business-to-consumer information is not excluded. Documents are publicly available	All type of products and services	Difficult, requires some environmental knowledge
The Eco Declaration (TED)	Extensive information for professional users. Standard documents are publicly available	ICT and consumer electronics products.	Difficult, requires some environmental knowledge

3.7 Other information sources

Evidence shows that internet-based opinion sources, such as online rating sites, blogs, company websites and social networking sites, all have an impact on consumers' purchasing behavior (Karakaya & Barnes, 2010). Moreover, with the increasing number of consumers using online sources to search and benchmark products online before the actual purchase, social media channels have great potential to influence consumers' decision making.

Another method to obtain more product-related information is through online consumer reviews. The online review systems are widely used by consumers and play an important role in the consumers' decision making with regards to purchasing a product or a service (Karakaya & Barnes, 2010). These online reviews are often used as informant and recommender of products. Two types of review sources can be identified: consumer-developed and marketer-developed reviews sites (Bae & Lee, 2011). The key difference between these two sites is that through consumer-developed sites social relationships can be established. One of the main reasons for consumers to establish and participate in online communities and blogs is to exchange product information and their personal unbiased experiences about a product with other consumer. Moreover, studies show that consumers often hesitate to use the marketer-developed sites, as they usually perceive it as untrustworthy providing 'biased product information in line with the sellers' objectives (Bae & Lee, 2011).

3.8 Exercising the influencial power

As noted before often consumers rely on different information sources; for example, recommendations, communication with friends, social networks, websites and magazines, when making purchasing decisions. Moreover, consumers' behavior depends to a great extent on the availability of products on the market and their environmental performance (European Commission, 2012f). Nevertheless, Devinney, Auger and Eckhardt (2010) argue that companies, retailers and the media have a great potential to manipulate the shopping experience by controling the information sources that consumers are relying on.

Retailers have the power to decide which product makes it to their shelves and limiting varieties and restricting to some degree the shopping behavior. Therefore the availability of certain products and brands at store level is not just the result of consumer demand, but this involves a more complex process by connecting supply chains and marketing activities (Devinney, Auger, & Eckhardt, 2010). At the same time retailers can influence the purchasing experience through the information provison, whether through product-related information received from the manufacturer, personal recommendations of salespersons or perceived expertise with respect to the product. Figure 8 shows the supply and demand interactions between producers, retailers and consumers.

The main consequence of this is that the marketplace is not solely influenced by consumers' preferences, manufacturers and retailers have the ultimate power to shape the shopping experience. As noted by Young, Hwang, McDonald & Oates (2009) consumers are more likely to purchase green products in major retailers. Whereas it is highly possible that green products may not be included at all on the shelves due to retailers strategy. Hence the average consumers purchase only what is available on the market and only those with a strong preference may go further and search for the desired product.
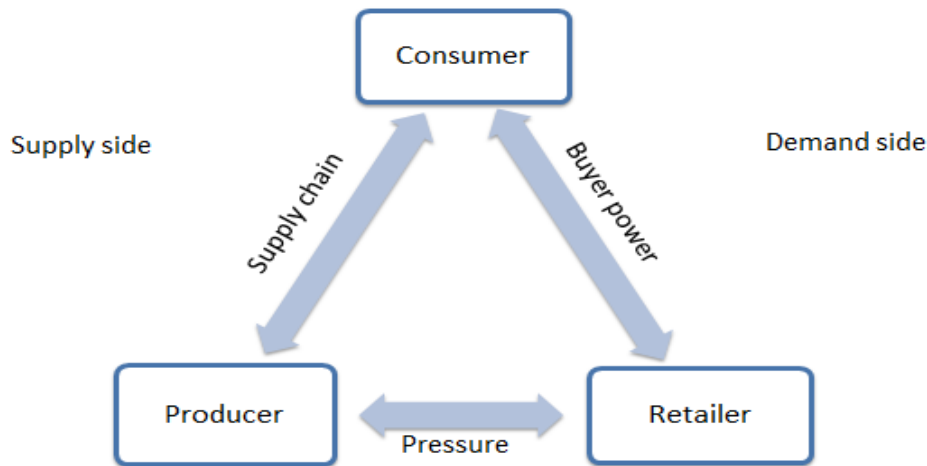
Figure 8 The Production Retail Consumption Triangle

Source: Lucas, Brooks, Darnton, & Jones, n.d.

Due to limited product packaging space, it is unlikely that additional environmental information would fit on the packaging, while it is not practical for salespersons to present all the information to a consumer (Ehrich, & Irwin, 2005), as it may be overwhelming at the same time. Therefore, retailers can play an important role in promoting or narrowing down consumers' choice by not including green products on shelves.

Conversely, it is important to mention that consumers have ability to act as change agents and are vital in encouraging pro-environmental change by expressing their preferences by sending clear signals to manufacturers and reinstating their buying power and creating demand. If there is demand, manufacturers will eventually adapt their product assortment and revise their marketing startegies in order to obtain a competitive edge. Currently there is somewhat demand coming from the consumers as manufacturers are starting to consider communicating the environmental characteristics of their products. However, more powerful signals should be sent by the consumers in order to achieve an actual change.

3.9 Providing environmental information for private consumers

As noted before the growth of the ICT sector raises major concerns with regards to the ICT's overall environmental impact. Providing meaningful product-related information may enable consumers to make more informed purchasing decisions, as well as contributing to sustainable consumption.

A 2009 Eurobarometer survey, conducted to examine EU citizens' (from the 27 Member States) knowledge about sustainable consumption and production, found that three out of ten EU citizens felt that the best way to promote environmentally friendly products is by providing suitable information to consumers. At the same time, eight out of ten EU citizens claimed that the products' environmental impact is an important factor when deciding which product to purchase, as well as a large number of respondents claimed that they often take into account energy efficiency when buying energy-using products. Moreover respondents of the same survey had different opinions with the level of trust in producers' environmental

claims, 49% trust of respondents claimed that trust such claims and 48% do not trust (Eurobarometer, 2009).

Discussions with practitioners revealed the fact that currently there is vast amount of product-related environmental information available in different forms and accessible through various channels. Most of this information is presented through self-declared claims by the producer, third party certified eco-labels, environmental product declarations, producers' website, consumer organizations, etc. Despite the fact the information is available, most of the times consumers would need to look hard and know exactly where to search for the relevant information. But it is well known that the average consumer would unlikely search for such information if it is not readily available on the product or at the point of sale, currently only the most curious consumers, described earlier as green consumers, would do so (European Commission, 2001).

Moreover, a recent EU study (BIO Intelligence Service, 2012) found that often consumers are overwhelmed with too much information which is not fully understood by them or even ignored when making a decision. As a result it is essential to provide the right information at the right time in order to empower them to make more sustainable decisions.

At the same time consumers often complain about the lack of information, wanting to know more about the product characteristics (BIO Intelligence Service, 2012). However, whether they understand it or are willing to use it in purchasing decision making is arguable. Nevertheless, studies show that a major part of the consumers are willing to make more sustainable choices provided they can afford it (Michaud, Llerena, 2008).

As noted before, currently only a small percentage of consumers with very strong environmental values, trying to adopt sustainable lifestyles, apply the same criteria used for everyday fast moving products when purchasing technology-based products (Young, Hwang, McDonald, & Oates, 2009).

Consumer studies conducted by Young, Hwang, McDonald, & Oates (2009) show that the most commonly used product-related criteria in case of green purchasing focus on the following areas:

- Environmental performance (energy efficiency, energy rating, durability)

- Product manufacturing (recycled material content, hazardous substances, repairability)

Moreover, McDonald et al. (2009) argue that 'being green' requires time in individuals' life which is not very customary in today's lifestyles. People do not have the time for searching for information, understanding it and searching for the right product. Therefore McDonald et al. (2009) highlight the importance of the introduction of single issue labels to guide the consumers.

On the other hand, various strategies have been identified attempting to change behavior. One of these strategies are known as informational strategies with the aim to increase the consumers' knowledge about the environmental implications of their behavior by changing perceptions, motivations and knowledge to encourage pro-environmental behavior (Engel, Blackwell, & Miniard, 1995).

Studies show that consumers are more likely to act pro-environmentally when adequately informed (Michaud & Llerena, 2008). Information has a major role in decision making, therefore consumers need to have the adequate information at the point of purchase. Furthermore, it is supposed that consumers will spend more time when purchasing durable goods such as consumer electronics as opposed to fast moving products (BIO Intelligence Service, 2012). For that reason and due to the limited volume of information that consumers can process it is necessary to communicate the right information in order to help consumers to make more environmentally concious decisions.

4 Findings

In the following chapter the main findings from the literature review, interviews and questionnaires are presented.

4.1 Key findings from literature review

As noted before, many consumer studies highlight that behaviours are complex and continuously changing, as well as various organizational and societal factors influence the individuals' behavior. At the same time it was found that behaviors are context-specific and product-specific and most often consumers are locked in unsustainable consumption patterns.

At the same time many consumer studies underline the fact that consumers are rational actors and make rational decisions by evaluating the costs and benefits. Even though the price and quality are the main criteria used in purchasing decision making, literature suggests that consumers often express their desire for more product-related environmental information, but then again only a small percentage of consumers actually take it into consideration when making purchasing decisions. At the same time, it was found an inconsistency in providing environmental information, as most often information is available only in case of certain products. Confronted with limited time, consumers are unlikely willing to search for more or properly understand all the available information in order to make an informed decision. Therefore, it is important to note that if the information is not available consumers are unlikely to search for it.

4.2 Key findings from interviews and questionnaires

Interviews with ICT practitioners revealed the fact that the general perception is that consumers rarely ask for product-related environmental information and there is an overall low level of awareness among consumers regarding the ICT industry's green achievements. At the same time, the price, performance, convenience and the brand are the main criteria influencing consumers' purchasing behavior.

Interviewees argued that product-related environmental information should be readily available at the point of purchase, at store level and online on the company's website. At the same time practitioners pointed out the need for providing simplified and consumer oriented environmental information, similar to the ECMA 370 Eco Declaration and the need for the introduction of a single label easily understandable by consumers covering all major environmental areas. Furthermore, ICT practitioners agreed that if demand is perceived from the consumers the companies will adapt their portfolios accordingly.

4.3 How much environmental information is available for private consumers?

As noted before, consumer studies show that the lack of information related to environmental performance is more common in case of brown products, especially in case of computers, televisions, DVD players, etc., as compared to other product categories (McDonald, Oates, Thyne, Alevizou, & McMorland, 2009).

By looking into how much environmental information is available for consumers for products within the ICT sector it was observed that environmental features currently are available mainly for products advertised as "green". Several ICT product categories, such as computers and mobile phones, from different major ICT producers' websites (for example

Lenovo, HP, Samsung) were examined in this respect, reaching to the same conclusion. In addition, the same was observed when visiting major electronics retail chains in the Skåne region in Sweden. Most of the time, none or very minimal product-related environmental information is displayed at shelf level or on the products' packaging or configuration information. Nevertheless, it is important to note that the terminology 'available information' here means information that could be easily understood and used by the private consumers. Practitioners from the ICT sector argue that there is plenty of product-related information out on the market, though most of this information is targeted to professional customers and public organizations.

Then again, informal discussions with salespersons from major consumer electronics retail chains in Sweden revealed the fact that there were cases when several manufacturers ran specific advertising campaigns in the stores to promote products with "green" features. In those cases additional information with regards to the products' "green" characteristics were displayed in the store next to the products. Unfortunately, data measuring the influences of these informative materials on consumer purchasing patterns was not available.

Interviews with ICT practitioners and questionnaire responses revealed the fact that the consumers' overall interest in product-related environmental information is very low. Only few requests are recorded by the companies' customer support centers in this respect. The same was confirmed by several consumer electronics retail salespersons as well. As observed, consumers rarely ask for more product-related environmental information, however, when they do so usually the main concern is focused on the product's energy consumption, primarily in case of the biggest energy-consuming products (TVs and white goods especially) and not necessarily in case of computers, laptops or smaller appliances.

Furthermore, discussions with consumer electronics retail salespersons revealed the fact that in case of small electronics and IT products the most frequent questions touch upon the durability and end-of-life, more exactly what happens with the product at the end-of-life and if there is any take-back system. Generally frequent questions about the products' lifetime occur mainly in case of printers. Although the ENERGY STAR labeling is easily recognized by consumers, in case of small electronics less attention is placed on environmental labels (BIO Intelligence Service, 2012). Retail salespersons confirmed that only few customers actually ask for more details about the eco-labeling of the IT products.

As mentioned before, it was observed that consumers generally are more concerned about the products' energy consumption, however, not necessarily for environmental reasons. It was found that there is a higher level of awareness of the energy label in case of white goods; in fact it may be the only label consumers truly understand. Interviewed salespersons from major Swedish retail chains confirmed the fact that consumers are more aware of the energy rating scheme, in fact this plays an important part in the purchasing decision making as consumers look for it and are willing to pay a premium for the highest rated product.

On the other hand, the majority of interviewees and questionnaire respondents pointed out that the ECMA 370 Eco Declaration is the main information source, mainly for professional users but also for private users, offering detailed information for consumer goods based on lifecycle assessment. Although it is available also for some of the products on the company's website, the Eco Declaration is not easily understandable by the private consumer (see Appendix 3).

In addition, interviewees pointed out that in general it is difficult to assess the current experiences of providing environmental information as low responses are being perceived from consumers. Moreover, since so many other factors influence the behavior change, it is extremely difficult to differentiate which factors that triggered the behavior change.

It was found that, opinions are divided when it comes to the importance of providing environmental information. Some consumer electronics retail salespersons claimed that providing any environmental information would not make any difference as currently consumers are not asking or searching for more information. On the other hand, other salespersons argued that even if consumers are not actively searching for the information at the store level it may be highly probable that if available they would use it in their decision when buying a product.

5 Analysis of stakeholders' viewpoints

The following section clusters the findings outlined in Chapter 4 and analyzes them using the SWOT analysis and the perception gap analysis.

5.1 Identification of SWOT elements

The SWOT analysis provides a good and simple framework for the assessment of strengths and weaknesses, as well as the opportunities and threats that the ICT companies are facing in the context of communicating environmental information.

The SWOT analysis was utilized in order to identify issues and problems based on internal and external forces, areas of action, as well as to list opportunities and threats with regards to providing product-related environmental information for ICT products.

5.1.1 SWOT profile of ICT manufacturers

The following section presents the SWOT profile of the ICT manufacturers, from the perspective of ICT practitioners, underlining their opportunities and risks in providing product-related environmental information to consumers. The analysis is based on data gathered from literature review, questionnaires and through interviews with practitioners from the ICT sector and consumer electronics retail salespersons.

Table 3 SWOT profile of ICT manufacturers

Strengths	Weaknesses
• Existing experience in providing detailed information to professional users • Availability of information through various consumer-oriented instruments (different eco-labeling schemes, TED, self declared claims) • Existing strong consumer relationship, loyal consumers • Higher demand and stricter requirements in Business-to-Business environment • Power to shape the shopping experience • Capability to influence other sectors, implementation of Green ICT solutions	• Poorly communicated product-related information • Lack of easily understandable information • Poorly communicated green achievements • Relative lack of consumers' knowledge • Different perception about consumers' wants and needs • Unharmonized eco-labeling schemes

Opportunities	Threats
• Competitive advantage • Brand differentiation • Improve company's and brand image • Comply with future legislation • Potential to drive change by promoting sustainable consumption • Attract green consumers • Increase consumer knowledge • Business and product development • Build on existing consumer-relationship	• Policy changes • Low perceived consumer demand • Low ranking on sustainability rankings • Lagging behind other industries • Competition with other industries • Competition with leapfrogging competitors • Underestimated consumer power

5.1.2 Consumers' SWOT profile

This section provides the SWOT profile of private consumers, by taking the private consumers' perspective regarding the advantages and disadvantages of the available and provided environmental product information.

Table 4 Private consumers' SWOT profile

Strengths	Weaknesses
• Growing interest in sustainable consumption • Environmental values • High awareness of the EU energy rating scheme (mainly in case of white products) • Existing consumer-brand relationship, brand-loyalty • Benchmark products online before purchase	• Time-consuming information search • Consumers locked in unsustainable consumption patterns • Consumers not motivated enough to search for more information • Sustainability criteria not used when purchasing ICT products • Difficult to judge relevant information if it exists (trustworthy versus misleading information sources)

Opportunities	Threats
• Change consumer behavior to a more sustainable one • Opportunity to act pro-environmentally if adequately informed • Make more informed decisions • Act as change agents – create demand	• Limited time to search and understand the information • Locked in old habits • Benchmark product before purchase • Vendors fail to communicate

5.2 Perception gap analysis

This perception gap analysis examines the industry's perception about consumers' interest, wants and needs with regards to product-related environmental information as opposed to what the consumers are really thinking. Outputs from the previously presented SWOT analyses are taken as inputs in the gap analysis in order to underline the different perceptions of the two actors.

The analysis helps in identifying gaps in current consumer knowledge by looking into the type of information that is currently provided by the ICT industry and the expectations of consumers (See Figure 9). This gap is the primary cause of misunderstandings in consumer knowledge.
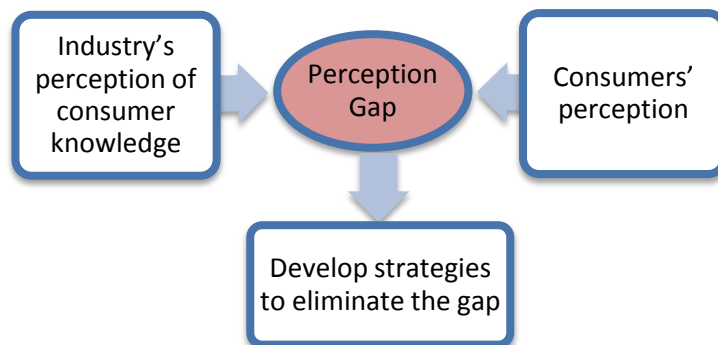
Figure 9 Perception gap analysis

Source: Author

As noted before, vast amount of information is communicated by ICT companies through various channels. However, these information sources are not always understood and used by consumers. There is a gap between the information communicated by ICT companies and the type of information used by private consumers. Therefore it is important to look into how consumers perceive environmental information (See Figure 10).

Figure 10 pinpoints the different views between the ICT industry and private consumers as revealed in the analysis in this research.
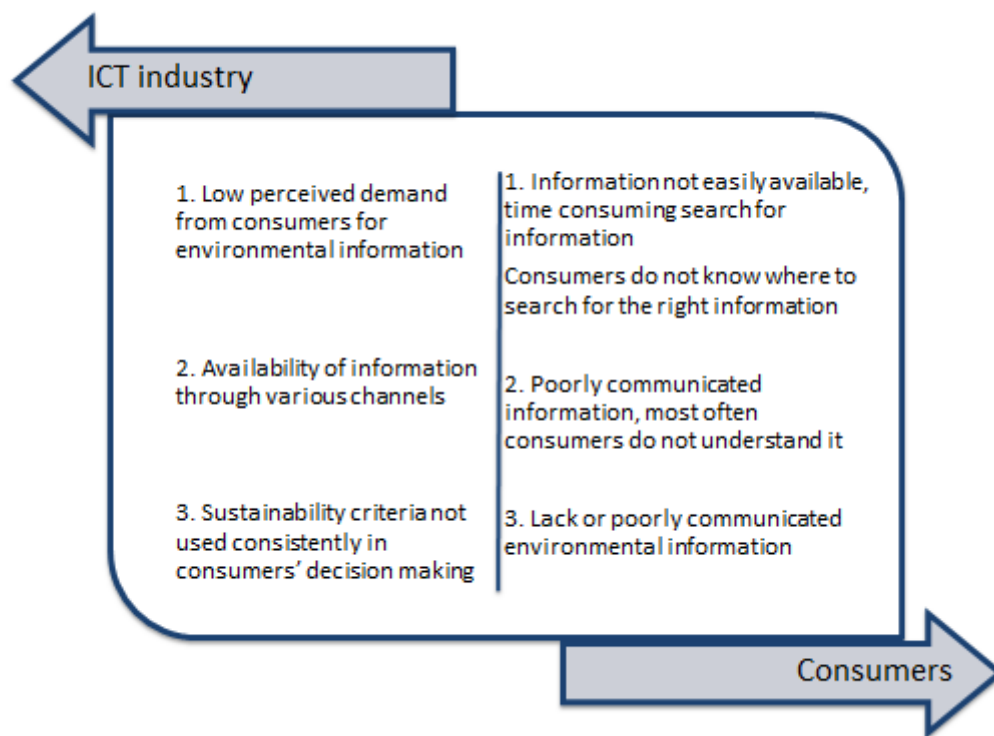
Figure 10 Results from perception gap analysis

Source: Author

As the companies' main priority is to meet consumer demand, understanding consumers' needs is vital for them to design and shape their business models in order to gain more market share. Moreover, from a business point of view it is important to identify whether the company's long-term strategies align with the consumers' demand.

5.3 Summary of the analysis

In this section the main results based on the outcomes of the ICT manufacturers and private consumers' SWOT profiles in connection with the perception gap analysis are collected.

Based on the analysis, one of the main strengths of the ICT companies is that the industry already has a history in providing environmental information in business-to-business environment. Therefore, they have the potential to transfer the lessons learnt from existing experiences with professional consumers and increase the environmental knowledge among consumers and triggering consumer behavior change.

One of the main weaknesses, supported by the perception gap analysis, is the relative lack of consumer knowledge and different perception about consumers' wants and needs. Even though a lot of product-related information is made available by ICT companies, consumers do not always know where to find this information or how to interpret it.

A strength and opportunity, at the same time, is the existing consumer relationship and brand loyalty. Therefore, building an information strategy on the existing consumer

relationship may develop stronger relationships and attract new consumer groups and improve brand image.

One of the main opportunities of communicating environmental information for ICT consumer products refers to the potential to comply with future legislation. There are indications that policy related to eco-labeling might change in the coming years. In fact, considering the positive experiences with the EU Energy label, one of the most widely recognized and used labels by private consumers, there are suggestions that the Energy Labeling Directive may be extended to all energy-using products in the future.

Furthermore, another major drawback, highlighted also by the perception gap analysis, refers to the poorly communicated information causing the different viewpoints and misconceptions between the ICT industry and consumers.

6 Discussion

6.1 Improving the use of information

It was found that, with the growing interest in sustainable consumption, consumers are becoming more aware of environmental issues. As a result their consumption patterns and information needs change. These results are also highlighted by consulted literature addressing consumers' sustainable consumption patterns, but most often analyzed with respect to fast moving products.

Providing environmental information for ICT products can be considered as a win-win-win solution for consumers, industry and the environment all together. It allows manufacturers to position their products on the market and gain larger market shares. At the same time, educating consumers and empowering them to make more informed choices will help move towards a more sustainable consumption.

Discussions with interviewed salespersons, supported by consulted literature, revealed the fact that if information is not easily available consumers are unlikely to search for it. On the other hand, if available, there is a higher probability that consumers will use it in their decision making process. At the same time, it was found that consumers are not motivated enough to demand more information, largely due to the fact that they do not have the time to research for more information when purchasing a product or even do not know where to find such information.

Currently several types of information tools are available. The information tools presented in this study have different target audience and usability. It was found that more detailed information is available for professional users as their purchasing requirements are stricter. Moreover, as seen in the case of eco-labels, the most common requirements based on the life cycle approach in case of electronic equipment focus on the following areas: energy consumption, materials used, noise level and content of hazardous substances.

Considering the amount of available information may have a significant effect on the consumers' choice, and in order not to confuse the consumers with too many indicators (BIO Intelligence Service, 2012), it was found that three to five are the optimal number of indicators that should be provided. Therefore, based on the common criteria used for eco-labels and eco declarations, as well as based on the interview discussions, five environmental impact areas were identified that should be communicated to consumers:

- Energy consumption

- Content of hazardous substances

- Noise emissions

- Use of recycled material

- Disposal and information about take-back system

It is relevant to point out that this information is already made available for professional users through the ECMA 370 Eco Declaration and it is publicly available on the Internet for some consumer products as well. However, in its current form, the ECMA 370 Eco

Declaration is too difficult to be understood by the private consumers. Then again, practitioners agree that a consumer-oriented simplified version of the ECMA 370 Eco Declaration would be a possible good method of communicating information to private consumers.

At the same time, practitioners agree that the information for consumers should be simple, straightforward, non-misleading and easily understandable, perhaps in the form of a single label for different product categories that comprises the most important environmental aspects (Young, Hwang, McDonald, & Oates, 2009). However, the development of a single label is not depending merely on the companies, it requires the involvement of a wide array of stakeholders.

The following communication channels were identified which would better reach the private consumers.

- Internet, companies' website, social media

- In store at the point of purchase, displays next to the product, information campaigns, information provided by salespersons

- Product packaging, however, due to the limited packaging space, the use of single labels is recommended

- Labels – offering shortcuts for consumers, commonly perceived as simple and reliable information sources

The majority of interviewees agreed that the main channel of communication should be the Internet, particularly the ICT companies' website and other social networks. However, even though businesses have little control over what information is exchanged by consumers through social networks it can still be used as a means of advertisement.

Moreover, ICT companies are faced with the options whether to provide environmental information for all products, regardless their environmental impact, or just promote the environmentally friendly products. As noted before, most commonly, only products with green features have environmental information displayed. This is partly due to the fact that, in order not look worse than the competitors, only information favorable from a business perspective is provided. For that reason, a common initiative is needed in order to involve all the actors from the ICT industry.

At the same time, the general assumption that private consumers are not interested in product-related environmental information is based on the fact that none or very minimal demand is perceived from consumers. Most likely ICT practitioners are adopting a *no demand – no change* approach. In other words if demand from private consumers is absent, businesses are unlikely to initiate change. However, viewing the issue from the consumers' perspective, the lack of demand may be due to the fact that information has not been communicated at all, or only in ways that private consumers cannot understand. Moreover, in the absence of such information consumers have nothing to relate to, hence they are adopting an ignorant position. At the same time, it is important to bear in mind that consumer behaviors are changing constantly and with growing interest in sustainability issues consumers have the power to act as change agents and create demand.

On the other hand, it is not certain that consumers would shift to greener purchasing habits if they were better informed. As pointed out in a Demos & Green Alliance (2003) study:

> *Information does not necessarily lead to increased awareness, and increased awareness does not necessarily lead to action. Information provision, whether through advertisements, leaflets or labelling, must be backed up by other approaches (Demos & Green Alliance, 2003, p. 46)*

Consequently, information alone will not drive change. Consumers may not know that such information is available, in fact, most of the times they do not know where to search for information. Therefore it is important to make consumers aware and educate them where to look for such information and how to interpret it. Thus it is relevant to point out that information provision is just one approach aiming to influence individuals to change their behavior. Information provision is not as effective unless it is linked with other approaches such as legislation, economic instruments and various marketing strategies. Hence the recommendations provided in this study are all interconnected with other methods that enable behavior change and at the same time trigger sustainable development.

6.2 Global versus local applicability

It is important to point out that the results of the research may have a higher applicability in the Nordic countries, due to the higher level of awareness with respect to sustainability. Despite the fact that sustainability may be part of the Nordic thinking, concern for the environment is not characteristic only for the Nordic region. Germany and the Netherlands share the common vision for sustainable development (Nordic Innovation, 2012).

Given the fact that the research focused on the Swedish market, largely due to the fact that data was collected from IT representatives from Sweden, and other relevant Swedish organizations and retailers, the results of the study are not limited to a specific country. In fact, the ICT companies in scope are global corporations with common suppliers and customers, their strategies are usually globally aligned.

In addition, practitioners agree that examples from the Swedish market may influence other markets. Considering Sweden's long history with eco-labels and the high general interest towards sustainability, Sweden along with the other Nordic countries may be seen as front runners and lessons learnt may be applicable in other regions as well. Moreover, this could be perceived also as an opportunity, according to the SWOT analysis, to drive change in other markets as well.

7 Conclusions

The main objective of the thesis was to assess the current state of knowledge as refers to private consumers and environmental information for ICT consumer products and to identify the advantages and disadvantages of providing such information.

7.1 Revisiting the research questions

The findings from the research demonstrate that various types of information tools are currently available. However, to what degree these are used and understood by private consumers is debatable. The different information tools highlighted in this research have different purposes and different audiences. Without doubt, information provided to professional users is more detailed as the requirements are much higher considering the growing demand for sustainable products in business-to-business environment.

The research was guided by two research questions as addressed below:

RQ1. What are the opportunities and risks of providing environmental information for ICT consumer products?

Based on the SWOT analysis areas of action were identified, as well as challenges that need to be addressed by ICT companies.

Key opportunities identified by the SWOT analysis highlight the potential to change consumer behavior and trigger sustainable consumption by providing environmental information for ICT consumer products.

Moreover, an opportunity and a risk, at the same time, is the changing policy setting. The possible modification of the Energy Labeling Directive and its extension to all energy-using products, as well as the potential harmonization of various eco-labeling schemes in the coming years pose some pressures on the ICT industry. Therefore, an early introduction of environmental information for ICT product companies has the advantage for the companies to position themselves ahead of future legislation.

RQ2. What types of environmental information are useful for consumers while purchasing an ICT product?

Evidence shows that consumers rarely ask for environmental information in case of ICT products. When they do so more emphasis is placed on the products' environmental performance with regards to energy efficiency and end-of life.

It is relevant to point out that adequate information has to be available, communicated in a way that will influence consumers' purchasing behavior. Taking into account that too many indicators confuse the consumers it was found that three to five environmental indicators should be communicated to consumers.

What to communicate?

Based on data gathered through interviews and examined eco-labeling criteria the following five aspects related to the products' environmental performance were identified: energy consumption, content of hazardous substances, noise emissions, use of recycled material, and information about the disposal and take-back system.

How and where to communicate?

When communicating environmental information it depends very much on how it is provided in order to be used in decision making. It is relevant to point out that how and where the information is provided has an important role on how the consumers perceive that information. Moreover, information reaches consumers through various means, though it is more likely to be taken into consideration if it is available when most needed and perceived as useful.

Therefore, considering when in time should environmental information be provided, before the sale, at the point of sale or after the transaction is completed, different communication channels were identified in order to better meet consumers' information needs, for example the Internet, in-store at the point of purchase, on product packaging and labels. It was concluded that the Internet should be the main channel of communication. In fact the companies' website is the main setting for such communication, as well as through social media and other online product review sites.

Other general recommendations

The research can also be used to provide practical suggestions for businesses in the ICT sector. In addition, the SWOT analysis along with the perception gap analysis facilitated the information clustering in order to formulate recommendations. The recommendations are aiming to address issues considering what ICT companies should do in order to better communicate product-related environmental information.

- Simplification of the ECMA 370 Eco Declaration, providing simple, understandable information to private consumers.

- Harmonization of different eco-labeling schemes, globally and nationally

- Development of a single label covering major environmental areas which might be of interest for consumers when purchasing a product or service

Moreover, going beyond information provision there is a need for a common initiative which entails the involvement of the ICT industry as whole, as well as linking companies' strategies with other approaches aiming to influence consumers' behavior, for example legislation and economic instruments.

Transferable lessons

The research provides an overview of the information tools directed to consumers. This information is relevant for policy makers considering future improvements of current eco-labeling schemes and other policies.

7.2 Suggestions for future research

Along the way a few potential research areas were identified. To build upon the present research it would be valuable to understand the consumers' perspective by conducting a comprehensive consumer survey in order to assess their expectations concerning environmental information when purchasing an ICT product or service. Additionally, it would be interesting to conduct an in-store advertising campaign and observe and analyze the influences of environmental information on consumers' purchasing patterns.

As the present study focused mostly on the Swedish market, in order to have a much broader variety of consumer behavior patterns, it would be interesting to investigate and bring examples from other geographical regions as well. Perhaps map out the ICT manufacturers' opportunities and challenges in regions where consumers do not place a high importance on sustainability issues and how is that influencing the companies' overall marketing strategies.

Moreover, given the fact that information alone does not drive change, it would also be interesting to conduct a more in-depth investigation in connection with other approaches aiming to change behavior, for example policies, economic instruments and marketing strategies.

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Appendix 1 - List of interviews

Name	Company	Position	Interview date	Interview type
Ulrika Strömqvist	IT&Telekomföretagen	Project Manager	19.06.2012	In-person
Ellinor Bjennbacke	IT&Telekomföretagen	Head of PR & Information	19.06.2012	In-person
Thomas Hedin	Samsung	Environmental Manager	19.06.2012	In-person
Hans Wendschlag	HP	EMEA Environmental Program Manager	19.06.2012	In-person
Lars Bjälkvall	Lenovo	Environmental Affairs Program Manager at Lenovo Nordic	19.06.2012	In-person
Elin Häggeborn	Swedish Consumer Agency	Legal Advisor	20.06.2012	Email communication
Fredrik Winqvist	Nordic Swan	PR Officer	02.08.2012	Email communication
Anna Bergström Pramborg	TCO Development	Communication Manager	10.09.2012	Email communication
Informal interviews with Salespersons (Lund)	Siba Expert MediaMarkt Elgiganten	Salespersons	27.06.2012	In-person

Appendix 2 – Example of interview questions

Questionnaire

Name:
Company and position:

1. How does your company collect environmental data?
    - How is this data communicated to private consumers?
    - How is this data communicated to professional consumers?
    - How is this data communicated internally?

2. Does your company track changes in procurement requirements from your customers and suppliers?

3. How does your company measure and follow the demand/interest of environmental information among private consumers? Are there any studies (internal) that measure and follow this interest/demand?

4. What is the level of interest in environmental information among consumers and how does that differ for certain products? Does it differ for private and professional consumers?

5. How much environmental information is available for IT & Telecom products at store level/websites/other? How and where is this information displayed?

6. What are the current experiences from providing environmental information for IT & Telecom products?

7. What is your vision, long term strategy and wanted position (perception and brand)?

8. What is your future strategy for mobile devices and laptops?

9. List the top three focus areas (products/services) going forward.

10. From your perspectives which are the main criteria that influence consumer's purchasing?

11. What type of environmental product information should be provided to private consumers? (Please list 5).

12. What would be a better way to communicate environmental features of products?

13. What actions should the IT & Telekom companies take when it comes to communicating environmental information? How and where should this information be provided?

14. What are the benefits of eco labeling?

15. Does your company have a take-back policy?

Thank you!

Appendix 3 – The Eco Declaration

Product environmental attributes – THE ECO DECLARATION

The declaration may be published only when all rows and/or fields marked with an * are filled-in (n.a. for not applicable).
Additional information regarding each item may be found under P14.

Brand *		Logo
Company name *		
Contact information *		
Internet site *		
Additional information		

The company declares (based on product specification or test results based obtained from sample testing), that the product conforms to the statements given in this declaration.	
Type of product *	
Commercial name *	
Model number *	
Issue date *	
Intended market *	☐ **Global** ☐ **Europe** ☐ **Asia, Pacific & Japan** ☐ **Americas** ☐ **Other**
Additional information	

This is an uncontrolled copy when in printed form. Please refer to the contact information for the latest version.

Quality Control Requirement met			
Item		Yes	No
QC1 *	The company enforces an internal quality control scheme to ensure the correctness of this eco declaration	☐	☐
QC2 *	The company is a member of an eco declaration system that enforces regular independent quality control such as organized by IT-Företagen (see www.itecodeclaration.org).	☐	☐

Model number *		
Issue date *		**Logo**

Product environmental attributes - Legal requirements Requirement met				
Item		Yes	No	n.a.
P1	**Hazardous substances and preparations**			
P1.1*	Products do not contain more than; 0.1% lead, 0.01% cadmium, 0.1% mercury, 0.1% hexavalent chromium, 0.1% polybrominated biphenyls (PBB) or 0.1% polybrominated diphenyl ethers (PBDE). (See legal reference and Note B1)	☐	☐	
P1.2*	Products do not contain Asbestos (see legal reference). Comment: Legal reference has no maximum concentration value.	☐	☐	
P1.3*	Products do not contain Ozone Depleting Substances: Chlorofluorocarbons (CFC), hydrobromofluorocarbons (HBFC), hydrochlorofluorocarbons (HCFC), Halons, carbontetrachloride, 1,1,1-trichloroethane, methyl bromide (see legal reference). Comment: Legal reference has no maximum concentration values.	☐	☐	
P1.4*	Products do not contain more than; 0.005% polychlorinated biphenyl (PCB), 0.005% polychlorinated terphenyl (PCT) in preparations (see legal reference).	☐	☐	
P1.5*	Products do not contain more than 0.1% short chain chloroparaffins (SCCP) with 10-13 carbon atoms in the chain containing at least 48% per mass of chlorine in the SCCP (see legal reference).	☐	☐	
P1.6*	Textile and leather parts with direct skin contact do not contain Tri-(2,3,-dibromopropyl)-phosphate (TRIS), Tris-(aziridinyl)-phosphineoxide (TEPA), polybrominated biphenyl (PBB) (see legal reference). Comment: Legal reference has no maximum concentration values.	☐	☐	☐
P1.7*	Textile and leather parts with direct skin contact do not contain more than 0.003% Azo colorants that split aromatic amines. (See legal reference and Note B1)	☐	☐	☐
P1.8*	Wooden parts do not contain arsenic and chromium as a wood preservation treatment as well as pentachlorophenol and derivatives (see legal reference). Comment: Legal reference has no maximum concentration values.	☐	☐	☐
P1.9*	Parts with direct and prolonged skin contact do not release nickel in concentrations above 0.5 microgram/cm^2/week (see legal reference). Comment: Max limit in legal reference when tested according to EN1811:1998.	☐	☐	☐
P1.10*	REACH Article 33 information about substances in articles is available at (add URL or mail contact):	☐	☐	☐
P2	**Batteries**	–		
P2.1*	If the product contains a battery or an accumulator, it is labeled with the disposal symbol and if it contains more than 0.0005% of mercury (for button cells only) by weight, or more than 0.004% of lead, it shall be marked with the chemical symbol for the metal concerned, Hg or Pb. Information on proper disposal is provided in user manual. (See legal reference)	☐	☐	☐
P2.2*	Button cells used in the product do not contain more than 2% by weight of mercury. Other batteries or accumulators do not contain more than 0.0005% of mercury or 0.002% of cadmium. (See legal reference)	☐	☐	☐
P2.3*	Batteries and accumulators are easily removable by either users or service providers (as dependent on the design of the product). Exception: Batteries that are permanently installed for safety, performance, medical or data integrity reasons do not have to be "easily removable". (See legal reference)	☐	☐	☐
P3	**Safety, EMC connection to the telephone network and labeling**	–	–	–
P3.1*	The product complies with legally required safety standards as specified (see legal reference).	☐	☐	☐
P3.2*	The product complies with legally required standards for electromagnetic compatibility (see legal reference).	☐	☐	☐
P3.3*	If product is intended for connection to a public telecom network or contains a radio transmitter, it complies with legally required standards for radio and telecommunication devices (see legal reference).	☐	☐	☐
P3.4*	The product is labeled to show conformance with applicable legal requirements (see legal reference).	☐	☐	–
P4	**Consumable materials**	–	–	–
P4.1*	If a photo conductor (drum, belt etc.) is used in the product, it does not contain cadmium max 0.01% (see legal reference and Note B1).	☐	☐	☐
P4.2*	If ink/toner is used in the product, it does not contain cadmium max 0.1% by weight (see legal reference).	☐	☐	☐

P4.3*	If the ink/toner formulation/preparation is classified as hazardous according to applicable regulations, the product/packaging is adequately labeled and a Safety Data Sheet (SDS) in accordance with these requirements is available (see legal reference).	☐	☐	☐
P5	**Product packaging**	–	–	–
P5.1*	Packaging and packaging components do not contain more than 0.01% lead, mercury, cadmium and hexavalent chromium by weight of these together.	☐	☐	–
P5.2*	Plastic packaging material is marked according to ISO 11469 referring ISO 1043 (see legal reference).	☐	☐	–
P5.3*	The product packaging material is free from ozone depleting substances as specified in the Montreal Protocol (see legal reference). Comment: Legal reference has no maximum concentration values.	☐	☐	–

Model number *			
Issue date *		**Logo**	

Product environmental attributes - Market requirements - Environmental conscious design Requirement met					
Item	*=mandatory to fill in. Additional information regarding each item may be found under P14.		Yes	No	n.a.
P6	**Treatment information**				
P6.1*	Information for recyclers/treatment facilities is available (see legal reference).		☐	☐	☐
P7	**Design** **Disassembly, recycling**				
P7.1*	Parts that have to be treated separately are easily separable		☐	☐	☐
P7.2*	Plastic materials in covers/housing have no surface coating.		☐	☐	☐
P7.3*	Plastic parts >100g consist of one material or of easily separable materials.		☐	☐	☐
P7.4*	Plastic parts >25g have material codes according to ISO 11469 referring ISO 1043.		☐	☐	☐
P7.5	Plastic parts are free from metal inlays or have inlays that can be removed with commonly available tools.		☐	☐	☐
P7.6*	Labels are easily separable. (This requirement does not apply to safety/regulatory labels).		☐	☐	☐
	Product lifetime				
P7.7*	Upgrading can be done e.g. with processor, memory, cards or drives		☐	☐	☐
P7.8*	Upgrading can be done using commonly available tools		☐	☐	☐
P7.9.	Spare parts are available after end of production for: years				☐
P7.10	Service is available after end of production for: years				☐
	Material and substance requirements				
P7.11*	Product cover/housing material type: Material type: Material type: Material type:				
P7.12	Electrical cable insulation materials of power cables are PVC free.		☐	☐	☐
P7.13	Electrical cable insulation materials of signal cables are PVC free		☐	☐	☐
P7.14	All cover/housing plastic parts >25g are free from chlorine and bromine.		☐	☐	☐
P7.15	All printed circuit boards (without components) >25g are halogen free. as defined in IEC61249-2-21. (See Note B2)		☐	☐	☐
P7.16	Flame retarded plastic parts >25g in covers / housings are marked according ISO 1043-4: Marking:		☐	☐	☐
P7.17	Alt. 1 Chemical specifications of flame retardants in printed circuit boards >25g (without components): TBBPA (additive) ☐ , TBBPA (reactive) ☐ , Other; chemical name: , CAS #:		☐	☐	☐
	Alt. 2 Chemical specifications of flame retardants in printed circuit boards (without components) >25g according ISO 1043-4:		☐	☐	☐
P7.18	Alt. 1 Flame retarded plastic parts >25g contain the following flame retardant substances/preparations in concentrations above 0.1%: Comment: No legal limits exist, this is a market requirement. 1. Chemical name: , CAS #: 2. Chemical name: , CAS #: 3. Chemical name: , CAS #: Alt. 2 Chemical specifications of flame retardants in plastic parts >25g according ISO 1043-4:		☐ ☐	☐ ☐	☐ ☐
P7.19	Plastic parts >25g are free from flame retardant substances/ preparations above 0.1% classified as R45, R40, R46, R48, R50, R51, R53, R60, R61 and any combination of these (See Note B3)		☐	☐	☐
P7.20	Of total plastic parts' weight >25g, recycled material content is **%.**				
P7.21	Of total plastic parts' weight >25g, biobased material content is **%.**				
P7.22	Light sources are free from mercury If mercury is used specify: Number of lamps: and max. mercury content per lamp: mg		☐	☐	☐
P8	**Batteries**				

Note B2: IEC61249-2--21 has maximum limits for chlorine and bromine but does not address fluorine, iodine and astatine which are included in the group of halogens.

Note B3: 'Starting from January 2009, Risk phrases can be replaced by Hazard phrases according to the Globally Harmonized System (GHS), mandatory by December 2010.

P8.1*	Battery chemical composition:	☐
P8.2	Batteries meet the requirements of the following voluntary program/s:	☐

Model number *		
Issue date *		**Logo**

Product environmental attributes - Market requirements (continued) **Requirement met**						
Item					Yes No n.a	

P9	**Energy consumption**					
9.1	For the product the following power levels or energy consumptions are reported:					
Energy mode *	Power level at **100** V AC	Power level at **115** V AC	Power level at **230** V AC	Reference / Standard for energy modes and test method *		☐
	W	W	W			☐
	W	W	W			☐
	W	W	W			☐
	W	W	W			☐
	W	W	W			☐
	W	W	W			☐
EPS No-load (External power supply / charger plugged in the wall outlet but disconnected from the product.)	W	W	W			☐
PTEC * Typical Energy Consumption	W	W	W			☐
TEC * Typical Energy Consumption	kWh/week	kWh/week	kWh/week			☐
ETEC * Annual Energy Consumption	kWh/year	kWh/year	kWh/year			☐
Display resolution* : Megapixels						☐
Print Speed * : Images per minute						☐
Default time to enter energy save mode: minutes						☐
P9.2*	Information about the energy save function is provided with the product.				☐ ☐ ☐	
P9.3*	The product meets the energy requirements of the following voluntary program/s: ENERGY STAR® version: Tier: Product category: Others specify:				☐ ☐ ☐ ☐ ☐ ☐	

P10	**Emissions**					
–	**Noise emission** – Declared according to ISO 9296					
P10.1	Mode	Mode description	Declared A-weighted sound power level L_{WAd} (B)	Declared A-weighted sound pressure level L_{pAm} (dB) Operator position ☐ / Desktop or Desk side ☐ / Bystander positions ☐ (only if product is not operator attended)		
	Idle	*	*			☐
	Operation	*	*			☐
	Other mode					
	Measured according to: ☐ ISO7779 ☐ ECMA-74 ☐ Other (only if not covered by ECMA-74 with L**pAm** measurement distance m)					
P10.2	The product meets the acoustic noise requirements of the following voluntary program/s:				☐ ☐ ☐	

Model number *						
Issue date *			**Logo**			

Product environmental attributes - Market requirements (continued) Requirement met				
Item		Yes	No	n.a
	Chemical emissions from printing products		–	–
P10.3*	Test performed according to ECMA-328 (ISO/IEC 28360) standard ☐, other specify:	–	–	–
P10.4	Typical emission rate (print phase) is (mg/h):	–	–	–
	Dust Ozone Styrene Benzene TVOC	–	–	–
P10.5	Chemical emission requirements of the following voluntary program/s are met for :	–	–	–
	Dust ☐ Ozone ☐ Styrene ☐ Benzene ☐ TVOC ☐			
	Electromagnetic emissions			
P10.6	Computer display meets the requirement for low frequency electromagnetic fields of the following voluntary program/s:	☐	☐	☐
P11	**Consumable materials for printing products**			
P11.1*	A Safety Data Sheet (SDS) is available for the ink/toner preparation, even if not legally required (see P4.3).	☐	☐	☐
P11.2*	Paper containing post-consumer recycled fibers can be used, provided that it meets the requirements of EN12281.	☐	☐	☐
P11.3*	2-sided (duplex) printing/copying is an integrated product function.	☐	☐	☐
P12	**Ergonomics for computing products**			
P12.1*	The display meets the ergonomic requirements of ISO 9241-307 for visual display technologies.	☐	☐	☐
P12.2*	The physical input device meets the requirements of ISO 9995 and ISO 9241-410.	☐	☐	☐
P13	**Packaging and documentation**			
P13.1*	Product packaging material type(s): weight (kg): Product packaging material type(s): weight (kg): Product packaging material type(s): weight (kg):			
P13.2*	Product plastic packaging is free from PVC.	☐	☐	☐
P13.3*	Specify media for user and product documentation (tick box): Electronic ☐, Paper ☐, Other ☐			☐
P13.4*	For paper user and product documentation, please specify contained percentage of post-consumer recycled fiber: %			☐
P14	**Additional information (See Note B4)**			

Legal references Europe Annex B

Reference	Declaration item
2002/95/EC (ROHS Directive)	P1.1, P4.1
REACH, Annex XVII	P1.6, P1.8, P4.2
REACH, Annex XVII	P1.4
REACH, Annex XVII	P1.2
REACH, Annex XVII	P1.7
REACH, Annex XVII	P1.9
Regulation (EC) No. 2037/2000, 2038/2000, 2039/2000	P1.3
Norwegian regulation relating to restrictions on the use of certain dangerous chemicals 20.12.2002	P1.5
2006/66/EC (Battery and accumulators Directive)	P2.1, P2.2, P2,3, P3.4, P8.1
2006/95/EC (Low Voltage Directive)	P3.1, 3.4
2004/108/EEC (New EMC Directive)	P3.2, 3.4
1999/5/EC (R&TTE Directive)	P3.3, 3.4
"REACH" Regulation (1907/2006), annex VII	P1.10
(EC) No.1272/2008 regulation on classification, labeling and packaging (CLP)	P4.3
REACH article 31, annex II	P4.3
2004/12/EC (Directive on packaging and packaging waste)	P5.1
(97/129/EC) (Commission Decision on Identification System for Packaging Materials	P5.2
2037/2000/EC Regulation on Substances that Deplete the Ozone Layer	P5.3
2002/96/EC (WEEE directive)	P3.4, P6.1
(EC) No.1272/2008 regulation on classification, labeling and packaging (CLP)	P7.19

Source: ECMA International. (n.d.). *Standard ECMA-370*. Retrieved September 1, 2012, from http://www.ecma-international.org/publications/standards/Ecma-370.htm