Empowering consumers' choice:

A new eco-label revealing environmental impact of products and services

Camille Ouellette

Supervisor

Mårten Karlsson

Thesis for the fulfilment of the
Master of Science in Environmental Management and Policy
Lund, Sweden, September 2007

Published in 2007 by IIIEE, Lund University, P.O. Box 196, S-221 00 LUND, Sweden,
Tel: +46 – 46 222 02 00, Fax: +46 – 46 222 02 10, e-mail: iiiee@iiiee.lu.se.

ISSN 1401-9191

Acknowledgements

This thesis has been made possible with the help of many collaborators scattered around the world. I would like to start my acknowledgements in Sweden. First of all, thanks to the IIIEE who gave me the opportunity to be part of this master programme and to access this stimulating educational environment. I would like to thank my tutor, Mårten Karlsson, who supervised me throughout this thesis work. Thanks to Thomas Lindhqvist and Åke Thidell for your support and sound advice. I would also like to mention the great work of Gunilla Kittel without whom, I am sure all my colleagues of batch twelve will agree, we students would have felt completely lost. Thanks for your patience to fill in the same forms over and over again. A special thank to Fredrik Eriksson who is truly dedicated to provide students, wherever they are in the world, with precious literature.

I had the exceptional chance to go in Iceland to do my thesis work. This country distinguishes itself by its incredible landscapes and the kindness of its inhabitants. I would like to express my gratitude to Stefán Gíslason, Alumni member, who made this memorable experience possible. I would also like to thank Brynhildur Pétursdóttir who supported me during my stay in Akureyri and lent me so much of her time and energy. Thanks Ágúst Þór Árnason for opening your door to Camille and I and to Birgir Guðmundsson for your warm welcome at Akureyri airport. Thanks also to Doddi Jonsson and to all Akureyri municipal library staff. I will always remember this unique summer in Iceland.

I would like to thank all the participants of the survey and the interviewees who kindly agreed to take part in this research. Without you, this thesis could not be complete. A special mention to all my classmates, your friends and relatives who participated, in large numbers, in the survey. Thanks to all my friends in Sweden, Quebec, Australia and elsewhere. You are more important than you think.

Thanks to my family and especially to Louise, Claude and Abel for your sustained support, encouragements and passing on to me this taste to always seek new challenges. I miss you more everyday.

And finally, Camille, I would never be able to thank you enough for your presence. You are more than what you are: a second supervisor, a friend, a confidant, an alter ego.

Abstract

The provision of environmental information is crucial in the effort to reach sustainability. In the last decades, it has been acknowledged that the promotion of sustainable consumption lifestyles cannot be achieved without providing individual consumers with environmental information and education. However, communicating complex environmental information to non-experts is never an easy task. The lack of comprehensible and accessible environmental communication available for individual consumers have often been observed and criticized. How can environmental information on products and services be modified and improved to ease individual consumers understanding?

This thesis proposes the exploration of a rating system of the environmental impact of products and services. Under the Eco-rating project, the creation of a novel environmental information system has been developed. This system should enable individual consumers to compare the environmental profile of products and services and, therefore, make informed choices.

The focus has been placed on the visual representation of environmental information. How can environmental information be visually represented to individual consumers? How can this visual representation allow comparison between the environmental profile of various products and services and be comprehensible at the same time? The goal of this thesis was to explore and develop a new way to visually communicate environmental information to individual consumers. Through a survey and individual interviews, the key elements to produce a comprehensible and accessible environmental information system have been determined. Furthermore, a concept of visual representation of environmental information is proposed according to the feedback and insights collated during the user-tests.

Executive Summary

Introduction

Unsustainable consumption lifestyles are putting growing pressure on the environment. The situation is becoming alarming due to the fast growth of certain developing countries. The adoption of unsustainable consumption patterns, modelled on OECD countries, is increasing around the world. It is indispensable that individual consumers modify their unsustainable consumption behaviours in order to limit environmental damages and reach sustainability. Environmental literacy has been identified as a major tool in the promotion of sustainable consumption and awareness.

In order to foster more sustainable consumption behaviours, households need to be provided with the appropriate information. Environmental information should be decisive to allow informed choice. It has been observed that current sources of environmental information on products and services have major gaps. Indeed, it appeared that essential information was missing in order to distinguish and compare the level of environmental impact of products and services. This lack of information has the effect of preventing individual consumers to make enlightened choices.

Eco-rating project & visual representation of environmental information

As correctly pointed out in *The Unmanageable Consumer*: "First, choice without information is not real choice" (Gabriel and Lang, 1995, p. 27). In order to make informed choices, individual consumers must be able to compare the environmental profile of products and services. This thesis proposes the exploration of an environmental information system that allows for comparison between the environmental impacts of products and services. This thesis was conducted under the umbrella of the Eco-rating project, a personal project that suggests the rating of the environmental impact of products and services. Since the span of the Eco-rating project was too wide, in the context of master's thesis work, the project is briefly introduced. Instead, the main focus is put on the visual representation of information. Indeed, very little information is available on the graphical and conceptual representation of environmental information intended for individual consumers.

A set of key criteria were determined in order to improve the communication of environmental information on products and services to individual consumers. Those key criteria are represented under the four following recommendations. The environmental information must:

- be **accessible** during **consumption acts**;
- be **comprehensible**;
- allow **comparison** of environmental impacts between products and services and;
- ultimately **educate** consumers opting for **sustainable consumption** behaviours.

This set of key criteria was the premise from which the development of a visual representation of environmental information was carried out. The key criteria should be applied to the novel environmental information system. A literature review of visual representation of environmental information and other types of information was carried out. The emphasis was put, more precisely, on the visual representation of comparative information.

To gain insights into which kind of visual representations would enable individual consumers to easily comprehend and compare (in this case the level of environmental impact of products and services), a survey and individual interviews have been carried out. Although not intended to produce statistical data, an online survey provided valuable insights on individual consumers' attitudes and preferences towards environmental information and comparison systems.

Three iterations of visual concepts have been tested on individual consumers and experts from professional sectors of sustainable consumption, information visualization and design. The concepts utilised different graphical elements to represent comparison (e.g. meter, time line, fraction, arrow…etc.) and convey the level of environmental impact. During individual interviews, the different concepts were presented and, throughout the process, were also refined. The interviews with individual consumers were built around a fictive scenario to simulate "real" consumption behaviour.

Conclusions and recommendations

It appeared that the use of a label displaying 1) a numerical system combined with 2) a denomination and 3) a set of benchmarks, enabled individual consumers to understand and compare the level of impact of different products and services. The numerical system indicates the level of impact of the product or service. The denomination is used for naming the benchmark system. This allows the user to make the relation between the label and the benchmarks system. The benchmark system, composed of three benchmarks, acts as a point of reference to relate the level of impact to a known or familiar activity for individual consumers. Regarding the graphical representation of information, it appeared that the positioning of information elements (i.e. numerical system, denomination and benchmarks system), as well as the use of colours, are especially significant in the comprehension of the label.

Participants confessed that the influence of this sole label on consumers' behaviour might be limited. They expressed reservations on the influence that such a label could have on individual consumers "greener" choices. The interviewees were much more confident that this label would be more effective in the presence of a policy framework. They acknowledged the potential of the label, but observed that its full potential could be reached in combination with other initiatives or policy tools. Furthermore, participants identified that the main criteria of an effective eco-label are: user-friendliness (easy to understand and use) and trustworthiness.

This thesis highlighted the importance of taking into account the type of users the environmental information is intended for. Indeed, participants' comprehension and attitude towards the information improved when complex information was related to a familiar activity. It appeared that translating environmental information into something that can be sized and related to, such as money or visible environmental damage, had a higher impact among individual consumers. Accordingly, individual consumers could be more inclined to change their own behaviours towards more sustainable behaviours.

Table of Contents

1 INTRODUCTION 1

1.1 BACKGROUND 2
1.2 PURPOSE AND OBJECTIVES 4
1.3 METHODOLOGY 4
1.3.1 The Eco-rating project 4
1.3.2 Research process 5
1.3.3 Survey and interviews 6
1.3.4 Stages of the study 7
1.4 SCOPE AND LIMITATIONS 7
1.4.1 Validity 8
1.4.2 Feasibility discussion 9

2 ENVIRONMENTAL INFORMATION TO CONSUMERS 10

2.1 INFORMATION TO WHOM? 11
2.2 TARGET ON INDIVIDUAL CONSUMERS 12
2.3 SOURCES OF INFORMATION 13
2.4 INFORMATION ABOUT PRODUCTS AND SERVICES 13
2.4.1 Life-cycle interpretation 14
2.4.2 Environmental performance indicators 15
2.4.3 Data sheets and declarations 15
2.5 ANALYSIS OF CURRENT ENVIRONMENTAL COMMUNICATION TOOLS 16
2.6 CURRENT INITIATIVES 18
2.6.1 United Kingdom and carbon labelling: two schemes in parallel 18
2.6.2 Carboncounted.com, a Canadian initiative 22
2.6.3 KRAV and the klimatmärkning 23
2.6.4 Eco-benchmark, a Finnish initiative 23
2.6.5 Analysis and discussion 25
2.7 CONCLUSIONS 26

3 ECO-RATING PROJECT 27

3.1 PROJECT TEAM 27
3.2 INFORMATION AND EDUCATION 28
3.3 INFORMATION FORMAT 29
3.4 ENVIRONMENTAL DATA 29
3.5 ENVIRONMENTAL INFORMATION: ON WHICH PRODUCTS? 30

4 VISUAL AND CONCEPTUAL REPRESENTATION 32

4.1.1 Definition 33
4.1.2 Comparison and rating 33
4.1.3 Literature review 34
4.2 DEVELOPMENT 39
4.2.1 User-centred design 40
4.2.2 User-tests 41
4.2.3 Survey 41
4.2.4 Interviews 44
4.2.5 Findings 52
4.3 CONCLUSIONS 53

5 EVALUATION 54

5.1 BACKGROUND 54
5.2 THE ROLE OF MAJOR STAKEHOLDERS 54
5.3 TECHNOLOGY 55

5.4 MANAGEMENT 56
6 FINAL CONCEPT AND RECOMMENDATIONS 58
6.1 GRAPHICAL AND CONCEPTUAL REPRESENTATION 58
6.1.1 Main objectives 61
6.2 IMPORTANCE OF A FRAMEWORK 64
6.2.1 Policy mix 64
6.2.2 Translation into daily life 65
6.3 SUPPLEMENTARY INFORMATION 66
6.3.1 Information campaign 68
6.3.2 Issue of trust 68
6.4 LIMITATIONS 69
7 CONCLUSION 70
7.1 FUTURE RESEARCH 72
BIBLIOGRAPHY 74
APPENDIX A: LIST OF INTERVIEWEES 79
APPENDIX B: INTERVIEW TEMPLATE 80
APPENDIX C: LCA STAGES 84
APPENDIX D: EXAMPLE OF GRAPHICAL REPRESENTATION OF AN EPD 85
APPENDIX E: 3D VISUALIZATION OF LCA DATA 86
APPENDIX F: NOVEL PROPOSITION OF VISUAL REPRESENTATION OF EPDS 87
APPENDIX G: SAMPLES OF DESIGNS - MALAYSIAN ENERGY-EFFICIENCY LABEL 88
APPENDIX G: SAMPLES OF DESIGNS - MALAYSIAN ENERGY-EFFICIENCY LABEL 88
APPENDIX H: SAMPLE OF EARLY POTENTIAL NUTRITIONAL LABELS 89
APPENDIX I: EXAMPLE OF SAMPLE BOARDS 90
APPENDIX J: SURVEY TEMPLATE 91
APPENDIX K: SAMPLE OF SKETCHES - FIRST ITERATION 93
APPENDIX L: THREE CONCEPTS - FIRST ITERATION 94
APPENDIX M: SAMPLE OF SKETCHES, SECOND ITERATION 96
APPENDIX N: THREE CONCEPTS – THIRD ITERATION 97
APPENDIX O: SAMPLES OF GRAPHICAL BRANDING 99

List of Figures

Figure 1-1: Chain of stakeholders' decision toward sustainable consumption. 2
Figure 1-2: The two main sections of the Eco-rating project. 5
Figure 1-3: Development of the research process. 6
Figure 2-1: The Carbon Reduction Label from the Carbon Trust 19
Figure 2-2: CarbonCounted label. 23
Figure 2-3: Graphical representation of the Eco-benchmark. 24
Figure 3-1: Potential members of the Eco-rating project 28
Figure 4-1: Designer's position into the Eco-rating project 32
Figure 4-2: Sample of a visual representation of an EPD 35
Figure 4-3 Sample of comparative energy-efficiency labels. 37
Figure 4-4 Sample of redesign of the EnergyGuide label. 38
Figure 4-5: Examples of the new signpost/traffic light food label. 39
Figure 4-6: One example of a concept of visual representation of environmental information, first iteration. 46
Figure 4-7: Examples of effective and less effective visual representations of information. 49
Figure 4-8: The three concepts of visual representation using the benchmark system, second iteration. 50
Figure 6-1: Final concept of visual representation of the Eco-rating project 58
Figure 6-2: Three potential versions of the Eco-rating project 61
Figure 6-3: Comparison of environmental impact of similar products 63
Figure 6-4: Potential integration of the Eco-rating label on products. 67

List of Tables

Table 2-1: Different types of users of environmental information. 12

Table 2-2: Classification of environmental information tools and methods. 14

Table 2-3: Comparison between the environmental information tools and the four key criteria for choice.....17

1 Introduction

Since the beginning of the Industrial Revolution, goods' production and consumption increased drastically in developed countries, as well as in developing countries. Indeed, the energy use in OECD countries grew by 36% from 1973-1998 and is expected to grow by another 35% by 2020, despite increases in efficiency (OECD, 2001b). Similar increases are observed in various sectors such as transportation, waste, water and food consumption.

This extensive consumption is not without serious impacts on the ecosystems. According to the Global Footprint Network: «Today, humanity's Ecological Footprint is over 23% larger than what the planet can regenerate…» (2006, para 3). A planet 23% bigger would be needed to support mankind's environmental impacts. If every human would consume as the average Canadian, around 4.8 planets would be necessary to support this level of resources' consumption.[1]

The release of the Brundtland report in 1987, which sets the basis of the sustainable development concept and linked environment and growth, raised public awareness about global environmental issues. In light of the Rio de Janeiro Conference in 1992, it has been recognised that all countries, and particularly OECD countries, were facing a major challenge to shift towards more sustainable consumption patterns. In 2002, the World Summit on Sustainability in Johannesburg released a *Plan of Implementation*, which addresses specifically the issues of consumption and production. The plan indicates that this shift will imply fundamental changes in the living and consumption patterns of societies to reach sustainability.

Fortunately, the public is getting more aware that its daily behaviour has a direct impact on the environment. There are evidences that consumers realise they can act positively by changing their consumption habits. This awareness is reflected, for example, by the increase of participation in recycling schemes and the expanding demand for ecological and environmentally sound products and services. Furthermore, consumers are asking for more information:

> «*…it is becoming more and more evident that consumers are increasingly interested in the «world behind» the product they buy…they want to know how and where and by whom the product has been produced.*» Klaus Toepfer, Former Executive Director of UNEP (UNEP, 1999, para 5)

Reaching sustainable consumption will require the involvement of various stakeholders. Sustainable consumption can be defined as: "the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste and pollutants over the life cycle, so as not to jeopardise the needs of future generations" (Norwegian Ministry of the Environment, 1995, Part 1, para 1).

[1] Based on the Ecological Footprint Quiz calculations. For more information see: http://www.ecofoot.org

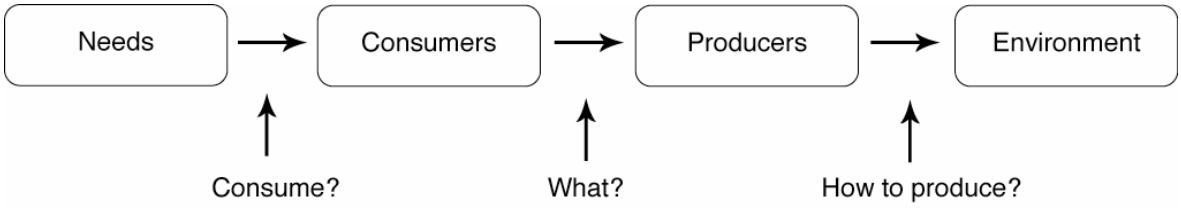


Figure 1-1: Chain of stakeholders' decision toward sustainable consumption.

Source: (OECD, 2002a)

Of course, consumers have a central role to play by changing their consumption behaviours. Consumers have to find the way to reconcile the fulfilment of their needs and responsible consumption behaviours. However governments and industries are responsible for putting in place the appropriate initiatives and incentives to guide consumers to make better choices. Having said that, the question is *how* is it possible to steer consumers' behaviour towards a more responsible consumption.

1.1 Background

The importance of adequate knowledge and education as one of the fundamental agents of change seems to make consensus among experts. Agenda 21 recognised that: «Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues.» Chapter 36 is dedicated to the promotion of education, public awareness training. In the report *Policies to promote sustainable consumption*, it has been observed that there are three key factors that induce consumers' change: 1) adequate knowledge; 2) positive attitude to change; and access to sufficiently attractive alternatives (infrastructure, goods) (OECD, 2002a). In his book, *The Overspent American*, Schor stresses that: «A necessary first step toward becoming an educated consumer is to learn about the impact your consumption has on the environment. Only then can you make responsible and informed choices.» (1998, p. 156)

The mean (container) to distribute information and educate consumers is as important as the message itself (contents). In the report *Background Paper for Experts Workshop on Information and Consumer Decision-Making for Sustainable Consumption*, information is divided in three distinct channels: 1) market (labels, advertisements, retailers and corporate environmental reports), 2) mass media (television, radio, newspapers, magazines and the Internet) 3) social organisation (consumers' association and environmental organisations) (OECD, 2001a).

In the previous classification of information channels, environmental impact calculation tools such as Life Cycle Assessment (LCA), Footprint or CO_2 emissions' calculators, are not included. The level of complexity varies greatly between the various tools. For example, assimilating the information on the Footprint[2] of a country is generally easier for most people than understanding the results of a product's LCA. Despite their higher level of complexity, they are nevertheless available for consumers (via the literature or mass media like Internet) and provide a great deal of information.

[2] The Ecological Footprint is a concept that measures how much land area and water is necessary to support human impacts. For more information: http://footprintnetwork.com/

It is hard to assess the effectiveness of the current information sources and tools for consumers' decision-making. There is evidence of success like the eco-label schemes well implanted in Nordic Countries and Germany. It has been estimated, in a survey carried out by Rubik & Frankl, that around 56.6% of consumers in Germany and 70 % in Norway know and recognize their national eco-labels (correspondingly the Blue Angel and the Nordic Swan) (2005). On the other hand, not all eco-labelling schemes are success stories. In an *Eurobarometer* survey carried out in 2006, Europeans' awareness of the EU flower (i.e. European Eco-label) revealed to be rather low (European Commission, 2007). Only 11% of EU citizens recognized and correctly identified the purpose of the label. According to the OECD *Workshop on Information and Consumer Decision-Making for Sustainable Consumption* (2001c), there are various barriers to the dissemination of information such as the growing volume and complexity of current information, credibility of information sources and free-rider decision-making dilemmas. However, the Commission of Integrated Product Policy (IPP) considers eco-labels and Environmental product declarations (EPDs) as one of the most important voluntary tools (Commission on IPP, 2003).

Despite the multitude of information sources, there is still little information available regarding the environmental impact of products and services. It is difficult for consumers to be aware of the environmental impact caused by their daily consumption activities. For simple consuming activities like shopping at the grocery store, there is often not enough information available for consumers to make an enlightened decision or the information available might not be accessible and understood by them. When time comes for decision making and purchasing, the information required for consumers to make informed decisions is often not available and accessible. Currently, there is no possible way for a consumer to know the environmental pressure caused by products and services. What is the environmental impact of buying a new sofa, or a new TV set? The consumer cannot associate and differentiate the environmental impact of various products and services. This lack of information makes the comparability of environmental impact of products and services difficult for the consumers. It prevents the consumer to create a wider understanding of the environmental pressure created by his/her consumption behaviour. Therefore, it is impossible to measure and balance the environmental impact of alternative options offered on the market.

A parallel could be drawn between nutritional labels and the environmental characteristics of a product or service. Nutritional labels provide information about the nutritional content of a product, which allow the consumer to make an informed decision corresponding to its tastes and values. Like the nutritional label, environmental impact could also be displayed directly at the time of purchase or on the product. However, the format of the labels would be different.

It seems that there is a real need from consumers to have access to information that presents the environmental profile of products and services. This need has been expressed by the emergence of various alternatives and tools which try to map and rate the environmental impact of products in a simplified and comprehensible manner for the consumer. Recent initiatives from the retail sector (e.g. TESCO[3], The Carbon Trust[4] and CarbonCounted[5]) are

[3] At the beginning of this year, Tesco, an English supermarket chain, committed itself to tackle climate change and promote sustainable consumption and production. The retails store is in the process of mapping the carbon footprint of its facilities and products. The data collected will be used to indicate the level of carbon produced on the products. For more information, see: http://www.tesco.com/climatechange/

[4] In 2006, The Carbon Trust launched a carbon eco-label that provides products' carbon footprint. This initiative is intended for companies who wish to provide its clients with more information about the environmental impacts of its products or services. For more information: http://www.carbontrust.co.uk/carbon/briefing/carbon_label.htm

planning, or have already undertaken, to map the footprint of some products and present this information to the consumer under the form of an eco-label. Initiatives can also be observed from social, academic and governmental organisations. For example the Finnish Environment Institute (SYKE)[6] in the context of the World Summit on Sustainable Development 2002, developed a consumers information tool (based on LCA method) illustrating the environmental impact of consumer products. Those initiatives are explored thoroughly in section *2.6 Current initiatives*.

Earlier attempts have been made to display the result of an LCA on the product, similar to Type III eco-labels (also known as EPDs). However, Type III eco-labels have low market recognition among individual consumers[7]. EPDs have often been criticised for being too complicated to understand and for being a source of confusion for individual consumers and households.

1.2 Purpose and objectives

The objective of this research was to propose the development of a system intended for individual consumers displaying, on the purchase moment, accessible and comprehensible information on the level of environmental impact of products and services. This system should enable consumers to compare environmental information of various products and services in order to allow an enlightened choice. Accordingly, dispensing this information would help raising consumers' awareness to opt for sustainable consumption behaviours.

In order to fulfil those objectives, the following questions were explored:

- What kind of visual representations allow for comparisons to be made between the environmental impacts of products and services and enable individual consumers to make informed choices?

- What are the barriers and success factors to the effectiveness of a rating system of the environmental impact of various products and services to improve consumers' information, knowledge and choice?

1.3 Methodology

1.3.1 The Eco-rating project

The research methodology is built around the exploration and elaboration of an environmental information system called the Eco-rating project. As a personal proposal, the Eco-rating project was the starting point for this thesis work. In the context of thesis research, the scope of the Eco-rating project was too wide and needed to be divided and scaled down.

---

[5] CarbonCounted.com is an online tool (ElementSix software) launched in 2007. The ElementSix software allows businesses to calculate the carbon emissions per product unit. The results of the embedded amount of carbon are displayed on a logo, which can be put on a product. For more information, see: http://www.carboncounted.com/

[6] Eco-Benchmark is a concept developed by the Finnish Environment Institute. Eco-benchmark is a tool intended for consumers, which illustrate in a comprehensible way the environmental impacts of daily consumption activities. For more information, see: http://www.environment.fi/default.asp?contentid=197441&lan=EN

[7] Although EPDs are mainly intended for the business sector (e.g. professional buyers in the commerce, industry and public authorities), individual consumers are not excluded from its users (Swedish Environmental Management Council, 2000)

The Eco-rating project was divided in two broad sections: the **Visual Representation of information** (container) and the **Evaluation** (content). The core activities of this thesis fall within the **Visual Representation of information** (section *4. Visual representation of information*). This section analyses how the information could be *visually and conceptually* presented to individual consumers. The Evaluation phase represents the development of the technical side of the project, where the primary data is collected and then calculated to produce simplified environmental information. However, since this section is not the core subject of this research, the type of technology used and the practicalities to calculate and analyse environmental impacts are only briefly explored.

Therefore, the focus of this research was intentionally limited to the development of a conceptual and visual representation of environmental information, constituting only one part of the Eco-rating project. Figure 1-2 shows the two broad sections of the Eco-rating project. The overlapped area represents the communication that exists between the two sections.

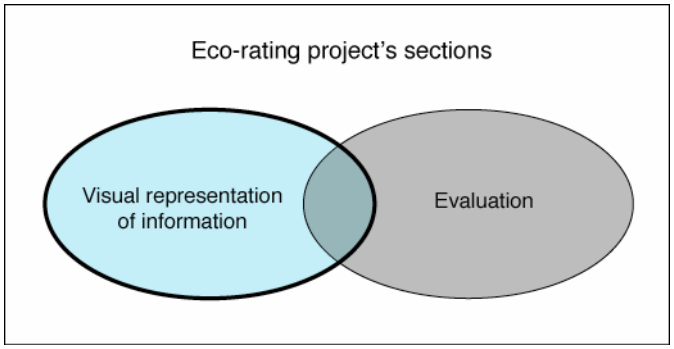


Figure 1-2: The two main sections of the Eco-rating project.

1.3.2 Research process

In order to represent visually environmental information, research has been done on environmental information available for individual consumers to identify success factors and barriers to effective communication (chapter 2). This step was necessary in order to define the basis of the Eco-rating project (chapter 3). This is followed by user-studies composed of a qualitative survey as well as interviews with individual consumers and professionals in the sustainable consumption work field (chapter 4). Based on the material gathered during user-studies, visual representations have been designed following a user-centred approach (chapter 4). User-centred design (UCD) is a design approach and philosophy, which tries to understand end-users' needs by engaging them actively into all phases of the design process (Black, 2006). A wider description and implications of user-centred design are presented in section *4.2.1 User-centred design*. Finally, the various design concepts of visual representation have been evaluated and refined into a final concept paired with relevant recommendations (chapter 6). Figure 1-3, illustrates the research process. The core activity of this thesis work is represented by the highlighted rectangle.

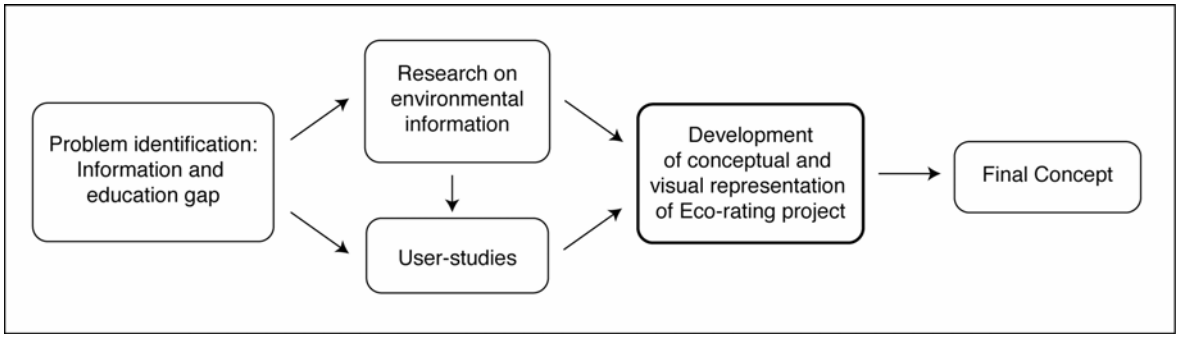


Figure 1-3: Development of the research process.

1.3.3 Survey and interviews

In order to develop an appropriate visual representation of environmental information on products and services, a survey and interviews were conducted between July and August 2007. An online survey has been carried out to sound out individual consumers' perception and attitude towards environmental information and its current visual representations. Around 85 persons participated in the survey. The purpose of this survey was to gather information on how individual consumers generally perceive environmental information on products and services. The survey also permitted to gain insights for the design phase where conceptual and visual representations have been developed.

Furthermore, individual interviews have been conducted to understand, more deeply, how individual consumers understand environmental information on products and services. From a total of nine interviews, four have been carried out with individual consumers and five with professionals in various fields related to sustainable consumption, environmental information and communication, as well as visual representation (information design). A list of interviewees is available in Appendix A. The interviews also allowed for identification of the best approaches to communicating, conceptually and visually, environmental information on products and services. Various concepts of visual presentation were tested on users and experts to verify their effectiveness and afterwards to improve them. Individual consumers participating in the interviews had various levels of environmental awareness. Three face-to-face interviews were carried out in Iceland, while one was conducted over the phone. Eight professionals were contacted for an interview and five of them accepted. Originally, all the interviews with professionals were supposed to be done by phone or face-to-face, but due to availability reasons, one session was carried out via email. It was important not to include only individual consumers, but also experts from different professional horizons. Including the views from a large range of stakeholders can increase considerably the acceptance of the label among users (Wiel and McMahon, 2005).

The interview's questions (semi-structured interviews) differed for individual consumers and professionals since the information desired from each type of participant was different. Furthermore, the interviews were constantly refined and followed the evolution of the project and concepts. At each stage of development of the project, different kinds of information from individual consumers were required. All the interviews were, with the authorisation of participants, audio recorded to facilitate the course of the interview and the recovery of information. For non-publication agreements, the names of the participants are not associated with any specific comments or disclosed.

The reader should bear in mind that the results of the survey have not been used as statistical data (for quantitative analysis), but rather to acquire feedback from individual consumers. The purpose of this thesis was to produce qualitative data, rather then quantitative data. The information gathered during the survey and interviews is essentially qualitative. A sample of the interview templates for professional and individual consumer is available in Appendix B.

1.3.4 Stages of the study

This thesis is composed of seven chapters, which follow the logical development of the visual representation of environmental information. This chapter, *1. Introduction*, briefly introduces the reader to the subject of this thesis as well as presents the research questions and methodology.

The second chapter, *2. Environmental information to consumers*, presents an overview of the environmental information available for households and individual consumers. In order to be able to provide consumers with comparable environmental information, it was essential to understand the basis of consumers' environmental information. This chapter includes a literature review and presents similar initiatives, currently in place or under development, to rate environmental performance of products and services for allowing informed decisions.

The third chapter, *3. The Eco-rating project*, briefly defines a personal proposal, called the Eco-rating project. It presents the main objectives, features and challenges that this project entails.

The chapter four, *4. Visual representation of information*, constitutes the core work of this thesis. This section discloses the results of the survey and of the individual interviews carried out with consumers and professionals. The material gained from user-tests (i.e. survey and interviews) fed the design of visual representations, which evolved in parallel. This chapter follows the development of the various concepts of visual representation of environmental information.

The chapter five, *5. Evaluation,* briefly explores the technical, operational and management areas of the project. This section, foresees the type of tools and methodologies, as well as the practicalities, surrounding the calculation of environmental impacts. It is worth noting that this chapter is not directly related to the core work of this thesis. This chapter presents the other section of the Eco-rating project which is not investigated thoroughly in this research. However, this section is considered essential in order for the reader to understand and size the scope of the Eco-rating project.

The chapter six, *6. Final concept and recommendations,* presents a final concept of visual representation. Furthermore, this section suggests recommendations that should be taken into account in the development and implementation of an environmental information system such as the Eco-rating project.

Finally, chapter seven, *7. Conclusions*, presents the conclusions and sums up this research.

1.4 Scope and Limitations

The targeted group in this research is households/individual consumers from countries where consumption patterns have been observed to be unsustainable and a shift toward sustainability is required. *Households* and *individual consumers* are intended to refer to all individuals taking an active part to consumption activities. The words *households* and *individual consumers* are considered to have the same meaning and are used interchangeably.

The time frame chosen for analysis corresponds to our current time (i.e. 2006-2007). The idea was to draw a representative picture of the current situation regarding the display and communication of environmental information on products/services available for individual consumers. This study is done with the intention to look at future alternatives to present environmental information to consumers. Therefore, it must be considered as an exploratory work. Hypothetical solutions are presented, which could lead, in a near future, to the development of new models of environmental information representations. A future projection (5 to 10 years) on the format and representation of environmental information will be proposed.

In section *5. Evaluation*, some of the aspects and challenges related to the collation and calculation of environmental information are mentioned. However, a lot of significant matters entering in the implementation of an eco-label scheme have not been covered. This type of project is wide and complex; drawing up a detailed plan would require a considerable amount of resources and time. Since this section was not the main focus of this study, the aim was not to produce an exhaustive plan, but rather to provide the reader with a brief overview of the major technical and managerial aspects of the Eco-rating project.

The final visual representation proposed in section *6. Final concept and recommendations* cannot be considered applicable to all countries and cultures. This visual representation research is applicable for the European market and might be extended to the North-American market. However, the level of trust towards the government and other independent organisations varies greatly between countries. Further research would be necessary to identify if the concept could be suitable elsewhere and especially outside the Nordic countries (i.e. Denmark, Sweden, Norway, Finland and Iceland).

1.4.1 Validity

Validity issues in qualitative research have often been mentioned in literature. Indeed, researchers as well as participants may be partial during the research process. It seems important to mention that those factors might influence the results' validity.

Researcher's bias

Maxwell identifies two main "validity threats": *researcher bias* (selection of data that fit the researcher's existing theory) and *reactivity* (influence of the researcher on the setting or individuals studied) (2005). It has been observed that the choice of user-centered design activities (e.g. scenarios, usability testing, interviews…etc.) by design practitioners can be a source of bias during the design process (Papantonopoulos, 2004). «…our choice of tasks is a source of bias that could affect perceptions of the product during development…» (Wilson, 2007, p. 48). In the context of this thesis, it is obvious that the choice of the following research activities: survey, individual interviews with scenarios and think-aloud, influenced the type of results collated. Furthermore, the questions asked during the survey and individual interviews might have influenced the kind of results being produced.

Participant's bias

On the other hand, participants may be tempted to hide their true thoughts or act differently in a research situation. Indeed, this kind of behaviour was observed in various research settings such as in contingent valuation method (CVM) where participants do not always disclose their real willingness to pay (Turner et al., 1994).

In addition, the interviews have not been carried out in a "real life context" (i.e. in this case a consumption situation in a store or on Internet for example). It is recommended for user-centered design practitioners to: «…interview users in their natural work setting.» (Wood, 1997, p. 54) However, for practical reasons, the interviews could not have been carried out in real purchase situations. Those observations should be taken into account when considering the validity of results.

1.4.2 Feasibility discussion

It should be noted that the further development of the Evaluation phase, which is not covered in this thesis work, would bring about significant issues that are highly political and debated among experts. This thesis does not deal directly with those delicate questions. Nevertheless, it is worth mentioning that those issues exist and should be considered by the reader.

First, the *data collection* of environmental impact (primary data) can be particularly complex and in certain cases even impossible. Should the use of estimates or reference data be accepted and if so, to which level? The widespread collection of data would also entail a high level of logistics.

Second, there is currently no widely accepted method to *weight* environmental data to produce a single environmental indicator. The choice to allow weighting and how it should be done is highly subjective since it depends on the beliefs and values of individuals. The evaluation of environmental impact of products and services, such as LCA, is not a purely scientific process since it involves making assumptions, value judgments, and trade-offs (Tibor and Feldman, 1996). Reaching a consensus on one single weighting methodology might be extremely difficult given that the various stakeholders do not necessarily share the same opinion on the question. Indeed, the ISO standards do not support the production of weighted environmental data, as well as under a single score, intended for communication with the public (ISO, 2006, ; Piper et al., 2003). Of course the weighting, as well as the aggregation of data into one indicator, implies that this information greatly simplifies reality. Therefore, weighting and aggregating tend to decrease the level of precision and accuracy of the environmental information.

Third, *developing and implementing* such a project on a large scale (at a national or international level) might be extremely difficult. The adoption of a standard on environmental information is foreseeable to give rise to a lot of opposition from many stakeholders such as producers and manufacturers. Gaining general agreement on this type of standard might be complex since various actors are involved (e.g. producers, retailers, government…etc.) with conflicting interests and goals. It is likely that this situation might lead to politics and power games. The players with the highest power might influence and lobby for some decisions. The choice of a specific weighting method can be highly beneficial for some and at the same time, highly unfavorable for others. This could lead to a partial system, which is not desirable.

It suffices to say that there are significant obstacles (e.g. financial, political and social) to the development and implementation of an environmental information system on products and services, such as the Eco-rating project. (See sections *3.* and *5).*

2 Environmental information to consumers

In an era of fast growing communication tools and services, access to information is crucial. Environmental information is one form of information, which is becoming more and more important and widely accessible. Environmental information is essential for several types of users (e.g. consumers, scientists, purchasers…etc.) and purposes. The term environmental information is extremely broad and can be interpreted differently. «The report "*Kunskap om produkters miljöpåverkan: tillgång, behov och uppbyggnad av livscykedata*" by IVL, states that "environmental information" is: «…all conceivable and necessary environmental information relevant for products in a life cycle perspective.» (Carlson et al., 2005, p. 103)

Under the concept of sustainable development, Agenda 21 explains environmental information as: «…everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual levels.» (UNEP, 1992, chap 40)

As we can understand from the two previous definitions, environmental information can take many forms and be presented under various formats: a television add, a sample of a chemical, the level of emissions, a journal article…etc. Scientists use the term *primary data* to describe the lowest level of aggregated data needed to produce a desired piece of information (Carlson et al., 2005). An example of primary data could be the total amount of a chemical emitted in the production of a product (e.g. quantity of waste yeast in the production of 100 ml of beer). However, it can be hard for individual consumers to evaluate the environmental profile of a product with the quantity of waste it produces. Distinguishing between significant or negligible factors of the environmental impact of a product or service is a complex matter. A combination of interpreted information (e.g. CO_2 emissions, ozone depletion, toxicity) is necessary in order for the consumers to make a judgment. The information must be put into context and compared to something known by the consumers. To obtain *simplified environmental information* to be used by non-specialists (e.g. individual consumers), primary data must be compiled or aggregated (*aggregated data*) and interpreted to make it accessible and comprehensible. Below, figure 2-1 represents the different stages of the production of simplified environmental information. As a result, the term environmental information encompasses all the stages.

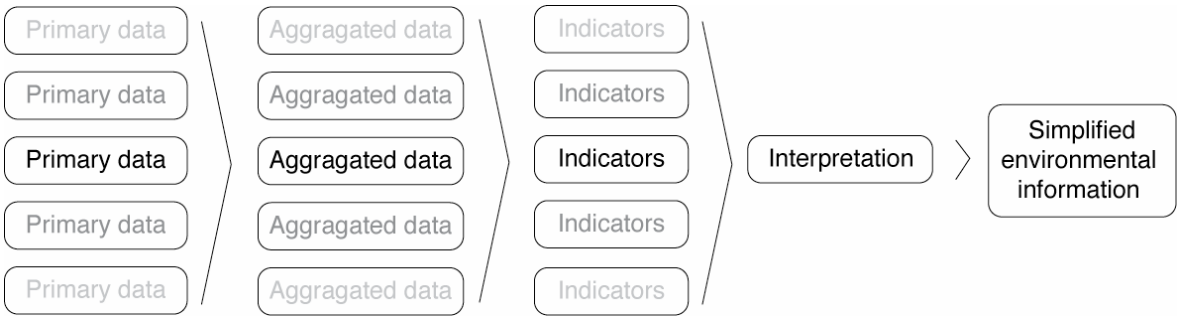


Figure 2-1: Stages of the production of simplified environmental information.

Source: Inspired by Establishing common primary data for environmental overview of product life cycles (Carlson et al., 2005).

In order to aggregate primary data, various tools can be used. The choice of a tool usually depends of the type of information needed. Examples of tools are: Life cycle analysis (LCA), input-output analysis (I/O) or ecological footprint. The aggregated data will provide *indicators*, simpler figures of specific environmental impacts. The combination of various indicators will allow for presenting a more representative environmental profile. To facilitate comprehension, the indicators are usually interpreted. For example, indicators can be presented in a band or pie graph. Due to the complexity, scientists often have difficulty conveying environmental information in an effective way to lay-users, such as individual consumers. This issue of information transfer from scientific sphere to the non-experts sphere has often been observed and criticized.

Indeed, the expression *environmental information* includes large amounts of data and therefore can become highly complex. This comes from the intrinsic complexity of natural processes/cycles and of the life cycle of the products and services. Multiple environmental impacts are connected at each stage of a product and service's life cycle, which makes it hard to gather it all. Furthermore, only that which can be observed can be measured. If a specific environmental impact cannot be measured, it cannot be added to the total environmental information. The limitations of science can also prevent to fully measure impacts of environmental damage. Time variation between environmental impact and its causal activity (e.g. the use of CFCs and the depletion of the ozone layer) is one more obstacle obtaining reliable environmental information.

As seen previously, the creation of simplified environmental information is complex and also expensive. Gathering primary data is a highly resources and time consuming activity. This is an important matter to consider before the production of primary data (Carlson et al., 2005; OECD, 2001a).

2.1 Information for whom?

It is said that environmental information is greatly important, but who exactly needs this information and for which purposes? Carlson identifies four user categories of environmental information: (1) environmental scientists and experts, (2) policy making of various kind, (3) professional decisions makers and (4) laymen in their everyday actions (2005).

User categories	**Description of user type**	**Degree of expertise**	**Time to interpret**	**Use of information**
Environmental **scientists** and **experts**	Deep interest in an understanding of many aspects of environmental information	Environmental expert	Weeks, months, years	New information
Policy making of various kind	Definer and decider of acceptable behaviour and products for society, business, professions, consumers etc.	General expert	Days, weeks, months	New information
Professional decisions makers	Environmental information as a professional tool.	Purchasing/ Technical expert	Minutes, hours, days	Physical world
Laymen in their everyday actions	Occasionally facing different environmental information as layman. Decisions have no legal implications	Layman	Seconds, minutes	Physical world

Table 2-1: Different types of users of environmental information.

Source: Adapted from Establishing common primary data for environmental overview of product life cycles (Carlson et al., 2005)

As observed in table 2-1 above, each category uses environmental information for different purposes. Since the level of expertise varies greatly, each category need different types of environmental information that correspond to different needs, such as scientific research, policy making or daily consumption activities. This means that a layman cannot use the same environmental information as a scientist and vice versa. The layman does not need to know and understand all the details of the environmental impact of a product to make a purchase decision.

In the report *Making Product Information Work for the Environment* from the IPP Working Group, the laymen category represents the end-user of environmental information and is divided in three sub-categories: (1) Businesses, (2) Public bodies and (3) Household/Individual consumers. Again, it is important to notice that the needs and purposes of environmental information are similar, but might also differ (2006). For example, since businesses and public bodies are more susceptible to buy in bulk, they might request more detailed information than household/individual consumers. The present research puts its focus on *Laymen in their everyday actions* category and more precisely on the *household/individual consumers*.

2.2 Target on individual consumers

The choice of individual consumers as target group can be argued and discussed. However, the literature provides evidences that individual consumers play a major role on environmental issues when it comes to consumption. The impact of households' consumption is significant considering the extensive number it represents.

Indeed, the OECD recognizes the importance of individual consumption as one of the major sources of environmental damage: «…although households as a group are not the largest contributor to most environmental pressures, their impact is significant and will intensify over the next two decades.» (2002b, p. 21) In the report *Environmental Outlook 2020*, some households' activities, mainly waste generation and personal travel, has been identified as major factors of environmental pressure in the coming years (OECD, 2001c).

Professionals and **lay-decision makers** are considered to be the most important users of information since they are the ones that make decisions which have an impact in the real world (Carlson et al., 2005). For example, individual consumers going to the supermarket have the power to make a choice between various products, which will a have a real impact on the environment.

Both reports *Making Product Information Work for the Environment* and *Establishing common primary data for environmental overview of the product life-cycle* recognize the impact and role of the end-users as agents of change (Carlson et al., 2005, ; IPP Working Group, 2006).

> «In a market economy, consumer desires and needs effectively drive the economic system. In other words, consumers directly and indirectly play a major role in determining the goods available on the market.» Jean Cinq-Mars and Carlo Pesso (OECD, 1999, p. 24)

However, the impact of other user categories of environmental information is significant and

should not be underestimated. In some OECD countries, purchase power from public bodies can be in total superior to household purchase.

2.3 Sources of information

In the last decade, the amount of environmental information available for consumers rose drastically. Environmental information took the medias by storm, delivering to their audience, news, television shows, magazines and blogs on various environmental issues. Some people even have the feeling of being overloaded with environmental information.

Various sources try to convey environmental information to consumers. In the report *Background paper – Experts Workshop on Information and Consumer Decision-Making For Sustainable Consumption*, three principal channels of information have been identified: (1) the market information, (2) the mass media, and (3) social organizations (OECD, 2001a). The market information consists of labels (eco-labels and declarations), advertisements, retailers and corporate environmental reports. Television, radio, newspaper, magazines and the Internet represent the mass media. Social organizations gather consumer associations and environmental associations. To those information channels should be added information provided by governmental organizations, which can be a rich source of information. For example, the government can diffuse information via information campaigns or its website.

It is important to note that the use of Internet is drastically increasing as a source of environmental information. Since few years, there has been a blooming of websites offering consumers various tools to calculate and measure the environmental profile of their daily life and activities. An example is the multiplication of "personal carbon calculators" (CO_2 calculators). Many airline companies (e.g. Air Canada, Air France, SAS Scandinavian Airlines…etc.) offer a tool on their website allowing consumers to measure the CO_2 emitted by their flights and, sometimes, to offset those emissions. However, it seems that many of those personal carbon calculators fail to give consumers appropriate guidance to make better choices (Bottrill, 2007).

Depending on the source, the information conveyed to consumers varies greatly. Usually, very little environmental information is provided on products and services. Only the market channel will give information about specific products/services. Although the mass media and social organizations are important sources of environmental information for individual consumers, those two channels are not being considered in this present work.

2.4 Information about products and services

As seen previously, there is an impressive amount of information presented to consumers. However, there is little information available on the environmental performances of products and services. Environmental information on products could be defined as all information that allows consumers to evaluate the environmental impacts of a product. The IPP Working Group defines the term as: «…information about the environmental aspects, impacts and performance of products which is significant across the whole life-cycle of those products» (2006, p. 5). Environmental information on products is fundamental, in order for consumers to compare the environmental profiles of products and make informed choices.

As presented previously, environmental information is produced with the use of tools and methods. Carlson classifies the various methods and tools depending on the intended end-users: (1) expert tools, (2) support tools and (3) communication tools. *Expert tools,* as the title implies, is intended for experts and are used: «…to answer complex questions about

environmental performance» (2005, p. 67). Examples of expert tools are LCA or Design for the Environment (Dfe). *Support tools* are also used by experts, but provide expert tools with primary data or aggregated data input. Databases are examples of support tools. *Communication tools* are used to produce simplified information intended for lay decision-makers. Individual consumers are direct users of communication tools. Table 2-2 presents environmental information tools and methods' classification.

Classification of environmental information tools and methods	**Examples**
Expert tools	LCA, Dfe
Support tools	Databases
Communication tools	1) Life-cycle interpretation 2) EPIs 3) Data sheets and declarations a) Eco-labels (Type I and III) b) Environmental reports

Table 2-2: Classification of environmental information tools and methods.

Source: Inspired by Establishing common primary data for environmental overview of product life cycles (Carlson et al., 2005)

In the *Communication tools* section, four main tools or methods have been identified. (1) Life-cycle interpretation ISO 14043, (2) Environmental Performance Indicators (EPIs), (3) Data sheets and declarations: eco-label Type I, eco-label Type III and environmental reports.[8]

The tools being described in this research do not represent an exhaustive list of all environmental tools available to consumers. Those tools have been presented because they represent the most commonly used tools.

2.4.1 Life-cycle interpretation

Life-cycle interpretation is defined as: «…the phase of LCA in which the findings from the inventory analysis and the impact assessment are considered…The interpretation phase should deliver results that are consistent with the defined goal and scope and which reach conclusions, explain limitations and provide recommendations.» (ISO, 2006, p. 16) The interpretation constitutes the last of the four stages of a LCA: a) goal and scope definitions, b) Inventory Analysis, c) Impact Assessment and d) Interpretation. See appendix C for a figure of the four stages of a LCA. It is in the Interpretation stage that the results are analyzed and put in context. The results of a LCA depend on the choice of the environmental impacts being measured (e.g. ozone depletion, global warming potential, acidification…etc.) Therefore, the results of a LCA for two similar products might be different and, as a result, not comparable.

[8] From the original text (Carlson et al., 2005) in section *3.2 Tools and methods for technical dialogue*, Safety Data Sheets (SDS) have not been considered in the present research. SDS (by law mandatory in the EU) are used to declare specific chemicals entering into the production process. SDS inform consumers, but only on one specific environmental characteristic of the product. It might be difficult to distinguish the overall environmental impact of the product or service and therefore make an enlighten choice.

2.4.2 Environmental performance indicators

The OECD defines environmental performance indicators (EPIs) as: «…a parameter, or a value derived from parameters, which points to provides information about, describes the state of a phenomenon/environment/area…» (2003, p. 5) In other words, EPIs provide a simple picture of the environmental performance of a product, service, company…etc. For example, an indicator can be the total amount of a material use, or the total amount of CO_2 emitted in one year. A wide variety of EPIs are available for companies via various guidelines. An example of guideline is the Global Reporting Initiatives (GRI)[9]. It provides companies with sustainability performance indicators (SPIs), which include EPIs as well as two other performance indicators: economic and social.

2.4.3 Data sheets and declarations

Under this section eco-labels/declarations and environmental reports are gathered. Type I and III Eco-labels, part of the ISO 14020 Standard series, are defined here. Eco-label Type II has not been considered in this research since it is not reviewed by a third party to prove its authenticity.

Eco-label Type I is a label or seal certifying that a product fulfils a set of predetermined environmental performance criteria (including life-cycle considerations) verified by a third-party. The label is awarded only if the product fulfils all the requirements. Otherwise, it is not awarded. Only a limited share of products from each product category can display the label «…due to the selective nature of formal eco-labels, only a minority of products can benefit (i.e. the top 10 - 30% of each product group in terms of environmental performance).» (DG Environment, 2000, Executive summary, p. II) The label is an indication for the consumer that a product has the lowest environmental impact of its product category. The product category is determined by the function of the product. Indoor paints and varnish, batteries or dishwasher detergents are examples of product categories used by eco-label programmes. There is no possible comparability of environmental performance between products. Various eco-label Type I programmes exist in many countries. The programmes are voluntary.

Eco-label Type III, also called Environmental Product Declaration (EPD), is a communication tool, based on LCA data, which provides the users with quantified information on the environmental impact of products. In theory, EPDs allow for comparing the environmental profile of different products. According to the GEDnet Secretariat: «the purpose of an environmental product declaration, EPD, is to provide easily accessible, quality assured and comparable information regarding the environmental performance of products and services.» (2007, chap 6) EPDs are principally intended for business-to-business communication. However, business-consumer's communication is not excluded.[10]

EPDs originate from an eco-label programme developed independently by the Swedish government.[11] The system is voluntary and open to all companies worldwide interested to participate. EPD programmes exists in others countries; Belgium, Poland, Finland, Italy, Japan, Denmark, South Korea, and are under development in Norway (Chiristiansen et al., 2006). See Appendix D for a sample of an EPD.

---

[9] For more information, see: http://www.globalreporting.org

[10] ISO 14025:2006

[11] For more information, see: http://www.environdec.com/

Environmental reports are documents produced by companies and institutions to provide stakeholders with information about their global environmental performances. Environmental reports generally appear in Corporate Social Responsibility (CSR), Corporate Responsibility (CR), Sustainability, or simply Environmental reports. It can also be added voluntarily through an Annual Report (Defra, 2006). The production of environmental reports often includes the use of qualitative and quantitative environmental indicators (described above). To guide the environmental report's production, companies often use guidelines or frameworks such as the ISO 14001 series, EMAS standard and the Global Reporting Initiative (GRI). Within the GRI, efforts are made to standardize the use of indicators allowing companies in the same business area to be compared.

2.5 Analysis of current environmental communication tools

It is clear that most tools are useful to provide environmental information to a specific audience and in different situations. However, few of those tools provide concrete environmental information on products and services, that can guide consumers to make informed choices. Indeed, to allow consumers considering environmental performance of products in the decision-making process (with other criteria such as the price or intrinsic quality of the product), the environmental information provided must fulfil some key conditions:

- **Accessibility** of environmental information at the **consumption moment**;
- **User-friendliness**: the information must be **comprehensible** for individual consumers (lay decision-makers);
- **Comparability** of the environmental information and;
- **Consumers' education** about **sustainable consumption behaviour.**

Accessibility for households to environmental information at the **consumption moment** is crucial. Presently, it can be observed that environmental information flourishes from many sources and channels, but it is not available or hardly available at the right time: the consumption moment. Individual consumers have access to environmental information through the Internet or magazines. However, those sources of information are not accessible while one is at the store weighing the pros and cons of two competing products (OECD, 2001a).

Furthermore, getting environmental information on products and services may require that households must expend a lot of effort that few are willing to do. As an example, to be able to compare and evaluate the environmental performance of two competing products, individual consumers must search for this information from various sources of information (e.g. Internet or contact a consumers union) prior to make the purchase. This type of behaviour can sometimes be observed when buying large appliances or cars for example, but rarely for daily purchases. The Commission for IPP identified that: «for most consumer products, relevant environmental information is not available on the product itself. In many cases the consumer would need to look hard for the information and would have to know where to find it. Currently, only the most motivated consumer would do this» (European Commission, 2001, p. 13). Therefore, searching for environmental information is often a time consuming activity.

User-friendly environmental information should be **comprehensible** for individual

consumers. Individual consumers usually have a low level of knowledge about environmental issues (Holdsworth, 2003, ; Nissinen et al., 2005). Accordingly, the information presented to them must be easy to read and understand. Type III Eco-labels are designed to allow comparability between products. However, they are not widely applied and have been criticised for being hard for lay decision-makers to understand. The OECD pointed out the importance of effectively communicating environmental information (2001c).

Comparability of the information is the key criterion to allow choice. Indeed, comparability has been identified as a critical success factor of EPDs (DG Environment, 2000, ; Swedish Environmental Management Council, 2000). If comparability of environmental information is possible between products, consumers have the necessary information to make informed choices and ultimately change their behaviour. The only source of environmental information available on the purchase moment is the eco-label. Products which display eco-labels Type I inform the individual consumers that they fulfil a set of criteria and therefore represent the best environmental performance of their product category. However, it is impossible to compare the environmental performance of two all-purpose detergents displaying two different eco-labels. What about products without any label? The fact that no eco-label is applied on a product does not necessarily mean that this product has higher environmental impacts. It might be the contrary. Furthermore, eco-label Type I does not allow comparison between products of different product categories.

It is necessary that the environmental information **educates** consumers to adopt more **sustainable consumption behaviour**. Education is one of the critical factor pointed out by Agenda 21 to reach sustainability (UN, 1997). The environmental information should not only provide information, but also educative information in order to train and develop environmental knowledge and skills of individual consumers. All pieces of environmental information will, in one way or another, educate individual consumers. However, some tools limit environmental education. For example, eco-label Type I do not really educate consumers to make better consumption choices. They only inform the consumers that some products and services are less damaging for the environment.

	Key criteria			
Classification of tools and methods	**Available on consumption moment**	**Allow comparability**	**User-friendliness**	**Education**
Life cycle interpretation ISO14043	-	✓*	✓	✓
Environmental performance indicator EPIs	-	✓*	✓	-
Data sheets and declarations a) Eco-label Type I	✓	-	✓	-
b) Eco-label Type III /EPDs	✓	✓	-	✓
c) Environmental reports	-	-	✓	✓

Table 2-3: Comparison between the environmental information tools and the four key criteria for choice.

**Comparability is possible only in some cases.*

Source: Inspired by Establishing common primary data for environmental overview of product life cycles (Carlson et al., 2005)

If the previous tools are reconsidered, none of them fulfil the four key criteria. Table 2-3 presents the different tools and the key criteria described above. This situation creates a lack of knowledge, preventing consumers to consider environmental performances of products in their daily consumption decisions. As an example, in a simple purchase situation like at the supermarket, it is presently impossible for a consumer to have access to environmental information that will allow him/her to compare products and make a decision. Only Eco-labels Type I and III fulfil three out of the four key criteria.

This reaffirms the real need for a system that will provide consumers with all the necessary environmental information to allow comparative choices. In the next section, current initiatives of environmental communication are explored.

2.6 Current initiatives

The previous section showed that standard environmental information systems available for individual consumers contain some shortcomings and are often incomplete. In the last years, novel environmental communication tools and systems attempting to rate environmental impact of products to allow comparability make their appearance. Up to now, five initiatives have been identified using different tools and formats to communicate environmental information. A distinctive interest in carbon footprinting and labelling can be observed. The United Kingdom clearly positions itself as a leader in the field of carbon footprinting and labelling. This section describes those new initiatives in order for the reader to understand the latest trends.

2.6.1 United Kingdom and carbon labelling: two schemes in parallel

Since the end of 2006, there has been a rise of carbon footprint and more specifically carbon labelling as a tool to tackle climate change. Presently, the United Kingdom government is actively promoting a "low carbon lifestyle". Indeed, in 2006 the *UK Climate Change Programme 2006* (revision from the 2000's plan)[12] was launched, a nation wide environmental plan focusing on the reduction of greenhouse gases (GHGs). In 2007, the UK government announced, in the *Energy White Paper*[13], its new Carbon Emission Reduction Targets from 2008 to 2011. It also presented a mandatory national scheme: the *Carbon Reduction Commitment*, which requires large commercial organizations (e.g. banks, supermarkets and large local authorities) to reduce their emissions.

2.6.1.1 Carbon Trust

This independent company was funded by the British government in 2001 to help the country move towards a low carbon economy by helping businesses and the public sector to reduce its carbon emissions (Carbon Trust, 2007b). The company serves as a tool for the government to bring forward its objectives of GHGs emissions reduction. One recent activity focuses on mapping the carbon footprint[14] of businesses. In 2006 the company released a report called *Carbon footprints in the Supply chain – The Next step for Business*[15]. The publication promotes carbon

[12] For more information, see: http://www.defra.gov.uk/environment/climatechange/uk/ukccp/index.htm

[13] For more information, see: http://www.defra.gov.uk/environment/climatechange/uk/energy/whitepaper.htm

[14] The Carbon Trust defines carbon footprint as: «…a methodology to estimate the total emission of greenhouse gases (GHGS) in carbon equivalents from a product across its life cycle from the production of primary material used in its manufacture, to disposal of the finished product (excluding in-use emissions).» (Carbon Trust, 2007, p 4)

[15] Available online: http://www.carbontrust.co.uk/Publications/publicationdetail.htm?productid=CTC616

footprinting as a tool for businesses to reduce their production costs. In the context of this Carbon footprint project, one of the pilot studies involved calculating the carbon footprint of specific products. Companies like Walkers Crisps and Boots participated in the project with the hope to find ways to cut down emissions.

This pilot study paved the way to the creation of a voluntary carbon label, the Carbon Reduction Label. The Carbon Trust states that, in the near future, a mean for manufacturing companies to go further in their commitments to tackle climate change will be to participate in the Carbon Reduction Label (2007b). For a company who wants to display the label on a product, the entire carbon footprint of the product (from cradle to grave) must be carried out following a specific set of procedures. As a result of the footprint process, it permits the company to discover opportunities along the production chain where embedded carbon emissions can be reduced.

The Carbon Reduction Label displays the total amount of emissions released per product in grams of CO_2. In other words, the number on the label shows consumers the amount of carbon emissions released by the product and at the same time the company's commitment to abate its carbon emissions. For example, if the number 100g appears on the label of a pack of chips, the product emits 100 g of carbon emissions (for each product). It has been determined that companies who participate in the carbon reduction label have up to two years to achieve emission reductions otherwise the label is removed. The label can be display on the product's packaging or can appear on the website of the product/manufacturer. For example, the company Innocent Smoothies[16] decided to put the label only on its website with some background information.

Figure 2-1: The Carbon Reduction Label from the Carbon Trust

Source: Carbon Reduction Label website (Carbon Trust, 2007a).

Currently, three companies, Boots Organics shampoos, Innocent Smoothies and Walkers Crisps, are taking part in a 12 months trial period. The label is in its early phase and a commonly accepted methodology, a code of practice and a set of rules still need to be developed. No information has been revealed about the required level of emissions' reduction that companies should reach in order to keep displaying the labels and how it is going to be evaluated.

2.6.1.1.1 Advantages and drawbacks

In the event of massive adhesion to the carbon footprint and labelling concept, some

[16] For more information, see: http://www.innocentdrinks.co.uk/us/?Page=our_carbon_footprint

advantages can be foreseen. If the Carbon Reduction Label were widely applied in United Kingdom for example, it would be possible for English consumers to compare the level of products' emissions. This would give consumers a good insight into the environmental profile of products and allow more informed choices. In addition, this concept has the advantage to push and engage companies to reduce their CO_2 emissions. Since the company's image is involved, it is in the interest of participating companies to reach their target of emissions' reduction. A company seeing his labels withdrawn from its products could seriously affects his image.

Before the emission's reduction has been attained (after a time period of two years), the Carbon Reduction Label shows a company's reduction commitment, rather than the real environmental performance of a product. Since very few products display the label, no comparison is possible for the moment. In addition, the label conveys limited information to individual consumers. The amount of carbon emissions from a product might be difficult to understand; it does not tell much to individual consumers. From an educational point of view, this type of label does not allow households to gain environmental knowledge and skills. However, some consumers could be tempted to favour carbon labelled products because the label shows the company's commitment to the environment.

Some medias took over the subject. The journalist and writer Chris Goodall expressed his doubts about the feasibility of a carbon-labelling scheme arguing the complexity and slow pace of the carbon footprint process (2007). Indeed, Goodall exposed that it took five years of work between the Carbon Trust and the Walkers to produce a single label on a pack of crisps, which is, in fact, a rather simple product.

The FarmersWeekly mentioned major problems, connected with farming practices that still need to be resolved, before carbon labelling can be realised. Indeed, the delimitation of life cycle boundary is brought back, an issue still debated among the LCA experts (Drummond, 2007). In an interview for The Retail Bulletin, Mr. Goodall adds that: «agricultural yields change. Let's say the Walkers Crisp packet says 75g and this year the farms produce 15% less potatoes because of drought. Since the main driver of Walkers' carbon emissions is agricultural fertilizer, which remains unchanged, the figure on the label ought to rise. Will it? And who will monitor this?» (Morgan, 2007, para 6)

In addition, carbon labelling is a single-issue tool, therefore it is easy to overlook other performances of the product such as animal welfare, ethical trading or nutritional content, wrote Caroline Drummond from Linking Environment and Farming. (Drummond, 2007)

2.6.1.1.2 Governmental involvement

At the end of May 2007, the British government announced in a press release the collaboration between the Carbon Trust, Defra (UK Department for Environment, Food and Rural Affairs) and BSI British Standard[17] to develop a Publicly Available Specification (PAS)[18] for the measurement of the embodied GHGs in products and services (Carbon Trust, May 30,

[17] BSI British Standards is the UK's national standards organisation, working with businesses, consumers and government to represent UK interests and facilitate the production of British, European and international standards to meet economic and social needs. For more information, see: www.bsiglobal.com/british_standards

[18] A Publicly Available Specification (PAS) is a sponsored fast-track standard driven by the needs of the client organization/s and developed according to guidelines set out by BSI. Key stakeholders are brought together to collaboratively produce a BSI-endorsed PAS that has all the functionality of a British Standard for the purposes of creating management systems, product benchmarks and codes of practice. After two years the PAS is reviewed and a decision is made as to whether it should be taken forward to become a formal British Standard (Carbon Trust, May 30, 2007).

2007). The main goal is to reach a commonly and internationally accepted method of GHGs calculations. The purpose of this work is to help companies calculating GHGs emissions and ultimately inform consumers about GHGs of the products and services they buy.

Mr. Pearson, UK Environment Minister, claimed that: «More and more, businesses are looking for ways to reduce their impact on the environment. To help them achieve that we need a reliable, consistent way to measure these impacts that businesses recognise, trust and understand. This will be fundamental in our efforts to move Britain towards a low-carbon economy in the decades ahead.» (Carbon Trust, May 30, 2007, para 7)

Furthermore, in his speech at the National Farmers' Union conference, David Miliband, the Environment Secretary, stated that: «…I can envisage the next step where, as well as quality nutritional standards, environmental standards become the norm of food packaging…a green standards that allows consumers to know something about the environmental provenance of what they are buying…» (Milliband, 2007, Shared Agenda, para 29-30).

2.6.1.2 TESCO

Tesco[19] is a British retail chain mainly known for its grocery stores. This company is working in the food and non-food sectors in Europe and Asia.

At the beginning of 2007, Sir Terry Leahy, Tesco's chief executive made an announcement about the company's new environmental programme. In his speech: *Tesco, Carbon and the Consumers*[20], Sir Leahy claims that Tesco is to takes action to tackle climate change by introducing a plan containing various approaches to reduce its carbon emissions. Tesco also wants to focus on the promotion of "green consumption".

In essence, the company proposes the ambitious project of measuring the carbon footprint as well as to display a carbon label on all its products. About the project, Sir Terry Leahy claims that: « Clear information about the carbon cost of the products we buy will enable customers to make effective green choices. Customers want us to develop ways to take complicated carbon calculations and present them simply.» (2007, The knowledge to choose, para 2)

In order to succeed in his project, the retailer is working in collaboration with the Environmental Change Institute (ECI) at Oxford University: «…on identifying and overcoming the carbon pressure points in our own operations and supply chain.» (Ibid, 2007, A Carbon Currency, para 3) One of its first challenges will be to find a commonly accepted method to measure the carbon footprint of products. The company also mentioned its intention to: «…bring down the cost of being green.» since «…price is a barrier for many customers.» (Ibid, 2007, In the Meantime, para 6)

The recent collaboration between Tesco and ECI led to a Carbon Labelling Symposium, held in May 2007. The Symposium, composed of a two days workshop, was organised by the ECI and UKERC (UK Energy Research Center) and sponsored by Tesco. 19 participants from academia, business and government (mainly from the food sector) accepted the invitation. The symposium allowed the participants: «…to explore the practicalities, complexities and implications of carbon labelling» with the intention «…to look at all aspects of the process that would enable 'carbon labelling' (i.e. including data collection and measurement)…» (White et

[19] For more information, see Tesco's website: http://www.tesco.com/

[20] Sir Terry Leahy's speech: http://www.tesco.com/climatechange/speech.asp

al., 2007a, p. 2) A roundtable has been held about the following topics: defining the aim of carbon labelling; debating issues relating to, for example, scope, feasibility, implementation, user information; considering methodological approaches; identifing policy linkages and outline research requirements.

Tesco's carbon labelling project is still under development. Like the Carbon Trust, many steps still separate the idea from the actual carbon label displayed on products in Tesco's supermarkets.

2.6.2 Carboncounted.com, a Canadian initiative

CarbonCounted is an online tool (ElementSix software), which helps businesses calculating the amount of CO_2 emitted by their products along the supply chain. Andrew Conway and Steve Cox, both chemical engineers, initiated this tool. The first version of the software, called ElementSix, was launched in February 2007 and a second iteration in April 2007. The tool is available for all companies (not only for Canadian companies) wishing to measure their carbon emissions.

The ElementSix software allows companies to calculate, online, the carbon emissions of their manufacturing activities. In other words, ElementSix is a carbon calculator and database intended for businesses. Each company is doing its own calculations by including the sources of emissions coming from its installations as well as the one from its suppliers. «Instead of isolated "snap-shot" carbon emission inventories, our web application, ElementSix, connects all of your sources of carbon together into a live supply chain. If your suppliers change their emissions, it will automatically adjust and inform you of the impact on yours.» (CarbonCounted, 2007a, para 2)

Once the calculation process is completed, the company is allowed to use the CarbonCounted label, a quantitative label displaying the amount of carbon in grams (also in kg) emitted by the product. The company can download its personalised label (with the quantity of CO_2) on the website of the CarbonCounted. The registration for companies is free, however fees are applicable for the auditing and certification processes (by a certified auditor). Prices range between CND$110-250 for small and medium size companies and CND$1,000 to 5,000 for larger companies (if an on-site audit is required)[21]. «In order for the Carbon Counted system to have integrity, the inputs and calculations must be reviewed and certified by a Carbon Counted accredited auditor…» (CarbonCounted, 2007b, section 4.1) The certification must be made annually.

In order to support companies in their emissions' calculation process, the CarbonCounted Standard 1.1, has been produced. The document serves as and explanatory tool and guide with step-by-step instructions to carbon calculations. The CarbonCounted system is based mainly on the following standards: ISO 14025:2006 (Environmental labels and declarations, Type III environmental declarations, Principles and procedures), The World Resource Bank, and The World Council for Sustainable Development.

[21] Around €70-170 to €690-3,450.

Figure 2-2: CarbonCounted label.

Source: (CarbonCounted, 2007b)

Up to now, around 30 companies are registered and are in the process of carbon calculations to finally obtain a CarbonCounted label. CarbonCounted is one step further than Tesco and the Carbon Trust since the label is already available for companies (in condition the carbon emissions are calculated and certified). CarbonCounted opted for a low to medium level of details for its calculations. Indeed, it includes CO_2 emissions only. It doesn't include consumption phase or calculations for capital fixtures, equipments and buildings. The calculations also rely a lot on databases (secondary sources). In addition, a company wishing to calculate its carbon emissions must convince its suppliers to participate and register with CarbonCounted. Since this initiative is really recent, it is hard to judge its impact on manufacturing companies and consumers.

2.6.3 KRAV and the klimatmärkning

KRAV is a Swedish association working in the field of organic labelling and standards. The KRAV label can be seen on various organic products sold in Sweden. In its first phase of the project, the association was holding a public hearing on the theme of climate marking (klimatmärkning) to sound out stakeholders' opinion and views. The main objective of the climate marking is to: «…contribute to reduced emission of greenhouse gases during the production, processing and distribution of foodstuffs». (Ekmark, 2007, section 1, para 1) The association wants to create a climate label displayed on food products that emitted less greenhouses gases than average products. The label would be awarded, like the current KRAV label. Therefore this label would not propose comparative environmental information.

2.6.4 Eco-benchmark, a Finnish initiative

Eco-benchmark is a research-based project born from the collaboration of four Finnish institutes: Agrifood Research Finland, Finnish Environment Institute, Finnish Game and Fisheries Research Institute and National Consumer Research Centre.

The project started with the proposition of the World Summit on Sustainable Development (WSSD) 2002, to develop consumers' information tools or systems promoting sustainable consumption. The research group opted for the use of LCA as the main methodology since it is a commonly accepted tool to calculate environmental impact of products and services. However, as discussed in section *2.4 Information about products and services*, LCA holds a high level of complexity, which becomes quickly incomprehensible for individual consumers.

One of the main goals of the project was to make environmental science accessible to lay consumers. The project consisted of the following objectives: (a) to develop different

benchmarks to which the LCA results of various products can be compared, (b) to study how consumers understand the different benchmarks and what proposals for improvement they have, and (c) to propose a few presentation formats and benchmarks for presenting LCA-based information in communications to consumers (Nissinen et al., 2006).

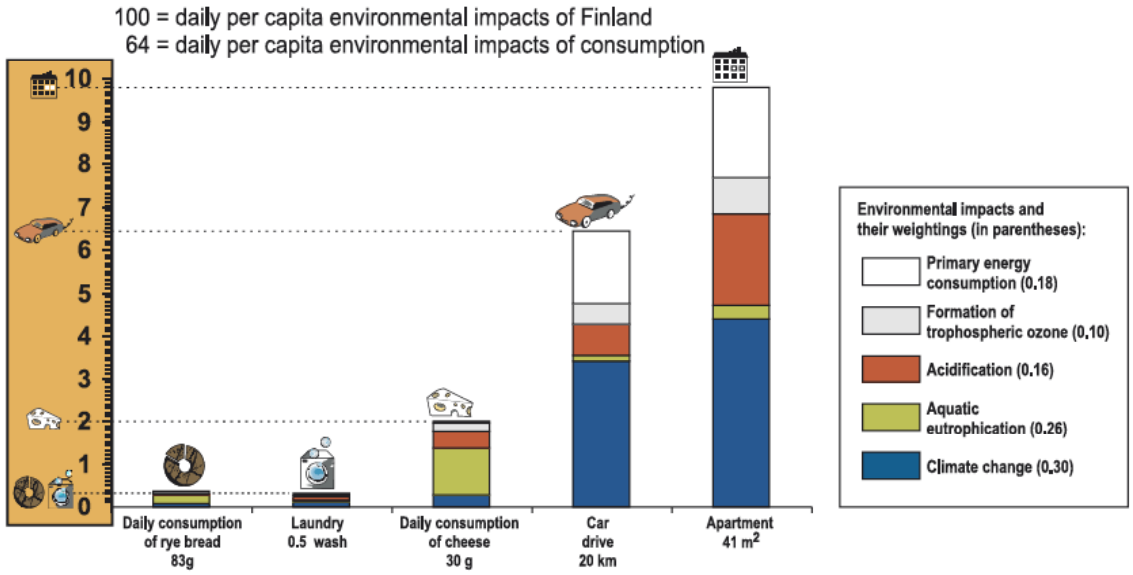


Figure 2-3: Graphical representation of the Eco-benchmark.

Source: Developing benchmarks for consumer-oriented life cycle assessment-based environmental information on products, services and consumption patterns (Nissinen et al., 2006)

The research team proposed the creation of an Eco-benchmark, a graphical representation of the environmental impact of various activities in a daily life. The Eco-benchmark was represented under the form of a band graph and was distributed via an informative brochure. The benchmark in itself is represented by five elements: a daily consumption of rye bread (83g) and cheese (30g), a laundry wash, a car drive (20 km) and an apartment (two rooms). In the graph, a ruler indicates the level of impact of each benchmark products. The impact of each product is put in relation to the average per capita daily consumption of a Finnish person.[22] «The value for the total environmental impacts was 64 for consumption, when compared to an index of 100 for the whole economy» (Nissinen et al., 2006, p.545). Consequently, 100 represents the total amount of daily impact per capita and consumption represents 64. Furthermore, the different activities and products are put in relation with each other to give the consumers an idea of the share of impact each (product and activity) represents.

The elaboration of the Eco-benchmark has been done in collaboration with consumers and various experts in environmental communication sector (e.g. public administration, business, NGOs). 57 volunteers have been included in the design process. The participants were assigned to (1) inspect the information package, (2) participate in a focus group interview, and (3) participate in a second round of feedback to improve the brochure via postal questionnaires. «As our interest was both in gaining information about how consumers understand the benchmarks and suggestions for further improvement, we selected focus

[22] Has been previously determined by input-output analyses of production and consumption in the Finnish economy in the year 1999 (Nissinen et al. 2006).

group discussions…as the method for collecting the first round of feedback» (Nissinen et al., 2006, p. 543). Two iterations of the Eco-benchmark have been released. The first iteration served as a trial to obtain feedbacks and suggestions for improvement of the second iteration.

It seems that the collaboration of participants greatly improved the elaboration of the Eco-benchmark. Indeed, comments from participants allowed refining the benchmark's graphical representation by using the image of a scale/ruler on the left side of the graph. Some participants expressed reservations about the usability of the tool in daily life. (Nissinen et al., 2005) The main drawback observed with this tool was the limitation of its application. For example, the tool works fine under the format of a brochure, but is not necessarily appropriate in other situations like on a product label. «LCA information is too data-intensive for making quick comparisons in shops, and the figures developed and not easy to print on packages» (Nissinen et al., 2005, p. 11).

In the next phase of the Eco-benchmark project, the team was trying to look for applications of the tool in order to diffuse the information. Presenting the project on a website or under the form of an information campaign on sustainable consumption for households were ideas proposed.

2.6.5 Analysis and discussion

Up to now, some of the initiatives presented above are coming from the research side, but mainly from the business side. It is relevant to consider what are the companies' motives behind those initiatives. It seems that there is a mixture of motivations for companies pushing those initiatives: 1) increasing profit by reducing inefficiencies, 2) improving the company's image and 3) being ahead of regulation to come.

It is a confessed aim for companies like Tesco, Walkers Crisps (PepsiCo) and Boots, that reducing carbon emissions means reducing related costs. Of course, manufacturing companies see the significant economical potential that cutting down carbon emissions represents. Companies can foresee clear advantages like gaining competitive leadership and allow substantial costs' reduction by cutting inefficiencies along the life cycle of products. Furthermore, the release of the Stern report in fall 2006 had an important echo in the business sphere. The report concludes that inaction now to tackle climate change would generate massive costs and have a major impact on the international economy in the future.

The anticipation of new regulations and policies also influence companies. As described before, the new British environmental programme is more demanding towards large companies. A fixed carbon emissions' reduction, the *Carbon Reduction Commitment*, is scheduled for large companies like Tesco. Of course, the British environmental programme is in line with the attainment of the Kyoto protocol targets.

Recently, reports on the environmental performance of companies have been published. The report *Greening supermarkets, how supermarkets can help make greener shopping easier* assesses the environmental friendliness of supermarkets in United Kingdom (Dibb, 2006). Only one supermarket received an overall rating of B (good), while the majority received a D (room for improvement). Such pressures from the medias, consumers' associations and consumers themselves contribute to the "greening" of companies like supermarkets.

However, it is clear that large companies have the purchase power to greatly influence their suppliers. This leadership put pressure on smaller suppliers to produce and diffuse environmental information along the supply chain. In addition, environmental initiatives of

large companies are not without influencing their competitors. Competing companies will be tempted to follow close behind and introduce similar initiatives in order not to loose market share.

2.7 Conclusions

Environmental information and education to consumers are key elements to the attainment of sustainable development and consumption. As seen in section *2.5 Analysis of current environmental communication tools*, available environmental information tools contain many gaps, preventing individual consumers to consider environmental profile of products in their consumption activities. Consumers are requesting from companies more environmental friendly activities and products as well as more accessible and comprehensible environmental information. The previous section shows that there are strong and visible initiatives to the promotion of clear and simple environmental information targeted to individual consumers. There is place and need for an environmental information system, which would rate environmental impact of products and services. This system should allow comparability and therefore informed choices.

Force is to say that the recent initiatives are really positive in the optic of sustainable consumption and climate change. However, is that really what consumers need? Are those alternatives representing the best possible solutions to improve environmental communication? Is it possible to go further? The following observation can be made: most of those initiatives do not focus on consumers' need for environmental information. As highlighted by some NGOs like Friends of the Earth and WWF, it is suspected that a carbon label is more a tool to stimulate activity along the supply chain and open green marketing opportunities rather than educating consumers (Baker, 2007).

In the case of the Eco-benchmark, the first premise of the project was to use LCA as a tool and try to make the science behind accessible to households. However, is the use of LCA necessary to generate the environmental information that individual consumers need? To determine the scope and format of environmental information, the data format must suit all the primary data needed by the intended users (Carlson et al., 2005). In other words, prior to the production of environmental information, the needs of users must be met.

The next section, *3. Eco-rating project*, describes and explores the development of an environmental information system, which rates environmental impact of products and services. The Eco-rating project is proposed as a new alternative to environmental information intended for individual consumers.

3 Eco-rating project

The Eco-rating project is a personal proposition which started with the following observation: right now, it is almost impossible for individual consumers to access and evaluate environmental information on products and services when time comes for consumption decision. Therefore, it is difficult to consider environmental information in the purchase process, along with other decision factors like price, aesthetics, etc.

Although not the main focus of this research, this chapter explores the development of the Eco-rating project: an environmental information labelling system intended for individual consumers allowing comparison of the environmental profile of products and services. This section provides the reader with a description and introduction to the Eco-rating project. As presented in section *2.5 Analysis of current environmental communication tools*, the Eco-rating project should fulfil those key criteria:

- be **accessible** during consumption acts;
- be **comprehensible**;
- allow **comparison** of environmental impacts between products and services and
- ultimately **educate** consumers opting for **sustainable consumption** behaviours.

3.1 Project team

In order to develop and manage the Eco-rating project, a project team should be created. To offer a fair and transparent representation, the project team should integrate all stakeholders involved in such a project. The project team could be compare to the programme managers (board or committee) that defines product categories, develops criteria and issues certifications for the Eco-label Type I schemes (GEN, 2004). Ideally, it should be composed of the programme managers and representatives from: consumers associations, industry, standards, government, environmental associations, scientific community and other interested parties. All organisations that would be interested to take part in the development of the label such as NGOs, International community, Medias and so forth are considered as other interested parties. The Global Labelling Network (GEN) states that: «The credibility of a programme can be enhanced through the involvement and support of various organizations, groups and individuals with no direct commercial interest in eco-labelling.» (2004, p. 11) Designers have not been included in the project team because they would probably not become permanently part of the project team. As presented in section *4. Visual and conceptual representation*, designers would be working on the Eco-rating project for a definite time period only. The figure 3-1 shows the different members of a potential project team.

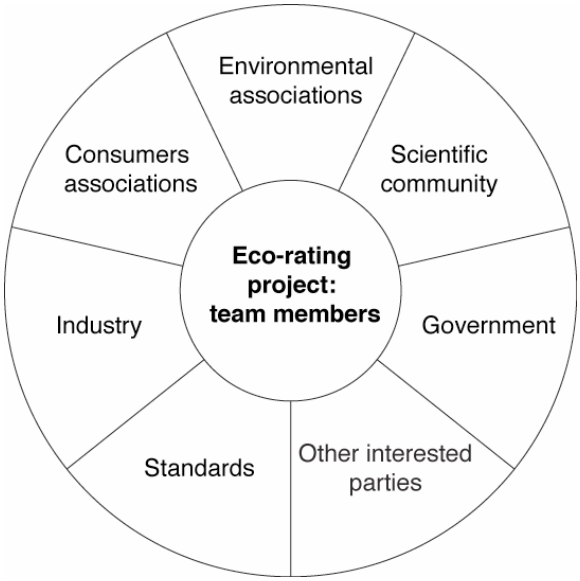


Figure 3-1: Potential members of the Eco-rating project

In a project like the Eco-rating, the role played by the scientific community is central. Since the comparison of products and services depends on the measurement of the level of environmental impact, the science behind the label is extremely important. Furthermore, the credibility of the label will rely partly on the measurements and calculations of the environmental profile of products and services. The users as well as other stakeholders of the Eco-rating project must believe in the results of calculations presented to them. In other words, they must trust what is behind the label. Since for a large share stakeholders it is almost impossible to verify the information displayed on labels, they rely only on the credibility of the organisation (Teisl and Roe, 2005).

3.2 Information and education

The Eco-rating project has a two-fold broad objective: to inform and educate individual consumers. Of course, those two objectives are not easy to fulfil. A project like Eco-rating cannot alone fulfil all informative and educative needs of individual consumers. However, it can contribute to it. In order to provide information, the project proposes the elaboration of a system that displays the level of environmental impact of products and services. This environmental information will allow comparison between products and permit informed consumption choices. However, it is hard to know if by the introduction of such a system, individual consumers will change their consumption habits and switch for more environmental-friendly products and services. Consumers' behaviour is still not so well understood. Consumers' acceptance of environmental information systems (e.g. eco-labels) depends on various factors such as: convenience, habit, value for money, personal health concerns, hedonism and individual responses to social and institutional norms and also resistance to change (Vermeir and Verbeke, 2006). Furthermore, environmental concerns generally do not come first in their consumption criteria (Egan et al., 2000, ; White et al., 2007b). However, many researches suggest that the number of consumers opting for environmental-friendly choices is increasing (OECD, 2001a).

By using a common comparison basis, on which the environmental performance of all products and services is based, individual consumers can then locate on an «impact scale» the position of various products and services used in their daily life. Displaying environmental performance of various products and services in relation to each other gives consumers a

clearer vision of the environmental impact provoked by its own consumption behaviour. Showing the rating of environmental performance of products and services can be used to educate people and therefore raise their awareness towards environmental issues related to consumption.

3.3 Information format

As seen previously in section *2.4 Information about products and services*, there are many ways used to convey environmental information on products. One way, which has been recognized to successfully transmit environmental information, are labels or eco-labels. Indeed, eco-labels have the advantage to display information directly on the products, as compare to mass-media information for example, where information is accessible via Internet or magazines. Even if the efficiency of eco-labels to reach consumers has often been challenged, it remains the most efficient way to convey environmental information (Teisl and Roe, 2005). Eco-labels have been often chosen by individual consumers, among other mediums of communication, as the favourite way to receive environmental information (Stø and Strandbakken, 2002).[23] Consequently, the Eco-rating project decided to considered label as a potential format. At the same time, other alternative formats would be explored.

However, the medium on which is displayed the environmental information can vary. Indeed, presenting environmental information directly on a product might not be the optimal medium in all cases. For example, putting environmental information on a car might not be the most effective way to convey this information to consumers. In the case of services, environmental information can hardly be put on the service itself.

3.4 Environmental data

According to literature, the understanding of environmental information by individual consumers is highly dependent on the kind of data presented. The report, *Consumer demands on Type III environmental declarations*, proposed some recommendations to improve EPDs and facilitate users' experience (Christiansen et al., 2006). In order to improve the comprehensibility and comparability of EPDs, it is recommended to foster research and find a commonly accepted method to calculate environmental impact in a single indicator (Ibid). Indeed, instead of displaying numerous environmental indicators (e.g. global warming, acidification, eutrophication…etc.) for users to analyze, a single environmental indicator could simplify greatly the assimilation of information. As an example, the EU energy label, which displays only one single indicator (i.e. energy consumption) has been proven to be effective and successful to promote the purchase of lower energy consuming white goods (ANEC, 2007, ; Christiansen et al., 2006, ; Sammer and Wüstenhagen, 2006).

Additionally, focus groups made by the research team of the Eco-benchmark revealed that many users preferred aggregated and weighted results. «Even with aggregated data, many of the users considered the information too complex and undiscriminating to be used as a proxy eco-label on product packaging.» (Nissinen et al., 2005, p. 12) As mentioned previously (section *2.5 Analysis of current environmental communication tools*), environmental knowledge and awareness related to the environmental impact of consumption are relatively low among individual consumers (Holdsworth, 2003, ; Nissinen et al., 2005). Consumers seem to be aware

[23] In a research carried out under the EU DEEP project, it has been shown that consumers prefer eco-labels as a medium to communicate environmental information in the cases of toilet paper and washing machine. In the case of tourist accommodation, eco-label is not the favourite medium, but remains highly appreciated by consumers.

of environmental issues, but not necessarily conscious to which extend it relates into in their daily life.

Following those observations and recommendations, it has been assumed that aggregated impact data in one single indicator would be the most appropriate kind of data to present to individual consumers in order to facilitate the assimilation and comprehension of this information.

3.5 Environmental information: on which products?

In order to provide real choice, individual consumers should be able to compare impact between all products and services; in the same product/service category and outside its category. Furthermore, to present consumers an overall picture of the level of environmental impact, this information should be available on all products and services.

The project team will have to face the following dilemma: how balancing the level of data precision and the quantity of products and services being labelled? More accurate and precise is the environmental information; harder and longer it takes to produce this information and finely finds its way on the product/service. As a result, precise information implies that less products and services are being labelled, at least in a short run. As mentioned previously, calculating environmental impact of a product from cradle to grave requires a lot of time and effort from all the actors along the supply chain. Indeed, time is becoming a growing issue. With the recent release of the Stern Report and the results of the IPPC, scientific evidences show that that it this time to act now to reducing environmental pressure, in order to avoid irreversible changes of the Earth's ecosystem (IPPC, 2007, ; Stern, 2006). In the present situation when action must be taken promptly, opting for the labelling of the widest range of products and services appears more justified. It seems more appropriate to provide individual consumers with less accurate information than no information at all. As the Eco-rating project goes along and is being developed, the information precision could be improved.

No matter how high the level of precision would be fixed, it is conceivable that in a short run the information produced would not be as accurate as desired. All actors included in the chain of information's production will need a certain time to adjust and get used to this new system. Furthermore, the calculation of environmental impact always includes a substantial level of simplification and therefore incompleteness (Carlson et al., 2005). With the current available technology, it is impossible to produce totally accurate environmental information on products and services. This is mainly due to the complexity of the task and the impossibility to calculate all environmental impact. Therefore, uncertainty cannot totally be totally avoided. The challenge for the project team remains to find an acceptable level of uncertainty and precision that would satisfy all stakeholders. However, a consensus on this question might be difficult to reach knowing that each stakeholder has different interests in the implementation of such a project.

The reality is that all products and services do not involve the same level of complexity to calculate environmental impact. Therefore, different criteria could guide the choice of the production of environmental data. For example, labelling first the most damageable products and services, start with the easiest products/services to calculate or start with the ones that has already available environmental information. A choice on which products and services should be labelled first would have to be made. This choice should be guided having in mind to start the calculation processes in order to be the most efficient as possible.

The production and diffusion of environmental information require the involvement of all actors in the production and consumption processes. The government has a central role to play supervising this effort.[24] Therefore, to reach the highest level of labelled products, it is estimated that a mandatory programme should be established. Mandatory eco-labels programmes have shown to be more efficient in some cases to induce consumers' behaviour. Indeed, some mandatory labels programmes acting on a single issue like energy consumption of white appliances (e.g. the EU energy label or Australia's Energy Rating programme) has shown to be very effective (Harris and Cole, 2003, ; Stø and Strandbakken, 2002).

On the other hand, there are drawbacks associated with mandatory programmes. They tend to be more costly since those programmes need to be maintained, controlled and enforced (Harris and Cole, 2003). The creation of trade barriers to third party countries is also brought up. Some argued that by requiring only minimum standards, the programme could slow down innovation (Stø and Strandbakken, 2002). However, the growing interest for wide spread environmental information on products and services, for example in Great Britain, could open the way to more mandatory programmes.

Opting for a voluntary approach might jeopardize the effectiveness of the label. To maximize the effect of the Eco-rating project, all products and services should be comparable and consequently labelled. In the case of some voluntary energy-efficiency labelling programmes, it has been observed that products with the lowest efficiency were not being labelled (Wiel and McMahon, 2005).

A combination of the two approaches, voluntary and mandatory is also possible. A label programme can start with a voluntary approach and progress slowly towards a mandatory approach. This strategy provides a certain time period to introduce the label, allowing stakeholders to familiarize and test the efficiency of the label (Wiel and McMahon, 2005).

It might also be important to consider the relevance of producing environmental information on all products and services with such a system. Could individual consumers do not benefit from having this type of environmental information on some products and services? As an example, for the choice of tourist accommodation, individual consumers did not consider eco-labels as the favoured information medium. One reason is because there are other sources of environmental information that seems to better fulfil the need of consumers (Stø and Strandbakken, 2002). The limitation of the Eco-rating project as a medium of environmental information for some products and services should be considered.

[24] For more information about the role of government, please refer to section *5.2 The role of major stakeholders*.

4 Visual and conceptual representation

How information is presented to an audience is highly significant. Effective visual representation can make all the difference between a successful communication and no communication at all.

> «…there are right ways and wrong ways to show data; there are displays that reveal the truth and displays that do not. And, if the matter is an important one, then getting the displays of evidence right or wrong can possibly have momentous consequences.» Edward Tufte (1997, p. 45)

This section is about transposing environmental information into comprehensible visual representation. The environmental data associated to products and services cannot be presented as it is to individual consumers. This information has to be displayed under a format that will enable individual consumers to understand and assimilate this information. Visual representation is recognized as a significant tool to promote sustainability. «Illustration can work to communicate an immediate and a holistic representation. We need this ability of visual languages to help spread an awareness…» (Boehnert, 2007, para 2) Indeed, NGOs like Greenpeace and Friends of the Earth are using visual representation to illustrate environmental issues and propose solutions (Ibid).

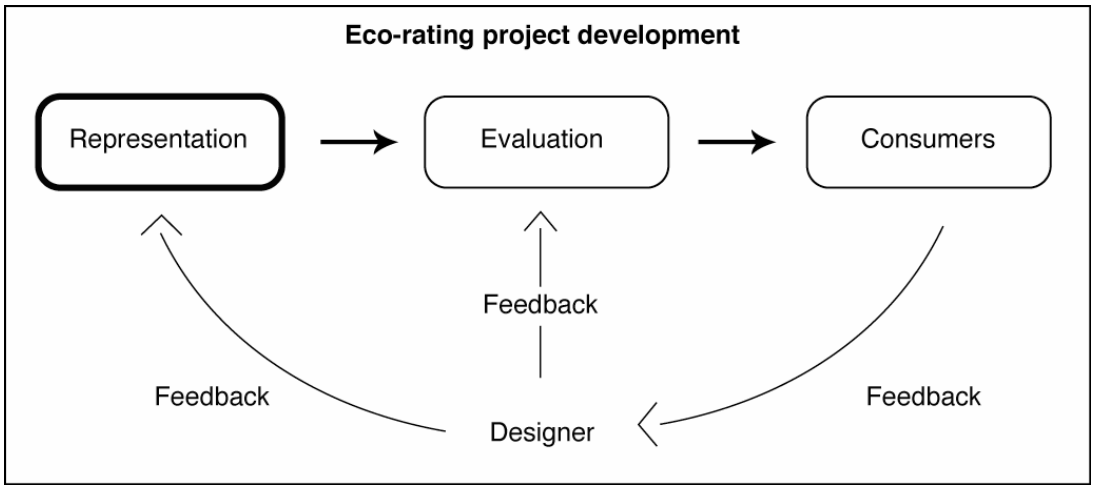


Figure 4-1: Designer's position into the Eco-rating project

In this research, this section corresponds to the development phase of the design process, which is composed of the ideation and the development of concept. It is at this phase that the designer's work is mainly concentrated[25]. The designer's role is to make the bridge between the consumers and the evaluation phase (see figure 4-1). The consumers' perception and needs for environmental information is caught and interpreted by the designer and delivered to them under a comprehensible visual format. By working with consumers, the designer can gain insights on how to develop an effective visual representation. This feedback is then reported to the Evaluation phase. The feedback would also guide the Evaluation phase in the production of environmental information that would suit consumers' needs. Figure 4-1 shows

[25]The term designer includes professionals in the field of design such as industrial designers, interactive designers and graphic designers. In the eventuality the Eco-rating project would be realized, a team of various professionals in the design field would be necessary to produce the visual representation.

the Eco-grading project phases as well as the role and position of the designer. It is important to notice that the designer's work is required only during the creation phase, i.e. while the Eco-grading project is elaborated until a final visual concept is tested and approved. Once the visual presentation is in use on products and services, the industrial designer work come to an end. In this present research, due to time and resources constraints, the development of the visual representation stops after the choice of a final concept, therefore no extended user-tests have been done.

4.1.1 Definition

The term *visual representation* (or visual presentation) encompasses all visual means of representing complex information where the relevant information is emphasized from the rest of the data (Infovis wiki, 2006). Visual representations lie within various disciplines such as information design, information visualization and visual analytics. All those disciplines use visual representations. Keim explains the discipline of visual analytics as: «… to visually represent information, allowing the human to directly interact with it, to gain insight, to draw conclusions, and to ultimately makes better decisions.» (2006, 1. Introduction) He also adds that: «Visual representation of the information reduces complex cognitive work needed to perform certain tasks.» (2006, 1. Introduction) A map, a graph, a glyph, a label are all examples of visual representations. In the context of this research, various visual representations have been explored to illustrate the environmental information of products and services.

4.1.2 Comparison and rating

If we go back to the very first objective of the Eco-rating project: consumers need to compare the environmental profile between products. The question is *how* and *what* will allow consumers to rank environmental impact of products and services and therefore be able to compare them.

The term *comparison* is defined as the identification of features; establishing points of comparison between two items or more (Merriam-Webster, 2006). Indeed, a comparison can only be made if a common comparison basis is selected. For example, one could compare the growth of various plants by measuring their heights. The height represents the comparison basis. In the case of the Eco-rating project, a simple visual comparison basis must be developed.

Facing new knowledge and information is never easy. Researchers found that new information is often linked to pre-existing information and knowledge, facilitating its assimilation (Nissinen et al., 2004, ; Wagner et al., 2002). Therefore, linking this new environmental information with a commonly known visual representation could improve the comprehensibility of the Eco-rating system. There are various forms of visual representations illustrating rating systems or comparison (e.g. graph, table, size of elements, etc.). It ranges from very simplistic to more complex representations.

However, visual representations vary depending on the users' culture. Restivo and Steinhauer observed that: «In the context of globalization IIT (information and information technology) designers need to be especially sensitive to the fact that and the ways in which visual cultures and visual literacies can and do change.» (2000, p. 175) It is therefore essential to design a visual representation that is in accordance with the cultural background of the public it is intended for.

4.1.3 Literature review

There has been considerable research on environmental information, but very few emphasized on visual representations and on comparative visual representations (i.e. allowing comparison). Usually, studies about environmental information focus on consumers' behaviour and attitude toward environmental information. An example of study is consumers' behaviour and consumption attitude related to various eco-label schemes. However, very little research explores how environmental information is graphically represented and perceived by households. The following section is reviewing some of the current researches and advances on comparative visual representations of environmental information.

4.1.3.1 3D Visualisation

There is limited literature available on visual representation of environmental data, although this issue have been often criticized. Currently, most of the environmental information is presented under graph or table format, on screen or on printed material. Some researchers are trying to elaborate new ways to visually present environmental information. With the help of new computing technologies, 3D illustrations made their appearance. Otto developed three-dimensional glyphs representing LCA information (2004). The items of the spherical glyph represent the various components of a life cycle such as material inventories or life cycle phases. The glyphs are use in a 3D environment, which allows the user to modify the viewpoint, size, spatial location and details of data represented (Ibid). However, those visual representations are mainly intended for experts and require the use of a computer. See in appendix E, for figues of the 3D glyphs.

4.1.3.2 Graphs and diagrams

Comparative eco-labels (e.g. EPDs) is one type of environmental information tool. Comparative eco-labels have caught interest of various stakeholders mainly for the following characteristics: offering detailed information and allowing comparison of the environmental profile of some products and services. However, comparative eco-labels have been rarely associated with their visual representations.

This situation could be partly explained by the lack of clear requirements about the visual representation of EPDs. The ISO Standards do not indicate precise instructions or requirements on the visual representation of EPDs. In essence, it is recommended that the design and format be developed with the needs of the end user in mind. (ISO, 2000) Consistency and harmonization of the visual representation is encouraged as well as some possible options on the design and format are proposed by the ISO standards (Ibid). Therefore, no standardised visual representation has been established, which did not foster the development of a common visual layout. As a result, the comprehensibly of visual representation of EPDs is often poor. Most of EPDs are more or less displaying the same information, but throughout inconsistent graphical elements. This information is conveyed using text, tables, graphs and sometimes images of the product itself. The figure 4-2, presents a sample of visual representations of EPDs. For more detailed information on EPDs, refer to section *2.4.3 Data sheets and declarations*.

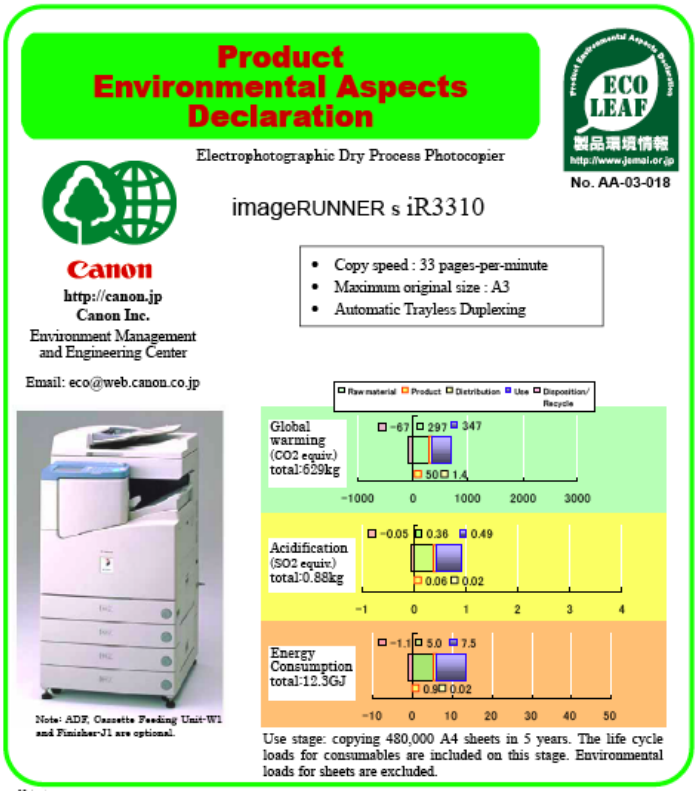


Figure 4-2: Sample of a visual representation of an EPD.

Source: Product Environmental Aspects Declaration - Canon imageRUNNER s iR3310 (JEMAI, 2003).

A report commissioned by ANEC (The European Consumers Voice in Standardisation) reported the concerns brought up by users of eco-labels Type III ((Chiristiansen et al., 2006, ; Christiansen et al., 2006). Among others, comprehensibility and comparability of the environmental information, reliability of data, completeness of the environmental information and adequate stakeholder involvement, were addressed. One of the concerns, comprehensibility and comparability of environmental information, suggested the creation of a novel visual representation of information. The proposition was made to improve the visual representation of EPDs and therefore increase comprehensibility and comparability. Usually, EPDs are presenting environmental information under a tabular format. It has been observed that few consumers are able to relate the numbers to any environmental impact and evaluate the importance of those impacts when the information was presented under the traditional tabular format (Ibid).

The main recommendation was to add to the numerical information a graphical representation of the indicators of environmental impact (normalized) of the product, which is compared to the environmental impact of a reference product. The graphical representation consists of two band graphs. One graph shows the impact of a product related to the impact of spending the same amount of money on an average product from the product group, while the other graph shows again the impact of the product, but this time in relation to the impact of spending the same amount of money on average consumer goods (Ibid). Furthermore, a colour code (i.e. green, yellow, red) representing how far the impact is from the average is complementing the graphical representation. See in appendix F, for images of the new graphical representation of EPDs.

Currently, EPDs do no present environmental impact of products in one single environmental impact indicator. There is no commonly accepted method to calculate environmental impacts in a single indicator. The authors claim that the use of a single environmental impact indicator would increase the simplicity of the graphical representation and improve the overall comparison (Christiansen et al., 2006). Indeed, the two graphs are presenting information that can be difficult to grasp at first sight. This type of visual representation requires users to make and effort and be attentive in order to understand the information presented in the two graphs.

4.1.3.3 Comparative energy-efficiency labels

An exception is the comparative energy-efficiency label where extensive research has been made on visual representation. In general, this type of label is applied on energy consuming appliances like fridge, freezer, air conditioner and so forth. Many energy-efficiency labelling schemes such as the EU energy label on households' appliances are implemented in various countries. In 2004, 55 governments around the world (including the addition of the seven EU accession countries without any programme) had implemented such a labelling scheme[26] (CLASP, 2004). Comparative energy-efficiency labels allow consumers to compare the energy performance of products. Three types of comparative energy-efficiency labels can be distinguished (Wiel and McMahon, 2005):

- Categorical labels
- Continuous labels
- Information-only labels

Categorical labels divide in different sections or groups the impact range of a product. All the products on the market are assigned in a section or group. The EU energy label is an example of a categorical type label. *Continuous labels* show the range of models available on the market on a continuous scale. The U.S. EnergyGuide label is an example of a categorical label. *Information-only labels* provide consumers only with technical information on the efficiency of the models available on the market. No visual element is displayed to help consumers comparing products between one another. Between comparative labels, research showed that categorical labels are generally better understood by users (Wiel and McMahon, 2005). Information seems easier to grasp because categorical labels are highly visual and less detailed then continuous or information-only labels (Egan et al., 2000).

Among the different energy-efficiency labels, it can be observed that some schemes put efforts into the development of comprehensible visual representations to facilitate the communication of information. Figure 4-3, presents a sample of different types of visual representations. It can be observed that most labels use flashy colours and in three occurrences, there is a graphical representation of progression: stars with a red half-circle band, line and pointer and the coloured bands used in combination with letters.

[26] This number includes comparative and awarded energy-efficiency labels.

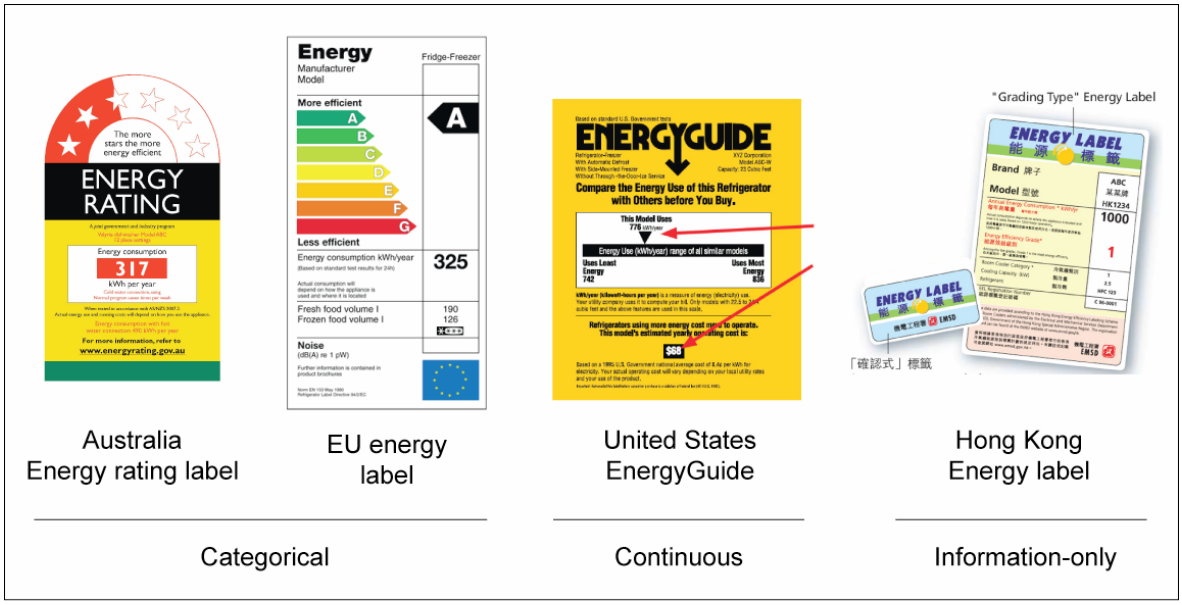


Figure 4-3 Sample of comparative energy-efficiency labels.

Sources: (Australian government, 2007, ; Defra, 2005, ; EMSD Energy Efficiency Office, ; Hong Kong Energy Efficiency Office, 2007, ; U.S. EERE, 2006)

In the wave of the Regional Symposium on Energy-Efficiency Standards and Labelling held in May 2001, Bangkok, Thailand, considerable amount of research have been carried out on energy-efficiency labelling. The Symposium included the development of appropriate visual representations. «The primary objective of the workshop was to share information and experience gained by countries within the (Asian) region on best practices, success stories and lessons learned in implementing energy-efficiency standards and labelling programmes.» (UNDESA, 2001, para 1) Following the Symposium, many Asian countries pushed forward the development and implementation of energy-efficient labels.

Around the same time, EnergyGuide, the U.S. energy-efficient label was being redesigned and improved. Since its creation, the label faced sustained criticism. Many users found the label difficult to use and understand (Egan, 2001). In a study on the evaluation of the U.S. EnergyGuide, researchers tried to improve the visual representation of the current energy label. Focus groups and interviews have been carried out to test different visual concepts on consumers. In the first round of focus groups, existing energy-efficiency labels (e.g. Australian and EU energy-efficiency labels), which have been slightly modified, were tested on U.S. consumers.[27] The main findings were: 1) reducing unnecessary text, 2) improving the graphical display to increase understanding and 3) the cost figure operation was considered as one of the most important information elements (Egan et al., 2000). Afterwards, a set of interviews with consumers shopping for white-goods has been held. This time, four refined concepts of energy-efficiency labels have been tested on users. Figure 4-4 presents samples of redesigns of the EnergyGuide label. Once again, the importance of the operational cost was confirmed. The current energy-efficiency label had been identified as the label causing the most misunderstanding among consumers. In general, no label stood out, but the label with a stars rating system, inspired by the Australian label model, was preferred. In 2000, Australia also modified and redesigned its energy-efficiency label (Wilkenfeld, 2003).

[27] Interviews have been carried out also with suppliers: 1) manufacturers, 2) heating, ventilating, and air conditioning contractors (HVAC) and 3) retail sales staff.

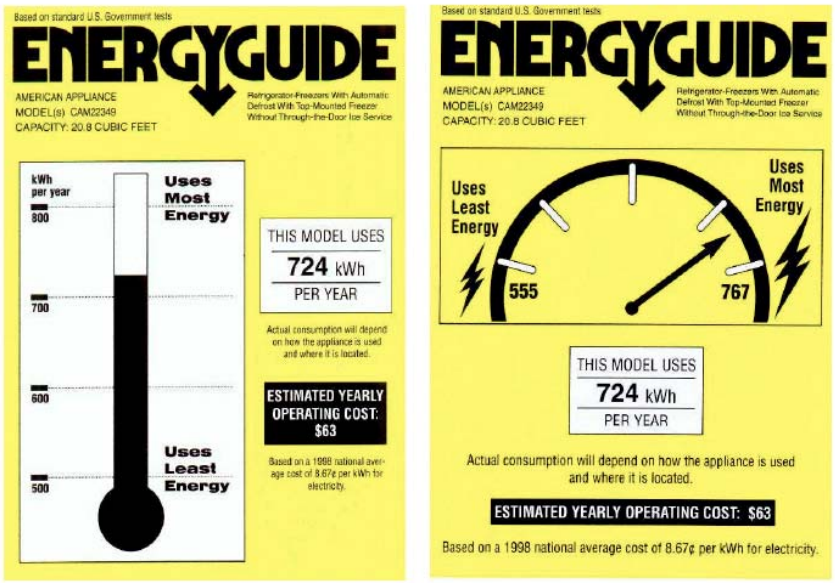


Figure 4-4 Sample of redesign of the EnergyGuide label.

Source: US Labelling Program Evaluation and Label Redesign Strategies (Egan, 2001)

Saidur et al., reported in a paper the effort of Malaysia for energy-efficiency labelling design (2005). On a span of two years, consumers and stakeholders have been surveyed about their preferences on the major existing energy-efficiency labels. Among those, the Australian, Thai and EU labels were preferred. The three favourite models have been adapted and modified to suit Malaysian consumers' preferences using: a stars rating system, coloured bands and letters and a speedometer type with letters. See in appendix G, for the three Malaysian energy-efficiency labels. Once again, the stars labelling system has been preferred for its simplicity and comprehensibility. Similar studies have been carried out in other Asian countries such as India, Thailand, China and Korea (Deshpande, 2001, ; du Pont, 2001).

4.1.3.4 Food labelling and signpost labelling

Outside the field of environmental information, food labelling is one area where research has been done on visual representations. Recently, a new visual representation of nutritional information (known as signpost labelling) has been introduced in the United Kingdom on the recommendation of the Food Standard Agency. The purpose of this new nutritional label was to help consumers making healthier choices. Five different concepts have been created and tested within focus groups. The research revealed that two concepts were widely approved by the consumers. The Option A "simple traffic light", using a simple traffic light system (green, yellow and red circles) shows the consumers the global contribution to a balanced diet. The Option D "key nutrient", using a key nutrient system, rates each nutrient with again a traffic light system (e.g. red-high, yellow-medium, green-low) (Food Standards Agency, 2004). Finally, a combination of "traffic light", "key nutrient" and a "GDA nutrient" was chosen to

compose the visual and conceptual representation.[28] Figure x, shows how visually the signpost label look like. Images of the early concepts of nutritional labels are available in appendix H.

Figure 4-5: Examples of the new signpost/traffic light food label.

Source: Food Standards Agency website (FSA, 2007).

The case of food labelling is interesting because part of the research's focus was on consumers' perception and understanding of visual representations of nutritional information. Like environmental information, nutritional information is complex and uses technical language, which can be hard for consumers to understand fully. Various actors in the field of nutrition supported the signpost food labelling.

4.1.3.5 Eco-benchmark

As presented previously, a Finnish research group developed benchmarks to convey LCA data on products and services to individual consumers. A visual representation has been created gathering different graphical elements: graph, logos or icons and colours.[29]For more information on the Eco-benchmark, please refer to section *2.6.4. Eco-benchmark, a Finnish initiative.*

4.1.3.6 Emerging carbon labels

In the last year, two organisations, the Carbon Trust and the CarbonCounted, released a comparative label displaying the level of CO_2 embedded in products or services. The visual representation of the two labels is mainly composed of numerical information with some text and a logo with colours in the case of the CarbonCounted. The development process and calculations are extensively detailed, but no information was available on the visual and conceptual design of the two labels. For more details on the Carbon Trust and the CarbonCounted, please refer to sections 2.6.1.1 *Carbon Trust* and 2.6.2 *CarbonCounted, a Canadian initiative.*

4.2 Development

The aim of the following section is to observe and interact with the users (individual consumers) in order to determine what makes them able to compare different environmental profiles and make informed choices. The main goal is to establish what kind of visual representations allow consumers to make comparison between products and services. Using different mediums and activities involving users, it will be possible to refine which kind of

[28] GDAs represents: «…Guideline Daily Amount developed by Institute of Grocery Distribution as a means of expressing the contribution a serving of food has the whole diet.» (Food Standards Agency, 2004, p. 8)

[29] One main visual representation has been elaborated. However, many variations have been done.

visual representation is the most appropriate. To do so, a survey and interviews have been carried out under a broad user-centred design approach.

4.2.1 User-centred design

The inclusion of users into the design process has been proven of high significance. At the beginning of the 90's in the United States, it has been shown that the success of new educational programmes was passing through the participation of stakeholders into the innovation process (Reigeluth M., 1993).

> «…the people destined to use the system play a critical role in designing it…»
> (Schuler and Namioka, 1993, p. xi)

In order to capture, understand and reflect individual consumers' needs into the design of environmental information formats and representations, a *user-centred design* (UCD) approach, also called human-centred design, has been applied. Carr explains UCD as a design approach where: «… users are considered central in the design specifications; however, design control remains firmly in the hands of professional designers…» (1997, p. 10) In other words, the users become the main study subject for the designers. «User-centred designers engage actively with end-users to gather insights that drive design form the earliest stages of product and service development, right through the design process.» (Black, 2006, para 1) Users are integrated at an early stage into the design process (which is not usually the case in the traditional design process), but the decisional power falls to the designers. The ultimate goal of UCD is to meet in an appropriate way users' needs. UCD does not constitute in itself an independent design process; it is rather an approach, a philosophy applied to the design process.

UCD originates from Scandinavia in the 1970's, where the first user participation projects appeared (Bødker, 1996). It slowly evolved and nowadays it is applied in a wide range of fields: urbanism, design, architecture, landscape architecture and notably computer science. Among others, large companies, such as IBM[30], are carrying out UCD activities. It is often associated with software and website design since usability and machine-man interaction are major issues in those research areas. There are various ways for designers to carry out UCD projects. Active or passive observation, fictive scenarios or games are examples of tools or activities used by designers to analyze and include stakeholders into the design process. However, no specific method stands out. Each situation is different and therefore opting for a tailor-made method is more suitable. UCD is steered by the international standard ISO (ISO 13407:1999 Human-centred design process for interactive systems)[31]. This standard mainly defines the different stages and list activities to follow in order to complete a UCD process.

The inclusion of users in the design process has however some drawbacks. UCD has often been criticized to be a resource consuming process. Furthermore, users' involvement does not guarantee the success of a design. The success of users' involvement depends highly on how it is carried out (Magnusson et al., 2003). This section details the tools and methods used into the design process of the conceptual and visual representation.

[30]For more information, see: http://www-03.ibm.com/easy/page/570 (IBM User-centred design webpage)

[31]For more information, see: http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=21197

4.2.2 User-tests

In order to understand better end-users and collect insights, consumers and professionals have been approached to participate in this research via the use of a survey and interviews. The design process has been divided into three distinct phases:

- Phase 1: Survey
- Phase 2: Interviews
- Phase 3: Final concept and Recommendations

The Phase 1: *Survey* constituted of an online survey that the participants (around 85 individual consumers) had to complete alone. The survey was used to sound out consumers' attitude towards visual representations and environmental information. The main goal of this survey was to give the designer substance and insights to move further into the Eco-rating project and the development of more advanced visual representations. In Phase 2: *Interviews*, the interviewees were asked to participate in the design process and give their views on the visual representations that were presented to them. Individual interviews with consumers and professionals have been carried out (i.e. 5 professionals and 4 individual consumers) See in Appendix A for the list of interviewees. The Phase 3: *Final concept and recommendations*, sums up the insights gained along the user-tests with the participants.

Focus groups and individual interviews are common tools used to develop the visual design of energy-efficiency labels (Wiel and McMahon, 2005). Focus groups are generally used at the beginning of the design process and allow gaining a broader feedback on the range of lables being considered, while individual interviews are carried out to test users' conprehension and interpretation of the concepts (Ibid).

In the current situation, an online survey and individual interviews have been determined to be the most appropriate methods to carry out user-tests. Probably, the best option would have been to start with a focus group and carry on with a large sample of individual interviews. However, because of time and resource constraints, the use of a survey and a smaller sample of interviews constituted acceptable substitutes.

4.2.3 Survey

At this stage of the research, there was not enough information available to start the development of visual representations; feedback from users was missing. A simple way to get information on users, and from users, is to use a survey.

4.2.3.1 Sample boards

Prior to the elaboration of the survey, some sample boards have been made. Sample boards consist of a collection and organisation of pictures (e.g. collages), drawings or all visual elements valuable in the elaboration of a design project. Sample board, also called moodboard, is a commonly accepted technique in the design process (Lucero and Martens, 2006). Used as a creation tool to explore a subject, sample boards serve as a source of inspiration and stimulation for the designer. It can be realised in a low-tech manner (e.g. with pens, scissors and glue) or under a digital format using a computer and graphic design softwares (e.g. Illustrator, Photoshop).

In this case, the boards created referred to visual elements representing comparison, rating and grading systems. Other boards presented various types of environmental labels: eco-labels Type I, Fair trade labels, organic labels, EPDs and so forth. The sample boards allowed collating all valuable visual elements, which constituted the first source of material for the creation the survey. Sample boards could be compared to a visual brainstorm. In other words, it composed the basis of the creation work. Refer to appendix I for example of sample boards.

4.2.3.2 Survey design

After the production of the boards, it was clear that there was a need to gain deeper insights about consumers' attitude and perception of visual representations and environmental information. With the help of the sample boards, a small survey of eight questions (generally with one or two sub-questions) has been created. The survey was composed of a mix of open-ended questions and multiple-choice questions. Of course, the survey was highly graphical.

This survey was a way to gain more material and information about users in order to progress in the development of the project design. The questions have been elaborated in order for the answers to bring as much information as possible for the design development. The questions have been elaborated following those three angles:

- **Relation between products/services and environmental impact**
- **Graphical language** (i.e. colour, logo, symbolic, semantics…etc)
- **Visual representation of comparison systems** (e.g. meters, graphs, colour code, letters, numbers, fractions, time line…etc.)

It was interesting to investigate how consumers perceive the **relation between products/services and environmental impacts.** How is the level of environmental impact associated with a product or service? Do consumers associate the size, the usage or the end of life of products (or a mix of those) with the level of environmental impact?

Information about consumers' interpretation of **graphical language** such as: colours, logo, symbolic and semantics was required. What kind of graphical representations evoke for individual consumers environmental preoccupations? As an example of a question, the participants had to indicate among five eco-labels Type I with different features (e.g colour, logo, text), which one illustrates the best the environmental performance of a product/service.

It was important to analyse consumers' perception of various types **of visual representations of comparison systems** such as: meters, a colour code or graphs. Currently used comparison systems of information (e.g. CarbonCounted.com, EU energy label, Eco-benchmark…etc.) have been slightly modified, to fit the purpose and context of the survey. In addition, preliminary visual representations, based on the visual elements gathered on the sample boards, were produced and tested. See appendix J for a sample of the survey.

A first iteration has been tested on two participants to ensure the survey was comprehensible and the questions not misleading. After some changes in the visual content and the formulation (i.e. wording) of the questions, the survey was put online for 10 days[32].

[32] The survey has been built and hosted on surveymonkey.com. Surveymonkey is a free survey software available for all. For more information, see: http://surveymonkey.com/Default.aspx

Unexpectedly, around 85 persons answered the survey. The survey was distributed among the widest sample of people as possible. Internet has been chosen as the most appropriate medium to diffuse the survey. Indeed, the use of Internet facilitated the access to the survey and increased its convenience for the participants as well as for the designer.

It is important to note that this survey did not fulfil the requirements of the statistical practice and did not have a representative sample. As mentioned previously, this survey was not intended to produce statistical data. The main purpose of the survey was to use the results as a source of insights for the designer to bring forward the design process.

4.2.3.3 Findings

The survey demonstrated that in general, people have a basic knowledge and understanding of the level environmental impact of products and services. They seemed to know there are some impact' variations between different products and services.

For people to understand and relate the graphical representation of a logo (such as an eco-label Type I) to environmental issues, the message needs to be really clear and simple. The use of strong natural symbols (e.g. plants and the Earth) is helpful. However, over-simplifying the graphical representations seems to make them loose their credibility. The colour green was highly associated with environmental purposes. In addition, the use of short and clear terms was also appreciated.

Among different types of existing comparative eco-labels, participants pointed out the following characteristics as important:

- The presence of a **visual** and **numerical** representation
- Displaying on the label the **gradation or range of the impact** (e.g. high number = high impact and low number = low impact).
- Showing **relative impact** of products (allowing comparison between similar products facilitating the decision-making process).
- Participants identified the **variation of impact between products as low.** Therefore, participants had the tendency to **underestimate the impact difference**.

This perception of low variation has also been observed in a research on consumers' perception of energy-efficiency labels. Consumers perceived that the differences in the energy efficiency are small within product categories (Egan et al., 2000). In addition, a scientific and trustworthy appearance seemed to be important. The challenge appears to have the right balance between a technical look, but without using scientific jargon.

4.2.3.4 Analysis

The results showed that consumers requested two aspects of comparative information: *relative* comparison and *absolute* comparison. Relative comparison of information involves comparing the environmental information between similar products or from the same product category.

In other words, apples are compared with apples. This type of comparative information should give the users the range of environmental impact of a product/service group. For example, the range of environmental impact between different models of mobile phones is displayed allowing the consumers to distinguish high impact mobile phones from the low impact ones.

Unlike relative comparison, absolute comparative information provides the users with an overall understanding of the level of environmental impact of different products and services. The environmental impact of products and services is built on the same comparison basis, allowing the users to locate the impact of a specific item on a broader scale, which encompasses all products and services. However, absolute comparison, does not necessarily allow comparison between products of the same product category. Accordingly, relative comparison does not provide this overall understanding of the level of environmental impact of various products and services.

From a consumption point of view, both types of information's comparison, relative and absolute are valuable. There is no best option, both are relevant and give the users valuable information, but serve different purposes. The relative comparison of information guides the consumer to identify less damageable options inside a product/service category (what the Eco-label Type I does to a certain level). On the other hand, the absolute comparison of information allows the consumer to locate and grasp the level of impact embedded in a product/service on an overall scale of impact.

In an ideal world, the combination of both types of comparison would provide the users with more complete environmental information. The question is: could a combination of both types of comparison possible? Would this type of mixed information be helpful and comprehensible for individual consumers? Using the insights gained during the survey, the phase 2: *Interviews* explored the possibility to visually represent relative and absolute comparison of information in a comprehensible manner.

4.2.4 Interviews

To push further the design of visual representations, individual interviews have been carried out with users (individual consumers) and professionals in the fields of sustainable consumption, information visualization and design. As mentioned previously, 9 interviews have been carried out in total (see the list of interviewees in Appendix A). Along with this series of interviews, the project evolved and took the form of different iterations of visual representations. Three iterations have been prepared during the three rounds of interviews. The interviews were used to gain insights and test the efficiency and comprehensibility of the various concepts. Between each round of interviews, concepts of visual representation were modified and refined following comments and suggestions of the participants.

The interviews were semi-structured and the questions were slightly varying between the iterations. Since each iteration was proposing a different content, the questions had to be adjusted depending on the visual representations. The interviews with individual consumers was composed of questions built around a contextual scenario, which simulated a «realistic» purchasing activity.[33] Scenario building is a common technique used in different areas of design which: «tries to capture the user and their activity as a story, with which designers and

[33] In the present case, it is hard to determine if the scenarios were truly realistic, probably not. Achieving complete simulation of reality is impossible. With the time and the medium available, the purchasing scenarios have been created using short texts (basic story-telling technique) and images of existing products.

users can envision possible design innovations.» (Blythe and Wright, 2006, p. 1141) It was supported with a think-aloud technique, also call talk-aloud protocol, where the participants had to say aloud everything they can think of while doing a precise task or activity (Uduma and Morrison, 2007). The interviews with professionals adopted a more observant mode than the active mode used with individual consumers. The questions addressed to professionals were to evaluate, according to their professional view, whether the different concepts of visual representations would fulfil the predetermined objectives and if not, how can it be improved. The different interviews' templates are available in Appendix B.

4.2.4.1 First iteration

The first iteration of visual representation was mainly based on the results of the survey. A multitude of visual representations have been sketched out on paper, using traditional drawing techniques. Appendix K, shows a selection of sketches. From those sketches, three concepts have been selected. This selection was necessary since it was impossible to present a too large variety of concepts to individual consumers. It was important to select the more promising concepts, with different features, to give the users a diversity of visual representations. Three boards, displaying the three chosen concepts, have been produced. The three concepts have been produced using illustration software. The first iteration has been tested on two individual consumers, through phone interviews. At this stage, it seemed to be more relevant to test the concept on consumers to see if the message (i.e. environmental information) can be efficiently communicated or not. Professionals' input could come later to refine the concepts. In addition, for logistics reasons, it is not always possible to have access to an interview with a specific interviewee at a precise moment of the design process. Appendix L, presents the three concepts, which have been used for the interviews.

The visual representations prepared were trying to convey two aspects of information: relative comparison (i.e. compare environmental impact of products in the same product group) and absolute comparison (i.e. compare and locate environmental impact of products from different product groups on an overall scale of impact). In order to communicate this information, different graphical representations of comparison have been used (e.g. line, fractions, numbers, logos and colours). In the three labels, a number represents the level of impact of the product or service. Numerical information has been chosen because it allows the representation of a very large environmental impact scale. It also permits to reach a higher level of precision of the representation of impact, which is not necessarily possible with letters for example. However, using numbers also have some drawbacks. Indeed, reaching a high level of precision in the calculation of environmental impact might be difficult depending on the calculation tool, the availability of data and the complexity of products (professional 4). Furthermore, it seems more difficult for users to remember numbers than letters for example (Ibid). The Food Standard Agency found during signpost labelling researches, that some consumers could not use the numerical information correctly. In addition, it seemed that the use of percentages was confusing some consumers (FSA, 2006b).

The level of impact in relation to the product category is represented under a visual manner using colours, or a graphical representation of progression. Since the level of precision needed is lower than for absolute comparison (between all products), the use of simple visual elements was more appropriate.

4.2.4.1.1 Findings

This first experience of user-tests showed major issues in the concepts. First of all, the users did not know what the numbers meant and what it represented. Even if the meaning of the

numbers was written in the visual representation (e.g. global impact), the participants could not make this relation and understand. Furthermore, the participants did not get the double message intended in the label; absolute comparison and relative comparison. Interviewees interpreted the numbers and the graphical representation of the product category as the same information, but under a different format. As an example, figure 4-6, presents one concept used during the interviews. In this concept, the numbers are representing the level of global environmental impact (absolute comparison) while the flower is representing the position of the product according to its product category (relative comparison). The more green petals are in the flower; the lowest is the impact of the product or service in relation to its product category. The divergence between the number and the graphical representation amplified consumers' confusion. For example, their thought was: how could an iPod has as much green petals as a flight? Does it mean that an iPod has the same level of environmental impact than a flight?

Furthermore, one participant expressed reservations about the denomination "Environmental Cost". Again, their question was: what is this cost worth? In addition, one participant raised the issue of credibility of the label, wondering which organisation was behind and how those numbers were calculated. One concept has been criticized to display too small numbers.

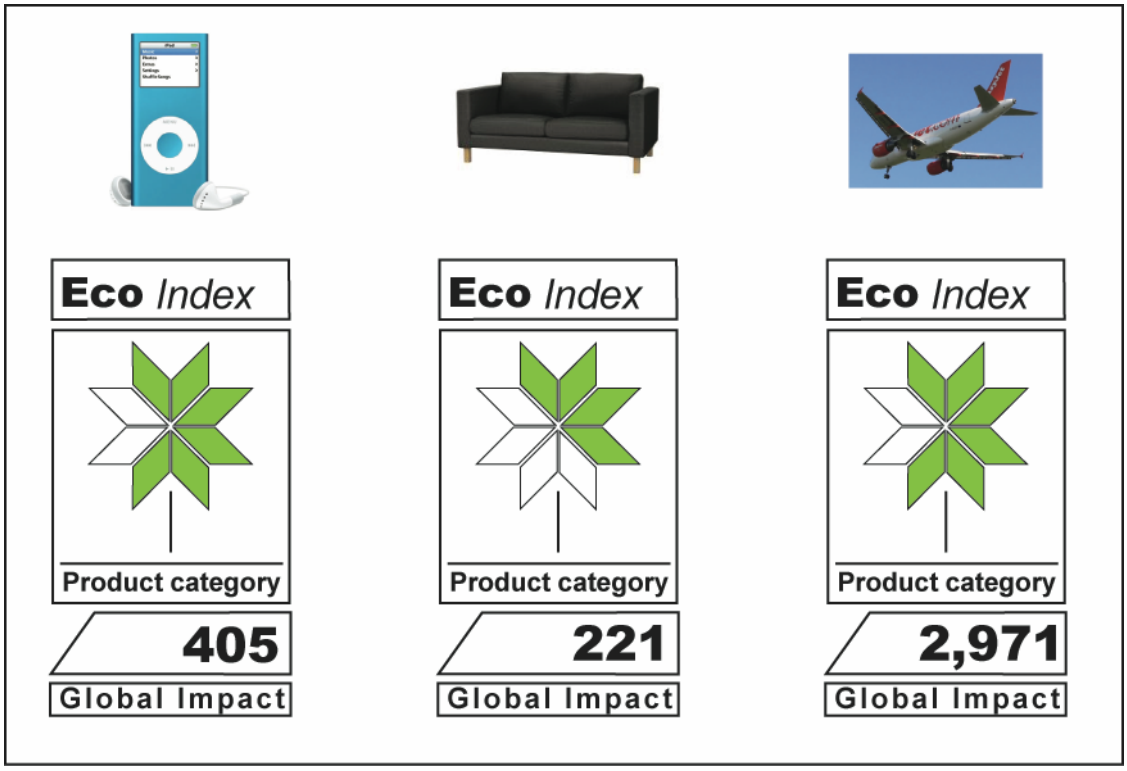


Figure 4-6: One example of a concept of visual representation of environmental information, first iteration.

On a more positive side, the use of colours to illustrate progression from high impact to low impact (i.e. from red to green) was appreciated. The use of logos like a tree with green leaves and a naked tree were saying a lot to participants without using any words.

It appeared rapidly that this strategy (double message: relative and absolute comparison) shown to be ineffective and failing to communicate the intended information. The main findings for this first iteration are:

- The current strategy lacks to efficiently explains what the numbers mean;
- The denomination "Environmental Cost or Index" and "Global Impact is an abstract term for participants and
- Trying to convey multiple messages had shown to be really complex and in this case failed.

4.2.4.2 Second iteration

The insights gained during the first iteration undoubtedly demonstrated that the development of a completely different concept was necessary. The main issue identified in the first iteration was the lack of representation and significance of the numbers, even if under the number the term "Global Impact" was written. To understand the meaning of the numbers, users need something they can relate to. Indeed, this is a problem that researchers (Tesco and Environmental Change Institute) who are currently trying to develop a carbon label are facing; nobody knows the level of carbon emissions of any product. In a research on consumers' knowledge about carbon and its implications, many consumers were confused with this new kind of information. Consumers were shown the new carbon label from the Carbon Trust, where the amount of carbon embedded in the product is stated on the label (e.g. one pack of Walkers Crips equals 75g CO_2). See figure 2-1 for an example of the Carbon Trust label. Consumers replied that they did not understand the label because they did not know if 75g was good or bad (White et al., 2007b).

The use of points of reference could allow users to based the numbers on and therefore give them a reference basis. As presented previously, the Eco-benchmark was using different benchmarks to illustrate visually the results of an LCI (Life Cycle Interpretation). Indeed, many participants appreciated the modified version of the Eco-benchmark, used in the survey. Although it has been criticized to contain too much information and be too complicated, many participants to the survey qualified the benchmark concept to be an effective way to communicate information.

In this second iteration, a legend concept using various benchmarks has been explored to communicate the environmental information. The idea was to provide on the label a set of benchmarks, which would allow individual consumers to locate the number on a scale of impact. Comparing the numbers to the benchmarks would give those numbers much more sense and meaning. The question that quickly arose was: which benchmarks should be used? The benchmarks should be understood by everyone the same way and give the right meaning. One problem with the use of benchmarks is their regionalist character. As an example, the interpretation of «boiling one cup of water» can differ depending on the country or the culture. This issue has also been raised by the Eco-benchmark developers and was confirmed by two interviewees in this research (Nissinen et al., 2006) (Professionals 2 and 4). Finding the perfect benchmarks that would always provide the same representation is impossible. However, it is possible to find benchmarks that would, despite their regional character, provide a rather similar representation among individual consumers. In addition, the chosen benchmarks had to represent a wide range or environmental impact; from low impact to high impact. The goal of the benchmarks is not to provide a precise measure, but to give, to a certain extent, an idea of the level of impact of a product or service.

Research has been made to indentify benchmarks generally used in scientific popularization publications like magazines or documentaries. The benchmarks used are mainly simple activities done on a daily basis by a vast majority of people. The first set of potential

benchmarks proposed was, in order from low to high impact: one cup of coffee or tea, a 100 km car drive and a flight London - New York. To make the benchmarks easy to understand and remember, a bracket of 10, 100 and 1000 has been assigned to each benchmark. In other words, a cup of tea or coffee equals 10, a 100 km car drive equals 100 and a flight London to Moscow equals 1000. The numbers used are not intended to reflect exactly the true environmental impact of each benchmark. The benchmarks are intentionally vague and not specific to allow a maximum of consumers to relate to them. Although the numbers do not represent the real level of impact, they are nonetheless realistic.[34] In the context of the interviews, it was important to provide the participants with realistic benchmarks in order to make the labels as credible as possible and avoid confusion and scepticism.

A selection of labels using this benchmarks system has been sketched out on paper. From those basic sketches, ten have been selected and presented during interviews with two professionals. The selected sketches are available in Appendix M. In this case, many different sketches have been intentionally presented. The aim was to allow the professionals to give their impressions on many different variations of visual representations.

4.2.4.2.1 Interviews with professionals

In general, the concept of benchmark has been well received from both professionals although many issues have been pointed out. To the question: «Would this kind of label raise consumers' awareness towards environmental impacts of products and services?», their answers balanced between yes and no. In other words, it would probably raise consumers' awareness, but shifting from knowing to concrete action, there is a high step. Information and awareness are often not enough to truly change consumers' behaviours. This gap between environmental information and action had been pointed out before in literature (OECD, 2001a, ; Vermeir and Verbeke, 2006).

The sketches were presenting three different denominations: "Environmental Cost", "Environmental Impact" and "Environmental Index". Both participants did not agree unanimously on the same denomination, each one has its own preference. One was in favour of the word index, while the other feared that index would not be understood by a majority of people. However, the word environmental did not seem to cause any problem.

The graphical representation of the various labels had been greatly criticized. Both professionals stressed the importance to differentiate primary information from secondary information; what should the users see in first and second place. The accent should be put on the right information using the right proportions including size and style of fonts. A recent research on requirements for food labelling showed that a font of 8 points was the minimum size for general information whilst 10 pt was more appropriate for important information (FSA, 2006a). In addition, the information should be placed in a way that sends the true message. For example the label A in figure 4-7 has been point out to be highly confusing, because of its position and size. Since the number 342 is positioned over the legend, it seems to be part of it, sending the wrong message to the user. Conversely, in the label B, the number was separated from the legend by the denomination and its size caught instantly the attention of users. Furthermore, they pointed out that the use of icons or logos have to be done with the utmost care. Since icons and logos can tell much more than words, it has to send a clear message that should not mislead users (FSA, 2006a). See label C in figure 4-7. In this case, the logos could not play this role and send the exact message that the words (benchmarks) could

[34] The numbers are based on average of CO_2 emissions (Greenpeace International, 2007).

send. As an example, label D in figure 4-7, uses a green tree and naked tree (first iteration) to illustrate low and high environmental impact, which is much more comprehensive.

About the benchmarks system, mixed answers were expressed about the choice of the three benchmarks. Both professionals mentioned that the benchmarks lack consistency. Should all the benchmarks relate to a numerical measure; 1 cup coffee (around 250 ml), 100 km car ride and 2500 km air flight? Or should all the benchmarks represent services or goods? It seemed that the choice of the benchmarks caused a conflict between its consistency and its understanding. The question that arose was: would the lost of consistency confuse users or is the consistency secondary as long as the benchmarks were understood? It was clear that different variations of benchmarks should be tested on users.

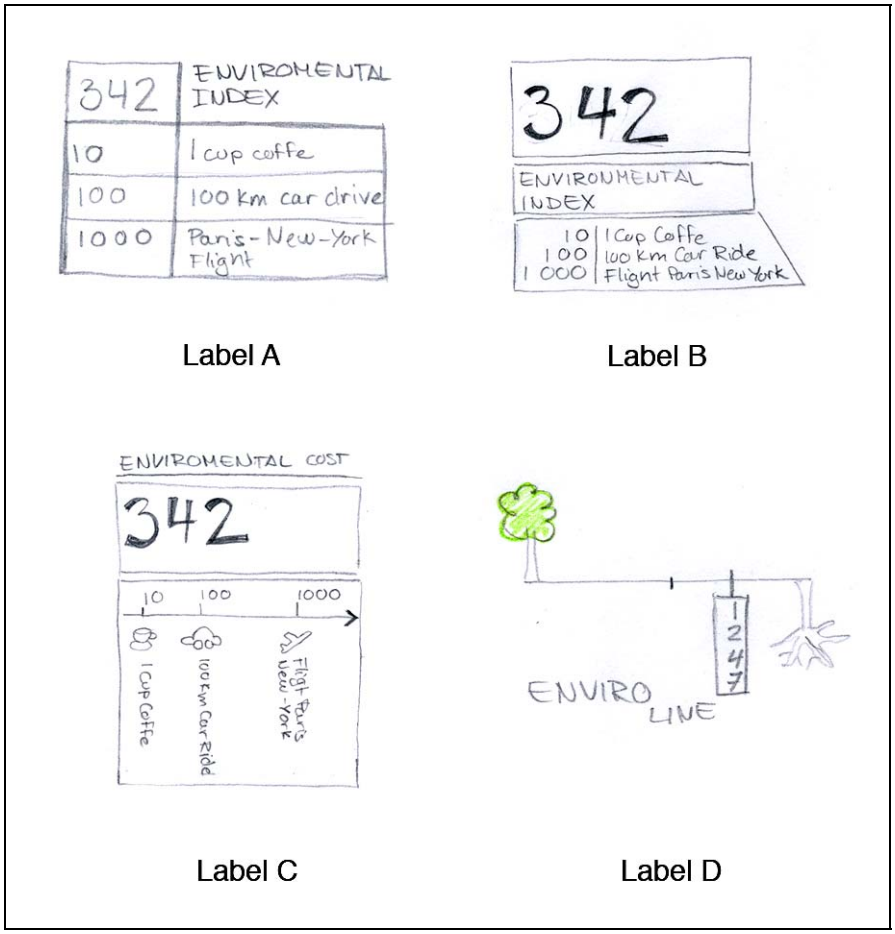


Figure 4-7: Examples of effective and less effective visual representations of information.

One professional had an interesting comment about the impact of such a label on the consumption's decisions of individual consumers: this sole-label cannot stand-alone, it has to be backed by something else (Professional 3). Indeed, this comment is in line with views of IPP, where a mix of various instruments (e.g. policies, information campaigns), developed for specific purposes, work together and support one another (DG Environment, 2000, ; European Commission, 2001). This interviewee added that the users don't have any rationale standing behind the numbers; what does saving 10 points mean for individual consumers and to what they can relate it in their daily lifes.

Furthermore, the questions of trust, credibility and acceptance of such a label gave rise to interesting comments. One interviewee mentioned that it would be interesting to know which

organisation is behind this label by using for example an approval or certification seal (Professional 1). In the first iteration, one participant has also questioned the origin of the information (Consumer 3). The importance of credibility as one of the major success factor of eco-label is widely described in literature (DG Environment, 2000, ; Rubik and Frankl, 2005). Various factors can influence the credibility of an eco-label such as the level of information, familiarity and uncertainty about the information sources, the presence of contact information (Teisl and Roe, 2005).

The need for education has been mentioned on several occasions during the interviews. It has been shown that a higher level of education about environmental issues increases consumers' response to environmental information and consequently to eco-labels (DG Environment, 2000). A survey conducted in 2002 by Environics International revealed that only four percent of Canadians believed they knew enough about environmental issues to keep the environmental healthy (EEON, 2003). Similar observations have been made in the United Kingdom (Holdsworth, 2003).

Following the professionals' interviews, two more interviews have been carried out with individual consumers. The goal of those interviews was to test on individual consumers the comprehensibility of the benchmark system and its ability to effectively communicate the message. There was also a need to review and assess: a) the positioning and size of information elements, b) what are the most appropriate benchmarks, c) sizing the importance of an approval or certification seal and finally d) evaluate consumer's response to a policy framework supporting the Eco-rating label.

4.2.4.2.2 Interviews with individual consumers

Following the comments of the two interviews with professionals, three labels with the benchmarks system were refined. Again, the pattern of the first interview with individual consumers (in the first iteration) using a simple scenario was built around the labels. However this time, the interviews have been done face-to-face, instead of by phone. Figure 4-8, shows the three concepts.

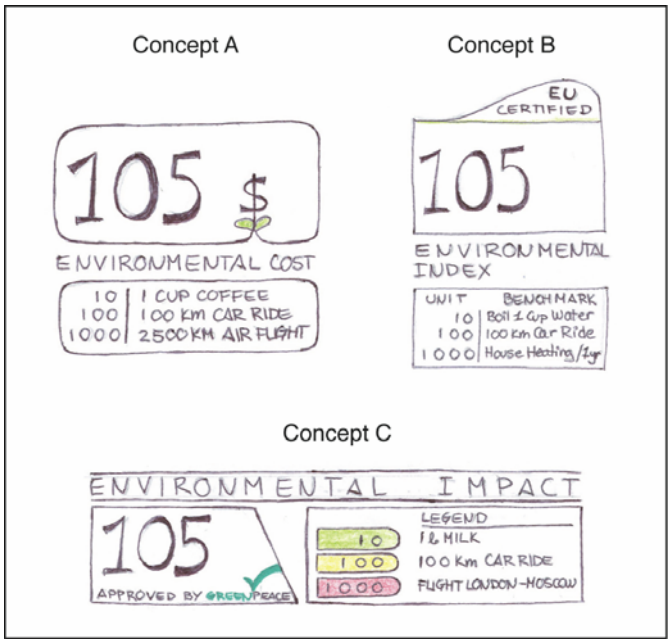


Figure 4-8: The three concepts of visual representation using the benchmark system, second iteration.

Both interviewees understood the message conveyed in the three different variations of concepts. Indeed, they identified correctly which product has the lower and higher environmental impact. It appeared that the easiest concept for participants to understand was highly related to its simplicity. A lowest amount of information appeared to work better. Both participants identified the same concept (Concept A in figure 4-4) has the easiest to understand. Since both participants understood, it can be supposed that the positioning of the various elements (i.e. number, denomination and benchmarks) was appropriate. No reservations have been expressed concerning the layout of the concepts.

Surprisingly, the simplest concept has been favoured even if it did not mention any approval or certification (by a known organisation), which has been considered previously as an important criterion for credibility. One of the participants claimed that: « …I don't necessarily want to know what is behind the number…all I want is the lowest score…» (Consumer 1) Those observations confirmed the comments made previously by professionals about the importance of simplicity. However, the challenge seems to keep the fragile equilibrium between enough information and information overload.

The benchmark system was also well understood by the interviewees. It seems that there was no need to indicate the benchmarks with a title. One participant mentioned that it was just adding unnecessary information (Consumer 2). There were some reservations about the following benchmarks "one litre of milk" and "one cup of coffee". Both participants were confused about to what the impacts were related to: the production phase or the usage phase (to make the coffee)? The flight seems to be well perceived, but there were some divergences between to use the mileage (in km) or the two destination cities (London - Moscow).

In general, the denominations "Environmental Cost" and "Environmental Impact" were understood. The participants explained that the terms meant something to them, creating a sort of mental image. However, the word "Index" was not understood so easily, perhaps because of language barriers and the fact that the word index is not as commonly used as cost and impact.

Again, one individual consumer expressed the need to know more about the benchmark system: how the numbers are calculated, how is the scale organized, what is it built on, what is in between of those three benchmarks, who stands behind the label, who makes it and so forth (Consumer 2). This reinforced comments previously made by other participants. It confirmed the need to support the label with supplementary information accessible by all individual consumers.

4.2.4.3 Findings

In this second iteration, many characteristics of a visual representation have been tested. The main findings in this second iteration are:

- The importance of the simplicity of the label (providing the right information);
- The importance of choosing the appropriate benchmarks;
- The importance of a coherent graphical representation;
- The importance of providing a meaning to the numbers and

- Trust and acceptance of a label is not necessarily related to the display of an approval or accreditation seal.

4.2.4.4 Third iteration

In this third iteration of concepts, the emphasis was put on the refinement of the visual display, the inclusion of colours, improvement of the benchmarks and the issue of the size of the label.

Since the benchmark system has proven to be a comprehensible way to communicate information, the concepts developed at this stage conserved the benchmarks system. The concepts were based on the ones of the second iteration, but have been refined. Three concepts have been selected and presented during the interviews. The three concepts selected are available in appendix N.

Three participants from the professional sector took part to the interviews. Once again the interviews followed the same structure as in the second iteration with professionals.

4.2.5 Findings

All interviewees understood the benchmark system. They agreed to say that this kind of visual representation would probably be efficient for educational purposes. However, one interviewee questioned the comprehensibility and usefulness of a concept conveying absolute comparison (Professional 4). The interviewee stressed the importance of relative comparison between products and services. The participant believed that relative comparative information, would push further consumers to switch towards less damageable products or services than absolute comparison.

The regionalist character of benchmarks has also been mentioned. One participant stated that this regionalist character of the concept could be problematic for manufacturers that would prefer a universal concept, since their production is often not confined to one country (Professional 4).

Two interviewees bring up the issue to use numbers and the industry (Professional 2 and 4). Using numbers might be difficult because of the lack of precision of data, which might cause legal problems within the industry. The industry might be reluctant to accept a system where the calculations are not completely precise. In addition, it has been stated that numbers might also be hard for consumers to remember (Professionals 2 and 4). Indeed, if a consumer is shopping; he or she might not remember the numbers seen on a product or service in a previous store.

Once again, there were some mixed views on the choice of a denomination. One interviewee expressed some reservations about using the word "environmental" arguing that users have no idea what it means and what kind of impacts it implies (Professional 4). However, other interviewees claimed that the term "Environmental Cost" was really comprehensible (Professional 2 and 3).

One concept has been appreciated in particular because of its graphical language, which was similar to the EU energy label and the signpost food labelling in UK. The fact that it referred to something familiar seemed to be helpful. The concept was using horizontal bands coloured in green, yellow and red. The length of the band referred to the percentage or level of environmental impact.

4.3 Conclusions

The survey and individual interviews have been extremely beneficial and valuable into the design process since they allowed assessing consumer's perception and attitude towards visual representation of environmental information. Indeed, both instruments allowed different, but privileged communication and relationship with the users (individual consumers) as well as with professionals from diverse work fields. The feedback and insights obtained along the user-test constituted a strong foundation for the design of a visual representation presented in section *6. Final concept and recommendations*.

5 Evaluation

5.1 Background

As presented previously in section *3. Eco-rating project*, the **evaluation** section constitutes the **content** of the Eco-rating project. In the evaluation phase, primary data would be collected and calculated to produce simplified environmental information. The difficult question that would need to be solved is: which type of environmental impacts should be considered and which tool should be adopted? This section looks briefly at the technical challenges that the Eco-rating project entails. The principal aspects that should be covered are:

- Which environmental impacts are being considered?
- Which tool is used to make the calculations?
- How is the primary data collected and by whom?
- How is it calculated?
- How is the information being managed?
- How is the label being accredited, verified and issued?

This list of prerequisites has been based on the management's experience of various eco-label schemes: ISO guiding principles for eco-labelling programs, the Carbon labelling symposium, the Energy-Efficiency Labels and Standards and the Requirements for Environmental Product Declarations (EPDs) (Boardman, 2007, ; GEN, 2004, ; Swedish Environmental Management Council, 2000, ; Wiel and McMahon, 2005).

5.2 The role of major stakeholders

In the achievement of the success of the Eco-rating label and of sustainability more generally, three stakeholders share a major role: consumers, the government and the industry. As presented in the report *I will if you will*: «People, business and government each occupy a corner in a triangle of change.» (SDC and NCC, 2006, p. 6)

The role of **consumers** is somehow obvious; consumers must change their consumption behaviour towards a greener way of living. However, consumers find themselves often locked in an unsustainable consumption patter (Schor, 1998, ; SDC and NCC, 2006). The provision of environmental information is a way to give consumers the opportunity to make more environmentally sound choices.

The role of the **government** can be of different nature depending on its implication into the project. Indeed, a governmental body or an independent organisation could run the Eco-rating programme. The EU flower and the Green-seal (US eco-label Type I) are respectively examples of a state own programme (in this case, multiple states) and an independent organisation programme. Environmental or consumers organisation (generally non-profit organisation) are examples of independent organisations that run eco-label schemes. An independent organisation can also be endorsed by the government, which can be integrated as a stakeholder participant.

As mentioned previously, in an ideal situation, the Eco-rating programme would be mandatory. Therefore, the implication of the government would tend to be much deeper. The EU Deep project found that consumers from four European countries, preferred consumer associations or environmental organisations to manage eco-label schemes (Stø and Strandbakken, 2002). This indication could guide the choice of an organisation's nature for the Eco-rating project. Since the Eco-rating programme has an educative goal promoting sustainable consumption behaviour, a greater implication of the government could be beneficial. It has been recognised that consumers consider sustainable consumption as a responsibility of national and local governments (Holdsworth, 2003). The same research revealed they also consider government and industry to have much more power to act than individual consumers. The report "I will if you will" stated that: «It is government, at all levels, that is best placed to co-ordinate a collective approach to change, through an enabling policy framework» (SDC and NCC, 2006, p. 6). Indeed, the government can open the way and guide consumers and industry towards sustainability. As the Eco-rating project can be seen as a part of a greater policy framework (this point is further discussed in section *6.2 Importance of a framework*), the involvement of the government seems to be an essential partner to its success (IPP Working Group, 2006).

Next to government and consumers, the **industry** constitutes also an important part of the puzzle. The industry is composed mainly of retailers, producers or manufacturers, which play different roles in the context of an eco-label programme. The *Integrated Product Policy Working Group on Product Information* distinguishes from the industry two principal roles: the production and diffusion of environmental information (Ibid). Manufacturers, as main producers of environmental information, can increase the production and diffusion of environmental information by sharing this information with other actors. Retailers generally do not produce environmental information, but rather plays the role of communicators of this information. Since they are the link between manufacturers and consumers, they have the key position to make environmental information accessible and visible for consumers. Depending on their size, companies can use their purchasing power to influence their suppliers to share environmental information. Some companies might as well influence other companies in the same activity sector by setting higher standards. The use of eco-label is one strategy (Eco-branding) that can be used by companies to gain a competitive advantage (Orsato, 2006). An example of the influence of a retailer on its suppliers and its activity sector is the recent initiative of Tesco, which committed itself to put a carbon label on all of its products (Sir Terry Leahy for TESCO, 2007). By making such an announcement, it is likely that other large grocery retailers will have in a near future to adjust to higher standard of environmental information on products and services.

Even if the environmental information is mainly intended for consumers, many other actors will benefit from this information. For example, manufacturers will use this information to increase the efficiency of their production processes and eventually make savings (Carbon Trust, 2007b).

5.3 Technology

One of the major challenges for the project team would be to evaluate which environmental impacts are being considered toward a final rating value. Of course, there is an obvious correlation between the kind of environmental impact (i.e. environmental indicators) and the tool used to make those calculations. The kind of environmental indicators that want to be obtained will dictate the tool and methodology to use.

As mentioned in section *2.4 Information about products and services*, there are different tools and methodologies used to measure environmental impact of products and services. Indeed, the project team will have to make a choice among various alternatives such as a simplified LCA, carbon footprint, MIPS, Input-output analysis (I/O), a set of criteria and so forth. Each tool offers some advantages and drawbacks. The choice of a tool and a methodology to provide environmental information should depend on its audience: individual consumers (Carlson et al., 2005). This choice should also be done consequently with the results of the Representation of environmental information phase (chapter *4. Visual and conceptual representation*). With the available resources for this research, it has been estimated that one way to present visually and conceptually environmental information is by using benchmarks associated with a numerical system. Following those results, the choice of the kind of environmental impacts, methodology and tool should be aligned.

Furthermore, the methodology associated with a tool would need to gain approval. Indeed, the tool and the methodology used should be commonly accepted and recognised by the users of the environmental information: consumers, the industry, the government and to a certain level the scientific community. Otherwise, the label might not be considered trustworthy and the users might be reluctant to buy products or services, which display it. However, it is very likely that a commonly accepted method to calculate the environmental impact would have to be developed. Therefore, the creation of a specific research group could be necessary.

In order to estimate the fair environmental profile of products and services, the whole life cycle has to be considered. Indeed, for some products and services the major source of environmental impact lies in only one phase of the product life cycle. Therefore, it is imperative to adopt a life cycle thinking in the evaluation of the environmental profile. This does not mean that the environmental impact of all phases have to be calculated for all products and services. However, all phases should be considered in the calculation processes to avoid environmental profiles that are not truly representative of their real impact. Once again, the aim would be to calculate the most environmental profile of products/services as possible.

In addition, to determinate the viability of such a project and the potential type of technology to use, preliminary studies should be carried out. A preliminary study will set the opportunities, limits and barriers that a eco-label programme, like the Eco-rating, entails (White et al., 2007b, ; Wiel and McMahon, 2005).

At this point, it would be improper to give a precise recommendation on the type of technology to use. Indeed, this research was not intended come up with a recommendation for a tool and methodology but rather to guide this choice.

5.4 Management

Considering its wide span, the management of the Eco-rating project would require a considerable amount of resources. In order to be effective and operational, a proper management of such a project is essential.

One key factor seemed to be the consistency across the production and measurement of primary data. The procedures must be consistent along the process of data gathering and measurement in order to produce comparable and reliable environmental information. As stated previously, the credibility of the project lays on the reliability of its environmental information. To do so, a clear procedure and protocol must be created and implemented.

Before the project can reach consistency, the project managers would have to precisely determine who is doing what and how. Indeed, who is going to produce/gather primary data and who is going to make the calculations? To which extend the manufacturers and producers would be responsible for the production of primary data. Is the Eco-rating project going take the entire responsibility to make the data gathering and measurement itself or delegate a part of the work to the industry or another third party? In the eventuality that producers would be assigned to produce and calculate primary information, it is likely that those would need to follow an educational programme (White et al., 2007c). Technical assistance and educational programmes would help to maintain consistency of the primary information. In addition, it should be determined how and who is doing the accreditation and the issuing of the label.

The calculation of environmental impact of products and services constitutes an impressive amount of primary data and information. The information being produced would be of great value and would need to be managed in a way that other people could benefit from it. For example, if a producer of plastic containers calculates the environmental impact of the plastic bins it produces, another plastic producer might be interested to have access to this information. Since the production processes are similar, the other producer could use this valuable information that also applies to its company. However, this sharing of environmental information may cause some confidentiality issues for producers, which are generally keen on keeping secret this kind of information as a competitive advantage (IPP Working Group, 2006). This issue could be bypassed using ethical databases such as the SEDEX, where the confidentiality of producers is respected.[35] (Boardman, 2007)

As mentioned previously, producing environmental information is expensive (Carlson et al., 2005, ; OECD, 2001a). As pointed out by Carlson et al., primary environmental information is needed in large quantities, for different materials, emissions, production processes, geographical information and so forth. «There are major financial advantages in coordinating primary environmental data acquisition, and in sharing the same data sources.» (Carlson et al., 2005, p. 17) Furthermore, in order to manage this information, a database would probably need to be created. Databases are commonly used to manage environmental information (as well as all type of information). For example, many databases are used to organise and manage LCA data (Ibid).

In addition, the creation of a novel eco-label requires the respect of labelling guidelines and standards. The Eco-rating project would need to be developed in conformity with the appropriate standards. For example, the label would need to follow ISO 14025 standards on Type III environmental labels and declarations (ISO, 2000). Depending on the tool and methodology, other standards could be applied. For example, in the case of the calculation of greenhouse gazes, the Greenhouse Gases Protocol could be followed.[36] And finally, the Eco-rating label would have to be in compliance with the relevant local and national legislation in place.

[35] SEDEX (the Supplier Ethical Data Exchange Ltd) is a secure, web-based system enabling companies to maintain and share data on labour practices in the supply chain. For more information, please go to the following website: https://www.sedex.org.uk/

[36] For more information on the Greenhouse Gas Protocol, please go to the following website: http://www.ghgprotocol.org/templates/GHG5/layout.asp?MenuID=849

6 Final concept and Recommendations

This section is presenting the results of this research. All the information, insights and feedback gained during this research were used to produce a graphical and conceptual representation of environmental information. Some recommendations are made on major issues that have arisen during the survey and interviews: the importance of a framework and the need for supplementary information. The section concludes with some limitations.

6.1 Graphical and conceptual representation

Before consumers even started to use the environmental information, the first thing they see is the label itself. Therefore, the graphical characteristics of the label are really significant. The *Energy-Efficiency Labels and Standards Guidebook* mentions that: «International experience suggests that the appearance of an energy label is a fundamental factor that influences its future impact» (Wiel and McMahon, 2005, p. 190). The label must catch the attention of individual consumers. They should be able to easily recognise it among panoply of diverse information displayed on products and services (e.g. other eco-label schemes, content information, nutritional information…etc).

Although the benchmarks system as well as the positioning of graphical elements have been defined as significant factors somehow early in the research process, producing the final graphical concept was not an easy task. Many graphical elements have been put aside to come up with a clean and simple design. For example, the idea to represent in a graphical manner the level of impact of a product (or service) in relation to its product category (e.g. traffic lights colours, arrows in progression) has been dropped. Interviews revealed that it was not essential neither facilitating the comprehension of the label.

The final graphical representation of the Eco-rating label is composed of three essential information elements:

- the **level of impact**;
- the **denomination** and
- the **benchmarks system**.

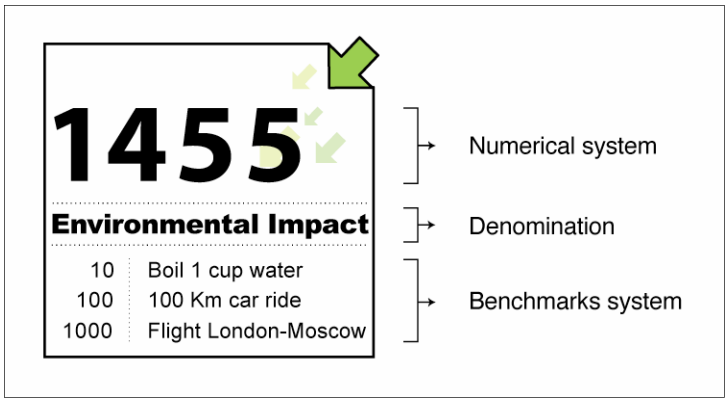


Figure 6-1: Final concept of visual representation of the Eco-rating project

On the top part of the label, a numerical system represents the **level of impact**. The number represents the most important information element, since it indicates the users what is the level of impact of the product or service (see figure 6-1). Indeed, the number is the first information element that users should see. In order to catch users' attention and increase readability, a massive font with a large size has been chosen. The black font is disposed on a white background to amplify the contrast.

The **denomination**, in the middle, was entitled *Environmental Impact (*see figure 6-1). The denomination serves two purposes: to give a "name" to the label and to indicate the meaning of the number above. Indeed, the user of the label associates the number to the term *Environmental Impact*. Throughout this research, different denominations (e.g. Environmental Index, Environmental Cost, Eco-line…etc.) have been tested on participants. This denomination has been chosen because it represents the most generic and inclusive term to express anthropogenic pressures on the environment. The decision to take a rather vague term came from two factors. First, at this point in the development of the Eco-rating project, the type of environmental indicator(s)[37] resulting from the calculation is not defined. Second, using a vague term allows consumers to make their own interpretation without using scientific jargon. During the interviews, it appeared that participants had a general idea of what the term environmental impact meant. If for example the terms carbon emission, ozone depletion or eutrophication would have been used, it is likely that most individual consumers would not necessarily have understood. On a day-to-day basis, non-experts rarely use those technical terms belonging to the scientific sphere. As mentioned previously, environmental literacy is generally low among consumers.

On the other hand, imprecision of the denomination has also drawbacks. A vague term, not relating to any precise impact can be confusing and misleading for some individual consumers. Furthermore, scientific terms are not restricted only to scientific matters. It is possible to teach and educate individual consumers about scientific and more technical notions. An example could be this global movement to raise consumers' awareness about the effect of CFCs on the ozone layer. In this case, complex scientific information has been communicated to consumers. However, further research would be necessary to determine which kind of term; vague or precise, is the most appropriate and comprehensible for individual consumers.

Once again, a plain and full font has been used. However, the font's size is smaller than for the numerical system. The denomination is making the transition between the number and the benchmarks system. The denomination must be distinguished from the two other information elements; it must take more importance than the benchmarks system, but less than the number. In addition, the meaning of the word *Impact* refers to something strong and powerful**.** Using a thin and frail font would not have been appropriate. Using a bold font supports the meaning of the denomination, which increases the coherence of the message.

The **benchmark system**, situated on the bottom part of the label, is represented by three benchmarks. As it can be observed on figure 6-1, the font used to display the benchmark system is much smaller and thinner than the ones used for the two other information elements. Indeed, compared to the number and the denomination, the benchmark system is the least important information element. Of course, the benchmark system is significant, but

[37] The procedures to calculations of environmental impact of products and services have not been considered in this thesis. Therefore, it is not known which tool, methodology and environmental indicators would be chosen to illustrate the environmental profile of products and services. A single or many environmental indicators could enter in the calculations of the environmental profile. This would need to be decided by the project team in a later stage of development of the Eco-rating project, which is not covered by this thesis work.

its importance decreases as the user is getting used to the label. At a certain point, the benchmark system is no longer a key information element since the individual consumer can use and understand the label without the benchmarks. Accordingly, it is reasonable to believe that the benchmark system do not required so much space and importance in the graphical display of the label.

A number of three benchmarks have been chosen. During the interviews, it seemed that three benchmarks was sufficient to give the user an adequate range of comparison (i.e. 10-100-1000). In the current situation, the dilemma was to provide enough information on a limited space that constitutes the label. The three benchmarks chosen are: boiling one cup of water, 100km car ride and a flight London-Moscow. The benchmarks work as points of reference for users to situate the level of environmental impact of a specific item on an overall scale of impact. Accordingly, the benchmarks must relate to something known or familiar for users. The three benchmarks cited above were according to the results of the interviews, the most comprehensible. The benchmarks are again voluntarily imprecise. The goal is to give the individual consumers an idea, rather than a precise level of impact.

The three main information elements have been disposed in this specific way on the label (i.e. level of impact on top, denomination in the middle and the benchmark system at the bottom) because it eased the comprehension of the label. Many different dispositions of information elements have been tested on interviewees. This current disposition appeared to be generally the most logical and intelligible for participants.

All information elements form a whole, the label, but need to be used separately at the same time. As an example, the numerical system relates to the benchmarks system, but those two information elements are not necessarily always used together. It was really important to separate the number from the benchmarks system to avoid confusion. When the number was displayed next to the benchmarks system, the number was considered to be a part of the benchmark, which made the benchmark loose its purpose and meaning. (For example, see section *4.2.4.2.1 Interviews with professionals*).

In addition to the three essential information elements, the label needed a distinctive graphical branding. The Eco-rating label must be differentiated from other sources of information on products and services. Various concepts have been produced following the exploration of the graphical branding. See Appendix O for samples of graphical brandings. The use of the arrow as a part of the branding has two main purposes (see figure 6-1). First, it catches the user attention on the number, which is the most important information element as well as on the label itself. Second, in a symbolic perspective, the use of arrows evokes the progression and variation, referring to the variation of number or level of impact.

The integration of colours in graphical branding is significant (Tufte, 1983). The use of certain colors is often strongly associated with specific activities and objects. Therefore, the choice of colour must be done with great care. As an example, large household appliances often display a white colour. Accordingly, those appliances are often called "white goods". This does not mean that another color than white can be applied to a fridge or a washing machine. However, the choice of a counter-intuitive color might be harder for consumers to accept. In some cases, it might even be difficult for consumers to understand what kind of product it is.

During the survey, it appears clearly that some colours, mainly green shades, were associated with environmental issues. Nonetheless, the use of green color did not immediately impose itself. Furthermore, green colour in environmental issues if often associated with positive or environmental-friendly features. For example, many eco-labels Type I, which are awarded

labels on best products of their product category, are displaying green colours. The use of green colour can imply for consumers that the products and services which display the eco-label are environmentally benign, which is not necessarily the case. This situation could possibly mislead individual consumers about the nature of the product or service.

In the present case, the use of colour serves much more as an eye catcher than as an informative element communicating fundamental information to the user. Therefore, the use of a bright colour was considered. Yellow has been seriously considered since it is a clear and bright colour. This colour is often employed in diverse types of communication for example in road signs and in traffic lights. In Western cultures, the yellow colour symbolically refers to "being carefull" and "paying attention". In addition, yellow has been often used in various energy-efficiency labels (e.g. EnergyGuide in U.S.A, Australian Energy rating label, Thai Energy label). Graphical references to known eco-label programmes might provide individual consumers with clues on the nature of the communication. In some cases, the use of colour might not be possible due to printing restrictions for example. Therefore a black and white version could also be used (See figure 6-2, Label B).

The Label C in figure 6-2, does not display the benchmark system. As mentioned above, the benchmark system is mainly necessary for new users of the Eco-rating label. Therefore, dropping the benchmarks system in some specific cases might be possible without preventing individuals to understand the label. For example, on small packages or on products and services that do no require packaging, using a "smaller version" of the label might be required. During the interviews, it appeared that participants could understand the smaller version of the label, which was not hindering comprehension and comparison of the level of impact of products and services.

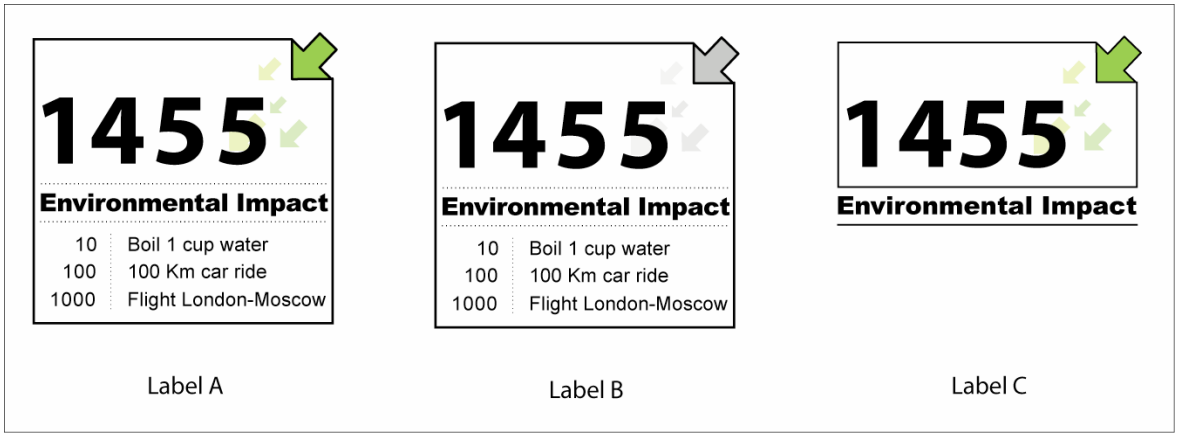


Figure 6-2: Three potential versions of the Eco-rating project

It is rather difficult to evaluate in advance consumers' interpretation and perception of the graphical design of a visual representation. However, this graphical branding has been chosen because it is in line with the Eco-rating concept and support the message transmitted by the label.

6.1.1 Main objectives

The final concept constitutes the result to the fulfilment of a set of objectives previously determined and explained in section *2.5 Analysis of current environmental communication tools*:

- **Accessibility** of environmental information **during consumption activities**;
- **User-friendliness**: the information must be **comprehensible** for individual consumers (lay decision-makers);
- **Comparability** of the information and
- **Consumers' education** about **sustainable consumption behaviour.**

6.1.1.1 Accessibility

The **accessibility** of environmental information **during consumption activities** is highly associated with the type of **format** chosen (e.g. brochure, mass-media, Internet page). From the different mediums explored throughout this research, the choice of the label became obvious. Indeed, eco-labels are providing relevant environmental information on products and services available for consumers on the purchase moment (Thøgersen, 2000). Eco-labels convey information at the moment and where it is the most needed for individual consumers, without having to find it among masses of information. These days, consumption acts do not only happen in stores, but also through various **mediums** such as by phone or by Internet. However, the adaptation of the label to different mediums has not been explored in this study.

6.1.1.2 Comprehensibility

This final concept of visual representation has proven to be **comprehensible** among the participants of this research. Most participants found the label easy to use and comprehend. Their ability to understand and use the label has been tested during the interviews. The intelligibility of the label is mainly due to the utilisation of the benchmarks system. The benchmarks system stood out by its comprehensibility and simplicity to convey information. It also allowed consumers to make the link between the number (i.e. level of impact) and its representation of environmental impact: higher impact or lower impact. The benchmarks system steers consumers to situate on a large impact scale, the impact of a specific product or service. It indicates the consumer the level of impact embedded in all products and services, allowing him or her to put the impact into perspective.

6.1.1.3 Comparability

Comparability of environmental information is made possible using the numerical system. Corresponding to its level of impact (calculated beforehand), a number is assigned to all products and services. Higher is the number, higher is the environmental impact and vice versa. Figure 6-3 shows a sample of products where the environmental impact can be compared using the assigned number for each product. As presented in section *3.5 Environmental information: on which products?,* it is assumed that all products and services are labelled.

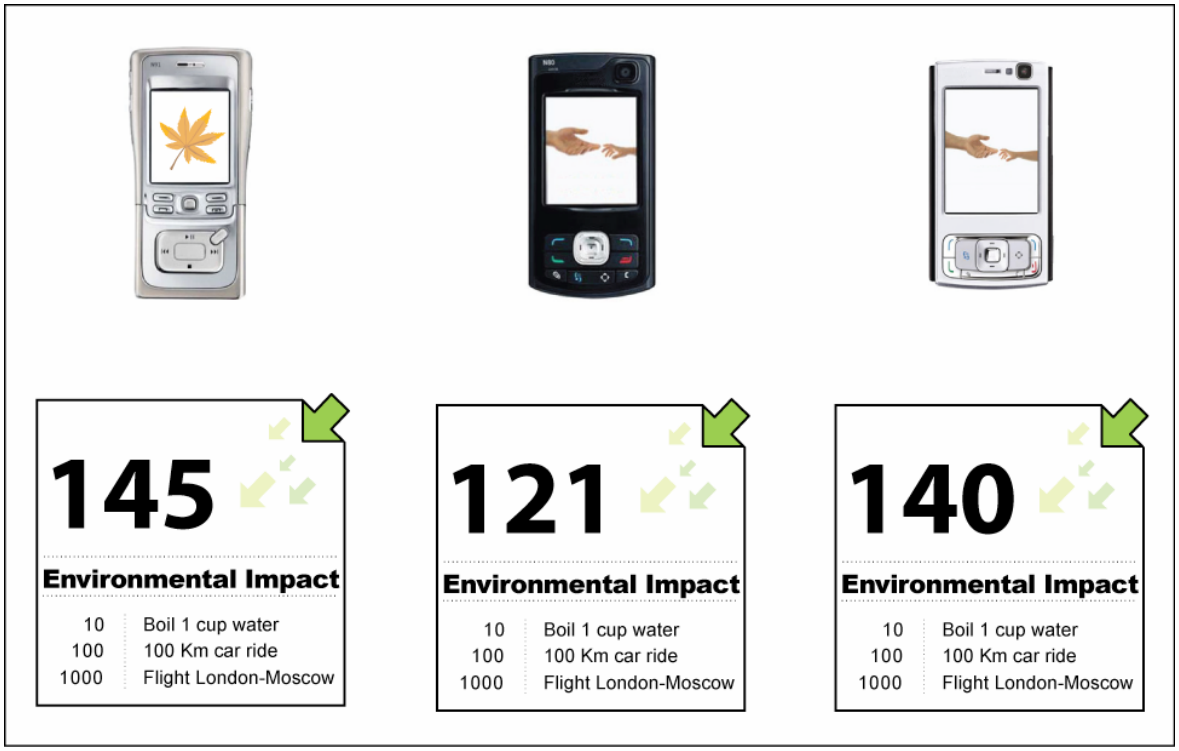


Figure 6-3: Comparison of environmental impact of similar products

From the beginning, a numerical system was used to indicate the level of impact of products and services rather than another form of indication like letters for example. Numbers allowed the inclusion of all products and services in a continuous scale of impact, at the opposite of using a category system (e.g. EU energy label) where the environmental impact of a product or service relates only to its own category.

6.1.1.4 Consumers' education

The use of a continuous scale of impact was essential because it allowed consumers relating and putting the impact of various products and services into perspective. This positioning of environmental impact of products and services provide **relative comparison** as well as **absolute comparison** of information. By using and reading the different labels, the consumers would gain a broader understanding of the level of impact of different products and services. Somehow, the consumers would be trained to identify the level of environmental impact. Some interviewees claimed that this kind of tool make them feel more informed about environmental impacts of products and services (Consumer 2 and 3). However, it is hard to say if such a label would lead to "greener" consumption behaviours. Since many factors influence consumers' behaviour, the success or failure of an eco-label scheme can hardly be predicted.

It also appeared that the **consistency of the visual representation** was essential to maintain. Indeed, the graphical characteristics of the label such as the size, the colours, the fonts and the positioning of elements should always be consistent whether it is put on a product or under another format (e.g. in a brochure or on Internet). By modifying some graphical elements, the label could confuse or mislead the users, whom might not recognize it. This confirmed the results of a research on food labelling requirements, which considered the standardisation of information display as a priority for the development of a novel food label (FSA, 2006a). Furthermore, the positioning of the label on the product (or other mediums) seems also to be

of great importance. However, this feature could not have been verified in the present research.

The label is although not constrained to one definitive graphical representation. A research from the Food Standard Agency revealed that: «…consumers are keen for different manufacturers and retailers to retain some differences in design approach…» (FSA, 2006a, p. 53). Similar results have been observed during the interviews. A majority of interviews stated that they would recognize and understand the label even if the benchmark system was absent form the label, as long as they had seen the benchmark system before and they can compare products with one other.

This kind of label tried to offer consumers with a different type of environmental information than the one already offered by other eco-label schemes. Indeed, products and services, which display an eco-label Type I indicate consumers that they have the best environmental profile from their product category. The Eco-rating label do not attempt to classify products, in a same product category like eco-label Type I schemes. The Eco-rating project indicates the level of impact of a product, which can be compared between similar products. However, the Eco-rating label does not indicate if the environmental impact of this particular product is low or high according to its product category. Therefore, both eco-labels, Type I and the Eco-rating, could be used together and complementing the information displayed by each other.

However, the complementary nature of the Eco-rating with other eco-label schemes has not been tested in this study. For that reason, is difficult to foreseen if consumers would use jointly the two eco-labels schemes. Furthermore, it is not known if consumers could be confused by the display of the Eco-rating label and another type of eco-label. According to the Standards & Labelling Guidebook, the poor integration of eco-labels might bring confusion among users (Wiel and McMahon, 2005). Then again, further research would be necessary to assess if the Eco-rating label could enter in conflict with other types of eco-labels such as the EU energy label, fair trade labels, single-issue eco-label (e.g. Forest Stewardship Council label and Marine Stewardship Council label), organic labels, EPDs and so forth.

6.2 Importance of a framework

Throughout the development of this project, it appeared clearly that a label cannot work alone and must be supported by other initiatives, tools and policies. Two main reasons have been discerned: the need for a coherent policy mix and the need of a structural framework that will give the label a coherent meaning.

6.2.1 Policy mix

To be effective, the Eco-rating label should work in collaboration with other policies, which would complement each other. The IPP Green Paper mentioned that an efficient strategy is not passing trough one instrument but trough: «…a mix of instruments, which needs to be carefully used and fine-tunes to ensure a maximum effect» (European Commission, 2001, p. 3). Furthermore, a sole eco-label scheme cannot pretend to be the only one solution to reach sustainable consumption. Indeed, the Eco-rating label is not intended for all types of users, but rather focuses its action on individual consumers. In addition, such a label does not cover all types of environmental impacts. For example, the label does not convey environmental damages entailed by industries. Only a selection or abstract synthesis of environmental impact would be covered by the Eco-rating label, which means that other initiatives and policy tools have definitely their place.

It has been reported that governmental initiatives would require better coordination in the promotion, production and diffusion of environmental information on products and services (DG Environment, 2000, ; IPP Working Group, 2006). A study from the European Commission on different types of environmental labelling, pointed out the need for a broader policy initiatives. It is observed that the implementation of complementary instruments of the European Type I Eco-lables (e.g. EU flower) would be beneficial and create a wider labelling strategy (DG Environment, 2000). Indeed, to develop its full potential, the Eco-rating project should work in conjunction with complementary measures.

6.2.2 Translation into daily life

To increase its efficiency and reach users effectively, the message conveyed by the Eco-rating label should relate to something familiar, with a sensible meaning for individual consumers. Consumers need to know how the new label would make a difference in their life. How the effect of purchasing a product with ten points lower than another translates into a beneficial option for the environment? What difference is it going to make in my life? And this goes beyond taking action to reduce environmental impact.

In the development of the Eco-benchmark project, it was reported that consumers were not convinced about the usability of the tool in everyday life (Nissinen et al., 2005). Some participants expressed similar thoughts during the interviews.

In order to improve the Eco-rating project's span, a structure should be build around the label to support and foster consumers to pay attention to the label and ultimately, make "greener" choices. However, this structure must be associated to something that consumers are familiar with in their daily lifes. The use of monetary incentives could be a simple and comprehensible way to increase consumers' use of an eco-label like the Eco-rating. All users are familiar with the monetary system, which is a common way comparing the value of products and services.

A good example of synergies between different tools could be reached with a carbon labelling scheme, a tradable permit scheme for the industry (already in place in Europe and in other regions of the world) as well as a potential personal tradable permit scheme. Those three tools have affinities, which could lead to the creation of a grater policy framework.

In December 2006, the British government commissioned a feasibility study considering the use of personal tradable carbon quota, meaning that each individual would receive an annual allowance of carbon emissions (BBC News, 2006, ; Moranttz, 2007, ; Morantz, 2007). For example, pretending that individuals are granted with a total of 50 000 carbon points annually and that for each product or service bought, the corresponding carbon points are deducted from this total. The Eco-rating label, in addition to inform the consumers about the environmental impact of items, could serve as an indicator of carbon points. The number corresponding to the level of impact on the item, could be the same number of points removed from the total carbon points when the item is purchased. If an individual wants to acquire more carbon points, he or she would have to trade permits and purchase them to the market price. A similar system could also be established for businesses. In addition to the carbon emission allowances, each company could be granted an annual allowance of carbon points according to its level of economical (purchasing) activity. The already existing carbon emission allowance, currently used by the industry, could also be extended to the trading of personal allowances. It would create an inclusive tradable carbon allowance scheme, from which the Eco-rating label could play an important role: informing and educating consumers. With such a system, the three policy tools would be interacting and supporting each other.

A similar scenario around personal allowance has been build up during the interviews with two users.[38] Both users claimed that this kind of "points ceiling system" would definitely influence their purchase behaviour (Consumers 1 and 2). One interviewee said that this would make people consider the label more when taking purchase decisions (Consumer 1).

Furthermore, it has been observed that translating abstract information such as gas emissions or energy use into monetary terms increased consumers' understanding because money is something that everyone can easily relate to. In a research on the US energy efficiency label (displayed on white goods): consumers claimed that having an operation cost figure was a very important criteria of a good energy-efficiency label (Egan et al., 2000). This confirms the importance of relating environmental information to something known by individual consumers, like money or savings.

Additionally, environmental impacts remain highly abstract for most people. It has been shown that some people do not understand the environmental information that is currently presented to them (Holdsworth, 2003). It is not clear for people how their personal contribution helps to tackle climate change. What difference does it make on the environment if I buy the product that has 10 points less than the other one? How is this influencing the environment? There are reasons to think that it could be really valuable for consumers to translate intangible environmental impacts into visible and concrete environmental impacts. Once again, using benchmarks could be useful. For example, 10 points saved (pretending that 1 point equals 1 Euro) would be translated into the cost to clean one glass of contaminated water into drinkable water (around 250 ml). Therefore, it would cost 10 Euros to clean one class of contaminated water. The same exercise could also be done without using a monetary comparison. For example, 100 points could correspond to $1m^3$ of smog. Each 100 points saved would contribute to reduce smog production by $1m^3$. The idea is to turn intangible environmental impact (e.g. global warming) into a concrete and visible environmental impact such as polluted water or smog. The type of environmental impact itself does not really matter. What matter is that people can associate this environmental impact to something known which they can relate with. Of course, this kind of benchmark is an extremely simplified representation of reality. Indeed, it might be hard to translate complex environmental impact into a simplified representation. However, high precision and accuracy of this kind of representation is not significant, as long as people can understand it. This kind of representation could be compare with the atomic model used in physics, which is a visual and conceptual representation really far from reality. However, this simplified representation allows non-experts to size and understand complex and abstract scientific information.

There is still a long way before such kind of policy framework would be implemented. This tradable carbon allowance scenario might however not be the best practicable option, but it allows seeing the sizeable potential that synergies between policy tools could lead to.

6.3 Supplementary information

The amount of information that can be communicated on a label is limited. During the interviews, many participants expressed the need to have access to more information concerning the label scheme. Supplementary information was requested about: which type of environmental impacts is included, having more benchmarks (between the ones displayed on the label), how are the numbers calculated, which organization or governmental body is

[38] The scenario built in the interviews was proposing an interaction only between a potential personal tradable allowance quota and the Eco-rating project.

behind this label. Providing users with more information, outside of the label itself, appeared to be an important criterion for participants. In an experiment with Forest product labels, it has been shown that providing users of the eco-label with contact information increased the general satisfaction as well as the perceived "eco-friendliness" of the label (Teisl and Roe, 2005).

Figure 6-4: Potential integration of the Eco-rating label on products.

Participants pointed out that providing the label with a website would be a must-have. Indeed, all major eco-label schemes have a website. Internet is now taking a growing importance in life of million of people and the use of Internet as source of information (all types of information) has become indispensable (van Dijk et al., 2007). It would be interesting to share with consumers how the calculations are done, which would give consumers valuable information at the same time than showing a transparent process. For example, the web site of the Swedish Railway Company, SJ, offers its consumers to compare the environmental impact of a train trip with a car or a bus trip on a comparable distance.[39] The SJ Environment calculator is interesting because it shows what kind of environmental impacts are being considered in the calculation (in this case, CO_2, HC, NOx and particles) (SJ AB, 2005). In addition, the level of impact is displayed using monetary terms and corresponding graphics, which facilitate comprehension.

However, Internet is not the only medium that could be used. Supplementary information could be displayed in store using technological devices, to scan the barcode of the product and get more information. Another option could be the use of 2D barcodes. 2D barcodes could be defined as a small device where information is encrypted under a graphical format. By taking a picture with their mobile phones, consumers could access more information via a website. Since the penetration rate of mobile phones is constantly growing and already really high in some countries, this type of technology could be used in a near future.

Recent technologies such as Near Field Communication (NFC) and Radio Frequency Identification (RFID) could also be used. NFC consists of a short-range wireless connectivity technology in consumer electronics and mobile devices (NFC Forum, 2007). This technology uses a magnetic field induction to transfer data when two electronic devices are put close to each other (around 4 centimetres) (Ibid). By putting a compatible electronic device close to the Eco-rating label displayed on a product, a consumer could be provided with supplementary

[39] For more information on the SJ Environment Calculator: http://www.sj.se/sj/jsp/polopoly.jsp?d=6783&l=en&l=en

information, which would appear on his or her mobile phone for example. Various companies are currently testing the NFC technology. RFID technology provides more or less the same function, but uses a radio signal instead. This technology is already in use. An example of the FRID technology can be found in some payment cards (Hong Kong and the Netherlands) and in payment system of public transportation systems (e.g. London subway and the "Oyster card")[40] (Ilett, 2006).

6.3.1 Information campaign

Various researches highlighted the importance of consumers' knowledge about the existence of the label, in order for this eco-label scheme of be successful (Stø and Strandbakken, 2002, ; Thøgersen, 2000). An efficient way for consumers to be aware of an eco-label is to make its promotion with an information campaign. The term information campaign is also encompassing communication campaign. Information or education campaign seek to educate and mobilize the public in support of social or behavioural change (Wiel and McMahon, 2005). Information campaigns have proven to be very effective if well executed. Teisl and Roe claimed that an information campaign can increase increase the credibility of a label (2005). A successful example is the work of the WWF and Conservation International to heighten public awareness about commercial trade of endangered species, like African elephants for their ivory (OECD, 2001a). In addition, a research carried out in Denmark on the Nordic Swan scheme (eco-label Type 1) showed that an information campaign through various mediums increased significantly consumers' recognition of the label (Thøgersen, 2002).

In order for consumers to pay attention and look for the label, they must be informed about where the label is present, what is the purpose of this label, but also what it looks like. Indeed, Thøgersen explained that an indicator of the knowledge of the existence of a label is the recognition of the visual image of the label (Ibid). During the interviews, it has been observed that the graphical representation of the label was strong for the participants. Interviewees reported that if certain graphical elements of the label would be modified, they might not recognize the label (Professional 2 and 5).

6.3.2 Issue of trust

As shown in literature, trust issue appears to be of great importance for users of eco-labels (Thøgersen, 2000). Many interviewees and participants of the survey requested to have more information on the organisation behind the label in order for them to trust the label. Since the Eco-rating project is a completely new organisation it would have to gain consumers' trust and acceptance. One possibility could be to affiliate the Eco-rating project to an existing organisation or eco-label scheme.

During interviews, logos and denominations of governmental bodies and environmental associations (i.e. European Union and Greenpeace) have been added to some concepts of visual representation. This has been done to investigate the influence of this kind of accreditation or approval mark on consumers' trust and acceptance of eco-labels. Indeed, to increase its credibility, some eco-label schemes use a combination of two types of eco-label, such as the EU flower, which can be combined with the EU energy label. Although trust is an important criterion, the combination of the Eco-rating label and an approval or accreditation logo did not seem to be an important visual addition for the interviewees. The participants

[40]For more information on the Oyster card, please see the following website: http://www.tfl.gov.uk/tickets/oysteronline/2732.aspx

claimed that the approval or accreditation logo was unnecessary, adding that it took the space of more valuable information and overcharged the label. This finding is in contradiction with a U.S survey on the location of an awarded label within a comparative energy label. The research showed that for most users the combination was comprehensible and seemed reinforcing the two eco-labels (Wiel and McMahon, 2005).

However, there are good reasons to believe that the combination of two eco-labels is not essential for an eco-label scheme to be successful. For example, European manufacturers of white goods have the possibility to combine two eco-labels. However, it seems to be rarely done because no competitive advantage could be observed (Ibid). Indeed, the EU energy label success has been recognised, even if the combination is rarely used.

6.4 Limitations

The final concept presented above constitutes one way to communicate comprehensible environmental information to individual consumers. However, this concept does not pretend to be the best option, but rather one option among others. The final concept of the Eco-rating label is one option that had shown, throughout this research, to successfully transmit in a comprehensible manner environmental information. Furthermore, it fulfils the objectives previously determined in this thesis, within this specific framework. In any case this visual representation could not be directly transposed in a real project. This present research focused solely on individual consumers and did not considered other stakeholders such as the industry, producers, manufacturers, the government and so forth. The concept would need to be modified and improved to fulfil a greater set of criteria that a real life situation would impose. The concept should be widely tested to evaluate its efficacy and comprehensibility. Since no quantitative research has been carried on, the results of this study cannot be generalized to a large population. Finally, many pertinent comments have been expressed during the user-tests that could not have been taken into account since it was falling out of the scope of this research.

7 Conclusion

Unsustainable consumption patterns, observed in OECD countries, are putting growing pressure on the environment. Providing consumers with accessible and comprehensible environmental information can help to rupture those generalized unsustainable consumption behaviours. Although popularization of environmental information has proven to successfully convey simplified messages, effectively communicating complex information to non-experts remains a challenge.

It has been observed that current sources of environmental information remain scarce and fail to provide the necessary information to make informed choices. Furthermore, their visual and conceptual representations have often been criticized as being incomprehensible and not user-friendly for individual consumers. It appeared that research on this subject had been neglected since literature on visual representation of environmental information has shown to be limited.

Within the context of this thesis, visual representations of environmental information, intended for individual consumers, have been explored. The development of the visual representation was based on the ability to compare, on an overall scale of impact, the environmental profile of all products and services. This visual representation would therefore provide individual consumers with all the necessary information to make informed choices. This type of information goes against the general tendency in environmental information to compare the level of impact of products and services only in their own product/service category. The idea was to look at new ways of presenting and communicating environmental information on products and services, which have not yet been explored. It was assumed that an aggregated single-score (i.e. only one environmental indicator) would be communicated and that all products and services would be displaying this environmental information.

To the question: *«What kind of visual representations allow for comparisons to be made between the environmental impacts of products and services and enable individual consumers to make informed choices?»,* it is likely that many variations of visual representation are possible. During this research, it appeared that the use of a **benchmarking system** with a **numerical system** is one way to communicate environmental information. The numerical classification indicated the level of impact of products and services while the benchmarks system gave the consumer a point of reference. The benchmarks enable them to locate the level of impact of products/services on an overall scale of impact. It has been identified that the eco-label is an effective medium to convey environmental information. Indeed, the eco-label has this unique characteristic of communicating information at the right time: during the consumption activity.

Prior to the design of the visual representation, a set of key criteria was determined. The literature review exposed the major shortcomings of current environmental information tools and the way they hinder consumers' abilities to make enlightened choices. To convey properly environmental information, the visual representation has to fulfil the following key criteria:

- **Accessibility** of environmental information on the **consumption moment**;
- **User-friendliness**: the information must be **comprehensible** for individual consumers (lay decision-makers);
- **Comparability** of the environmental information and;

- **Consumers' education** about **sustainable consumption behaviour.**

In the context of this thesis, the benchmarking system and the numerical system had shown to fulfil those key criteria. However, it is impossible to know if, outside of the context of this research, this system would be effective and accepted by individual consumers. Furthermore, it is extremely complex to determine if such as system would foster more sustainable consumption behaviours. The answer to this question seemed to be yes, but it was not possible to measure to what extent the label would have an influence.

Regarding the second research question: «*What are the barriers and success factors to the effectiveness of a rating system of the environmental impacts of various products and services to improve consumers' information, knowledge and choice?*» two aspects have to be considered: **how is the message communicated** and **how it is graphically represented**.

Regarding **how the message is communicated,** it seems necessary to provide individual consumers with a coherent meaning of the environmental information. Indeed, it has been shown that the concept of environmental impact or damage remains abstract and vague for many people. To be sized and understood fully, the environmental information needs to mean something for individual consumers. Environmental information has to be put in relation to a familiar activity, to give it a sense. This attribute has been observed twice.

Firstlty, the level of impact of products and services has been represented with the use of benchmarks. The use of simple benchmarks enabled participants to understand easily the environmental information. The benchmarks constituted familiar activities made daily by a large number of people (boil water, a 100km car ride and a flight from London to Moscow).

Secondly, the impact of those numbers had to be translated into something tangible. What impact has my consumption behaviour on the environment? What difference is it going to make on the environment if I choose the one with the lowest impact from two similar items? Indeed, the fact that most participants perceived a low difference between the environmental impacts of products/services can be explained partly because they cannot translate the environmental information into visible and concrete environmental damage. To convey consumers with a coherent and meaningful message, it is suggested to translate intangible information into a familiar comparison method. Money, which is a known and widely used comparison method, could be a promising option. Also, intangible environmental impact could be translated into visible environmental impact such as polluted water or smog. Furthermore, to be effective the label would need to be used in collaboration with complementary policy tools and initiatives. The label should be included in a greater policy framework.

Of course, the amount of information displayed on the label is limited. Many participants expressed the need to have access to extra information. It appeared that the provision of supplementary information was related to the trust individual consumers put in the label. Trust has also been identified as a crucial factor in the success of the label.

Regarding **how the message is graphically represented**, some key strategies need to be applied:

- **simplicity**;

- effective **positioning** of information,

- **emphasis** on the correct information **elements**

Simpler concepts of visual representation performed better than the ones providing more information. Interviewees preferred the simplest concepts because they understood the information more rapidly. Since most of daily purchasing choices are made rapidly (i.e. a few seconds), it is essential that consumers can quickly grasp the information.

The right positioning of information can make all the difference between an effective communication and confusing or misleading communication. Only by changing the position of the information elements, was the label interpreted in a whole different manner.

Emphasis placed on some key elements made the label much comprehensible and simpler. Many graphical elements included at the beginning in the visual representation have been put aside along the design process.

7.1 Future research

The potential of the provision of environmental information to reach more sustainable consumption patterns is significant. This thesis showed that it is possible to communicate comparable environmental information in a comprehensible way to individual consumers. The next step would be to assess and confirm the efficacy of this visual representation through further research to evaluate thoroughly the visual concept. User-tests on a representative sample of individual consumers should be carried out. Furthermore, this thesis focused only on individual consumers' perception and understanding. Other users of the environmental information such as manufactures, retailers and sales persons should be considered in the design of the label.

The development of visual representation of environmental information corresponded only to one aspect of the Eco-rating project. In the eventuality of the implementation of the Eco-rating or a similar project, the next step would certainly be the development of the Evaluation phase. Perhaps a pilot test could be performed to evaluate how individual consumers react to the label and the information which it communicates.

Bibliography

ANEC. (2007). *ANEC study reveals: Significant shortcomings in implementation of EU Energy Label scheme*. Brussels. p.3.
Energy Labels for Appliances. (2007). [Online]. Available: http://www.energyrating.gov.au/labels-artwork.html [September 10, 2007]
Carbon labelling to hit the shelves. (2007). [Online]. Available: http://www.gozero.org.uk/news/287 [June 15, 2007]
Carbon credit card considered. (2006). [Online]. Available: http://newsvote.bbc.co.uk/1/hi/uk_politics/6167671.stm?dynamic_vote=ON#vote_carbon_cards_6167671 [August 21, 2007]
User-centred design by Alison Black - The basics of user-centred design. (2006). [Online]. Available: http://www.designcouncil.org.uk/en/About-Design/Design-Techniques/User-centred-design-/ [Juy 18, 2007]
Blythe, M. A. & Wright, P. C. (2006). Pastiche scenarios: Fiction as a resource for user centred design. *Interacting with Computers*. 18 (5):1139-1164.
Boardman, Brenda. (2007). *Carbon labelling Provisional perspectives - Report on 3-4 May roundtable*. Oxford. p.12.
Boehnert, Jody. (2007). The Greening of Illustration - When Words Fail. *Varoom Magazine*. 04.
Bottrill, Catherine. (2007). Internet-based tools for behaviour change. In *European Council for Energy Efficient Economies (ECEEE) Summer Study 2007: Saving energy - just do it!* 4-9 June, 2007. La Colle sur Loup, France.
Bødker, Susanne. (1996). Creating Condition for Participation: Conflicts and Resources in Systems Development. *Human-Computer Interaction*. 11:215-236.
Carbon Reduction Label website. (2007a). [Online]. Available: http://www.carbon-label.co.uk/ [September 9, 2007]
Carbon Trust. (2007b). *Making the low carbon economy a reality - What the Carbon Trust does*. London. p.16.
Carbon Trust, Defra with BSI British Standards. (May 30, 2007). *Step forward on reducing climate change impacts from products*. [Press release]. London.
CarbonCounted for businesses. (2007a). [Online]. Available: http://www.carboncounted.com/CarbonCountedBusinesses.html [July 5, 2007]
CarbonCounted. (2007b). *The CarbonCounted Standard 1.1*. p.15.
Carlson, Raul et al. (2005). *Establishing common primary data for environmental overview of product life cycles - Swedish Environmental Protection Agency*. p.225.
Carr, Alison A. (1997). User-Design in the Creation of Human Learning Systems. *Educational Technology Research and Development*. 45 (3):5-22.
Chiristiansen et al., 2.-0 LCA consultants. (2006). *Consumer demands on Type III environmental declarations*. Brussels. p.122.
Christiansen et al., 2.-0 LCA consultants. (2006). *Consumer demands on Type III environmental declarations*. Brussels. p.122.
History ans Scope of Energy-Efficiency Labels and Standards. (2004). [Online]. Available: http://www.clasponline.org/resource.php?nnx=4 [September 9, 2007]
Integrated Product Policy, Building on Environmental Life-Cycle Thinking. (2003). [Online]. Available: http://ec.europa.eu/environment/ipp/ippcommunication.htm [2007, May 27]
Energy Labels - Helping you make the right choice. (2005). [Online]. Available: www.defra.gov.uk/environment/consumerprod/energylabels/energylabel.pdf [August 12, 2007]
Defra. (2006). *Environmental Key Performance Indicators - Reporting Guidelines for UK Business*. London. p.76.
Deshpande, Vijay M. (2001). Labelling Design Effort in India: Lessons Learned. In *The Regional Symposium on Energy Efficiency Standards and Labelling: Lessons Learned in Asia*. 29-31 May, 2001. Bangkok, Thailand.
DG Environment. (2000). *Study on different types of Environmental Labelling (ISO Type II andIII Labels): Proposal for an Environmental Labelling Strategy*. Oxford. p.108.
Dibb, Sue. (2006). *Greening supermarkets, how supermarkets can hwlp make greener shopping easier*. London. p.38.
Do we need carbon labels on food? (2007). [Online]. Available: 2http://www.fwi.co.uk/Articles/Article.aspx?liArticleID=104127&PrinterFriendly=true [June 19, 2007]
du Pont, Peter. (2001). Learning By Doing: The Wealth of Experience Implementing Standards and Labelling Programs in Asia. In *The Regional Symposium on Energy Efficiency Standards and Labelling: Lessons Learned in Asia*. 29-31 May, 2001. Bangkok, Thailand.
EEON. (2003). *Greening the way Ontario Learns*. Toronto. p.24.
Egan, Christine. (2001). US Labelling Program Evaluation and Label Redesign Strategies. In *The Regional Symposium on Energy Efficiency Standards and Labelling: Lessons Learned in Asia*. 29-31 May, 2001. Bangkok, Thailand.

Egan, Christine, Payne, Christopher T. & Thorne, Jennifer. (2000). Interim Findings of an Evaluation of the U.S. Energyguide Label. In *ACEEE Summer Study on Energy Efficiency in Buildings*. June 2000.
Ekmark, Zahrah. (2007). *Draft Bases and Principles for Climate marking - Supporting documents to the hearing on 15 June 2007*. Uppsala. p.11.
EMSD Energy Efficiency Office. *Ideal Electrical Appliances with Energy Label*. Hong Kong. p.6.
Green Paper on Integrated Product Policy. (2001). [Online]. Available: http://eur-lex.europa.eu/LexUriServ/site/en/com/2001/com2001_0068en01.pdf [2007, May 27]
European Commission. (2007). *Eco-label Flower week 2006 - Special Eurobarometer*. p.15.
Fet, Annik Magerholm & Skaar, Christofer. (2006). Eco-labeling, Product Category Rules and Certification Procedures Based on ISO 14025 Requirements (6 pp). *International journal of life cycle assessment*. 11 (1):49-54.
Food Standards Agency. (2004). *Concept Testing of Alternative Labelling of Healthy / Less Healthy Foods*. p.70.
FSA. (2004). *Concept Testing of Alternative Labelling of Healthy / Less Healthy Foods*. p.70.
FSA. (2006a). *Food Labelling Requirements - Qualitative Research*. p.87.
Food Standards Agency website. (2007). [Online]. Available: http://www.eatwell.gov.uk/foodlabels/trafficlights/ [September 10, 2007]
Signpost labelling research - Main findings. (2006b). [Online]. Available: http://www.food.gov.uk/foodlabelling/signposting/siognpostlabelresearch/ [August 15, 2007]
Gabriel, Yannis & Lang, Tim. (1995). *The Unmanageable Consumer - Contemporary Consumption and its Fragmentations*. Cambridge: SAGE Publications.
Guidebook. (2007). [Online]. Available: http://www.gednet.org/?page_id=14 [October 12, 2007]
GEN. (2004). *Information Paper: Introduction to Ecolabelling*. p.17.
Ecological Footprint: Overview. (2006). [Online]. Available: http://www.footprintnetwork.org/gfn_sub.php?content=footprint_overview [October 10, 2007]
Goodall, Chris, (2007). 'Expert View: Five years of work - one lable on a packet of crisps'. *The Independent*. London.
Harris, Jane & Cole, Anne. (2003). The Role for Government in Ecolabelling - On the Scenes or Behind the Scenes? . In *The Future of Ecolabelling in Australia*. Canberra, Australia.
Holdsworth, Maxine (2003). *Green choice: what choice? - Summary of NCC research into consumer attitudes to sustainable consumption*. London. p.20.
Hong Kong Energy Efficiency Office. (2007). *Ideal Electrical Appliances with Energy Label*. Hong Kong. p.6.
RFID subway pass? Sure, New York says. (2006). [Online]. Available: http://news.com.com/RFID+subway+pass+Sure,+New+York+says/2100-1039_3-6033364.html [September 9, 2007]
Visual presentation. (2006). [Online]. Available: http://www.infovis-wiki.net/index.php?title=Visual_Presentation [September 9, 2007]
IPP Working Group. (2006). *Integrated Product Policy - Making Product Information Work for the Environment*. p.30.
IPPC. (2007). *Climate Change 2007: Impacts, Adaptation and Vulnerability - Summary for Policymakers*. Geneva. p.23.
ISO. (2000). *ISO/TR 14025 Environmental labels and declarations - Type III environmental declarations*. Geneva. p.25.
ISO. (2006). *ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework*. Geneva. p.28.
Product Environmental Aspects Declaration - Canon imageRUNNER s iR3310. (2003). [Online]. Available: http://www.jemai.or.jp/english/ecoleaf/pub_label.cfm [September 9, 2007]
Keim, Daniel A., Mansmann, Florian, Schneidewind, Jörn & Ziegler, Hartmut. (2006). Challenges in Visual Data Analysis. In *Information Visualization (IV'06)*. London, England.
Lecouls, Henri. (1999). ISO 14043: Environmental Management - Life Cycle Assessment - Life Cycle Interpretation. *The International Journal of Life Cycle Assessment*. 4 (5):245.
Lucero, A. & Martens, J. (2006). Supporting the creation of Mood Boards: Industrial Design in Mixed Reality. *Horizontal Interactive Human-Computer Systems, 2006. TableTop 2006. First IEEE International Workshop on*:127-128.
Magnusson, Peter R., Matthing, Jonas & Kristenssen, Per. (2003). Managing User Involvement in Service Innovation. *Journal of Service Research*. 6 (2):111-124.
Maxwell, Joseph A. (2005). *Qualitative Research Design - An Interactive Approach*. Thousans Oaks: Sage Publications.
Merriam-Webster OnLine. (2006). [Online]. Available: http://www.m-w.com/ [July 27, 2007]
Speech by Rt Hon David Milliband MP to the annual meeting of the National Farmers Union. (2007). [Online]. Available: http://www.defra.gov.uk/corporate/ministers/speeches/david-miliband/dm070226.htm [July 20, 2007]
Récompenser des modes de vie plus écologiques. (2007). [Online]. Available: http://www.checkerspotmagazine.ca/fr/issues/spring07/carbon_trading.asp [August 21, 2007]
Récompenser des modes de vie plus écologiques. (2007). [Online]. Available: http://www.checkerspotmagazine.ca/fr/issues/spring07/carbon_trading.asp [August 21, 2007]

Carbon labelling may not be a smooth ride. (2007). [Online]. Available: http://www.theretailbulletin.com/?tag=18df51b97ccd68128e994804f3eccc87 [June 15, 2007]
About NFC. (2007). [Online]. Available: http://www.nfc-forum.org/aboutnfc/ [September 9, 2007]
Nissinen, A. et al. (2004). Development of benchmarking for the environmental impacts of different products, services and consumption patterns. In *Proceedings Sustainable Consumption: The Contribution of Research*. 10-12 February 2005. Oslo.
Nissinen, A. et al. (2005). Developing LCA-based benchmarks for sustainable consumption – for and with users. In *erScp - 10th European Roundtable on Sustainable Consumption and Production*. 5-6-7 October 1995. Antwerp, Belgium.
Nissinen, Ari et al. (2006). Developing benchmarks for consumer-oriented life cycle assessment-based environmental information on products, services and consumption patterns. *Journal of Cleaner Production*. 15 (6):538-550.
Norwegian Ministry of the Environment. (1995). Element for an International Work Programme on Sustainable Production and Consumption. In *Oslo Ministerial Roundtable Conference on Sustainable Production and Consumption*. 6-10 February, 1995. Oslo, Norway.
OECD. (1999). "Eco-Labelling for a Sustainable Future" In *Conclusions and Papers presented at The International Conference Green Goods V*. 26-28 Octobre 1998. Berlin.
OECD. (2001a). *Background Paper Experts Workshop on Information and Consumer Decision-Making for Sustainable Consumption*. Paris. p.26.
OECD. (2001b). *OECD Environmental Outlook*. p.328.
OECD. (2001c). *Report on the OECD workshop on information and consumer decision-making for sustainable consumption*. Paris. p.41.
OECD. (2002a). *Policies to Promote Sustainable Consumption: an Overview*. p.36.
OECD. (2002b). *Towards Sustainable Household Consumption? Trends and Policies in OECD Countries*. Paris. p.161.
OECD. (2003). *OECD Environmental Indicators: Development, Measurement and Use*. Paris. p.37.
Orsato, Renato J. (2006). Competitive Environmental Strategies: WHEN DOES IT PAY TO BE GREEN ? *California Management Review*. 48 (2):127-143.
Otto, Harald E., Karl, Muller G. & Kimura, Fumihiko. (2004). Efficient Information Visualization in LCA: Application and Practice. *Journal of Life Cycle Assessment*. 9 (1):2-12.
Papantonopoulos, Sotiris. (2004). How system designers think: a study of design thinking in human factors engineering. *Ergonomics*. 47 (14):1528-1548.
Piper, Lennart, Ryding, Sven-Olof & Henricson, Curt. (2003). *Continual improvement with ISO 14000*. Stockholm: SIMF miljö&kvalitet AB.
Reigeluth M., Charles. (1993). Principles of educational systems design. *International Journal of Education Research*. 19 (2):117-131.
Restivo, S. & Steinhauer, A. (2000). Toward a socio-visual theory of information and information technology. *Technology and Society, 2000. University as a Bridge from Technology to Society. IEEE International Symposium on*:169-175.
Rubik, Frieder & Frankl, Paolo. (2005). *The Future of Eco-labelling*. Sheffield: Greenleaf Publishing.
Saidur, R., Masjuki, H. H. & Mahlia, T. M. I. (2005). Labeling design effort for household refrigerator-freezers in Malaysia. *Energy Policy*. 33 (5):611-618.
Sammer, Katharina & Wüstenhagen, Rolf. (2006). The influence of eco-labelling on consumer behaviour - results of a discrete choice analysis for washing machines. *Business Strategy and the Environment*. 15 (3):185-199.
Schor, Juliet B. (1998). *The Overspent American*. New York: HarperPerennial.
Schuler, Douglas & Namioka, Aki. (1993). *Participatory design: Principles and practices*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.
SDC & NCC. (2006). *I will if you will - Towards sustainable consumption*. Cambridge. p.78.
Tesco, Carbon and the Consumer. (2007). [Online]. Available: http://www.tesco.com/climatechange/ [May 17, 2007]
SJ Environmental Calculator. (2005). [Online]. Available: https://www.sj.se/sj/jsp/polopoly.jsp?d=6783&l=en&l=en [September 9, 2007]
Summary of Conclusions - Stern Review: The Economics of Climate Change. (2006). [Online]. Available: http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm [September 9, 2007]
Stø, Eivind & Strandbakken, Pål, (2002). 'Advantages and limitations of eco labels as consumer and environmental political instruments. Report from the European DEEP project.' In: Hertwich, E. (ed). *Life-cycle Approaches to Sustainable Consumption Workshop Proceedings - Interim Report*: International Institute for Applied System Analysis (IIASA), 246-267.

Swedish Environmental Management Council. (2000). *Requirements for Environmental Product Declaration, EPD*. p.45.
Teisl, Mario F. & Roe, Brian. (2005). Evaluating the factors that impact the effectiveness of eco-labelling programmes. In: Krarup, S.andClifford, R.S. (eds). *Environment, Information and Consumer Behaviour*. Cornwall: Edward Elgar Publishing. 65-90.
Thøgersen, John. (2000). Psychological Determinants of Paying Attention to Eco-Labels in Purchase Decisions: Model Development and Multinational Validation. *Journal of Consumer Policy*. 23 (3):285-313.
Thøgersen, John. (2002). Promoting Green Consumer Behavior With Eco-labels. In: Dietz, T.andStern, C.P. (eds). *New Tools for Environmental Protection: Education, Information, and Voluntary Measures*. Washington: National Academy Press. 83-89.
Tibor, Tom & Feldman, Ira. (1996). *ISO 14000 A Guide to the New Environmental Management Standards* Burr Ridge: Irwin Professional Publishing.
Tufte, Edward. (1997). *Visual Explanations: Images and Quantities, Evidence and Narrative*. Cheshire: Graphics Press.
Tufte, Edward R. (1983). *The Visual Display of Quantitative Information* Cheshire: Graphics Press.
Turner, Kerry R., Pearce, David & Bateman, Ian. (1994). *Environmental Economics - An elementary introduction*. Harlow: Pearson Education Limited.
U.S. EERE. (2006). *Energy Savers - Tips on Saving Energy & Money at Home*. Washington. p.34.
Uduma, L. & Morrison, G. R. (2007). How do instructional designers use automated instructional design tool? *Computers in Human Behavior*. 23 (1):536-553.
Programme for the Further Implementation of Agenda 21 (1997). [Online]. Available: http://www.un.org/documents/ga/res/spec/aress19-2.htm
Energy: Lessons Learned in Asia: Regional Symposium on Energy Efficiency Standards and Labelling - Technical Cooperation. (2001). [Online]. Available: http://www.un.org/esa/sustdev/sdissues/energy/op/claspworkshop.htm [September 9, 2007]
Agenda 21: Chapter 40, Information for decision-making. (1992). [Online]. Available: http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter40.htm [May 19, 2007]
UNEP promotes concept of Life cycle economy - Press release 24 August 1999. (1999). [Online]. Available: http://www.grida.no/Newsroom.aspx?m=54&pressReleaseItemID=385 [October 15, 2007]
van Dijk, Geke, Minocha, Shailey & Laing, Angus. (2007). Consumers, channels and communication: Online and offline communication in service consumption. *Interacting with Computers*. 19 (1):7-20.
Vermeir, Iris & Verbeke, Wim. (2006). Sustainable Food Consumption: Exploring the Consumer ``Attitude -- Behavioral Intention" Gap. *Journal of Agricultural and Environmental Ethics*. 19 (2):169-194.
Wagner, Wolfgang, Kronberger, Nicole & Seifert, Franz. (2002). Collective symbolic coping with new technology: Knowledge, images and public discourse. *British Journal of Social Psychology* (41):323-343.
White, Rebecca, Boardman, Brenda & Bright, Sarah-Keay. (2007a). *Carbon labelling - Report on symposium*. London. p.7.
White, Rebecca, Boardman, Brenda & Bright, Sarah-Keay. (2007b). *Carbon labelling - Report on symposium Appendix*. London. p.44.
White, Rebecca, Boardman, Brenda & Thottathil, Sapna. (2007c). *Carbon labelling: evidence, issues and questions - Briefing Paper for the Tesco-ECI carbon labelling workshop*. p.21.
Wiel, Stephen & McMahon, James E. (2005). *A Standards & Labeling Guidebook for Appliances, Equipment, and Lighting (2nd Edition)*. Washington. p.257.
Wilkenfeld, G. (2003). Transition to the New Energy Label in Australia: Early Results. *APEC ESIS Library,*:10.
Wilson, Chauncey. (2007). Taking usability practitioners to task. *Interactions*. 14 (1):48-49.
Wood, Larry E. (1997). Semi-Structured Interviewing for User-Centered Design. *Interactions*. 4 (2):48-61.

Appendix A: List of Interviewees

Professionals

Professional 1, PhD Candidate, Sustainable Consumers and Product Design Sector, Anonymous

Professional 2, Consumers Association Organisation, Anonymous

Professional 3, Information Visualization Sector, Anonymous

Professional 4, Sustainable consumption Sector, Anonymous

Professional 5, Freelance graphic designer, Anonymous

Individual Consumers

Consumer 1, Librarian, Anonymous

Consumer 2, Librarian, Anonymous

Consumer 3, Catering sector, Anonymous

Consumer 4, Municipal public services, Anonymous

Appendix B: Interview template

Interview template: individual consumers

Questions & scenario

1) You want to buy a mobile phone, you enter in a shop and you see two models that you like. You want to consider environmental impacts of products in your purchase decision. According to the available information, which mobile phone has the lowest environmental impact? Can you explain your reasoning?

2) You are interested to know more about environmental impacts of mobile phones. There is one model of mobile phone that you especially interested in and you decide to compare different environmental information on the same model of mobile phone. Which eco-label presents the easiest information for you to understand? Can you explain why?

3) If you look at the bottom part of the eco-label where is displayed the legend or the benchmarks, what does each of these legend or benchmarks represent for you? (What does it mean)

4) If you look at the three denominations (the name, or term) presented here, what does each of these denominations represent for you? (What does it mean)

a) If you look at the three eco-labels with the previous denominations, which one helps you the most to understand the eco-label? Can you explain why?

b) Which from the three eco-labels presented here is trustworthy for you? Can you explain why?

5) You are still shopping for a mobile phone. You hesitate between three models. The model A has a marking of 98, the model B has a marking of 105 and the model C has a marking of 120. Do you think the environmental information displayed here will influence you to buy the mobile phone with the lowest environmental impact? Can you explain why?

6) If I tell you that you that every thing you buy has a marking of points. Each year you have a total of 50 000 points that you can use. If you overpass this amount of points, you have to pay US$ 1 per extra point (65 ISK). Knowing this, do you think the environmental information displayed here will influence you to buy the mobile phone with the lowest environmental impact? Can you explain you reasoning?

7) In general, do you think that the environmental information displayed on those eco-labels is important of you? Can you explain why?

8) You are an informed consumer and you are concerned about environmental issues related to consumption. Do you feel that this kind of environmental information helps you to make more environmental-friendly choices?

9) Can you find one positive and one negative characteristic for each of the three eco-labels? Please, write or draw it down on the paper. Can you explain why?

10) Can you describe what would be for you the perfect eco-label? Please, write or draw it down on the paper.

11) I will show you different eco-labels. I want you to tell me what do you see first, what catches you eye first, without thinking. You must answer quickly.

12) According to you, what would be important to consider in the development of such a system (eco-labels)?

13) Do you have any comments or suggestions to improve the system (eco-labels)?

Interview template: professionals

The Eco-rating project:

Consists of the development of a system intended for individual consumers, which display on the purchase moment accessible and comprehensible information about the level of environmental impacts of products and services. The Eco-rating project can be divided in two broad sections: the **Representation** (container) and the **Analysis** (content). The focus of this research is put on the **Representation** section, which analyses how the information could be *visually and conceptually* presented to the users: consumers. The Analysis, which constitutes of the technical side (tools to calculate the impact, choice of environmental indicators…etc), is not considered in this project. This is an experimental project aiming at the exploration of visual representation of environmental information intended for individual consumers.

Goals of the visual representation:

- Allow to **evaluate and compare** the environmental impact of products and services in order to make enlighten choices
- Be **comprehensible**
- Be **accessible** during the consumption act
- Ultimately **raise consumers' awareness** of environmental impact of products and services

Characteristics:

- Assumption that this kind label would used aggregated data, so only one environmental indicator would be communicated to users.
- Assumption that this label would be mandatory in the future. This would imply that almost all products and services would be labeled.

Concept design:

- System that indicates the level of impact of products and services: **numbers** that represent the level of impact
- System that allows comparison across various types of products and services: **benchmarks**
- Inspired by the **monetary system: (**numbers and value unit) universal, generic and simple

Stage of the study:

- The benchmark system has been tested on four users and up to now it has shown to be a comprehensible way to communicate environmental information on products and services to individual consumers.
- This current study is at a later stage in the design process.
- The three propositions (labels) presented in this interview are based on the benchmark system. The three propositions can still be modified and improve. One those labels will be chosen as a final proposition.

Questions:

I am interested to have your views in general on the concept of the label and more precisely on the different propositions.

1) Would this kind of label (in general) raise consumers' awareness towards environmental impacts of products and services?

2) Would you describe this kind of label (in general) as: informative (convey knowledge), educative (train, develop to feel and act in a certain way) or both? Can you explain your reasoning?

2) Is this kind of visual representation comprehensible for consumers? Can you explain your reasoning?

3) What do you think is effective in those labels, and what is not? Can you explain why?

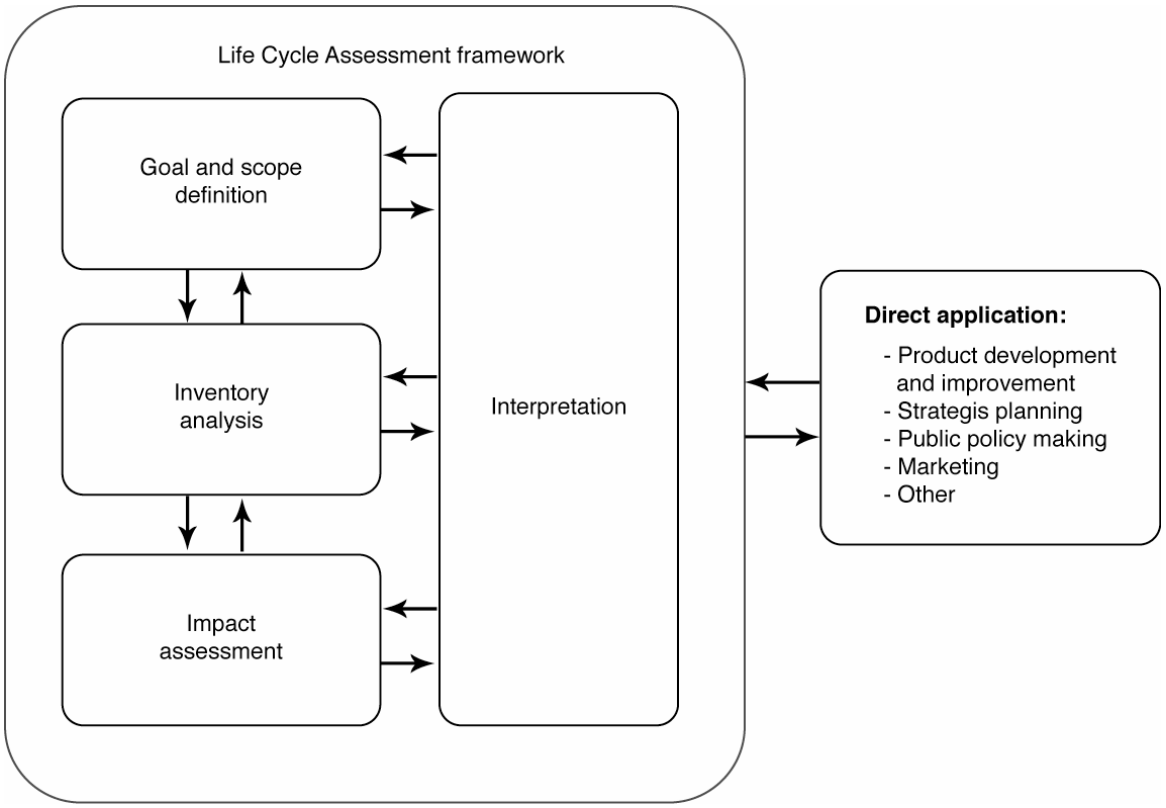
a) Is in general the benchmark system comprehensible? Are individual benchmarks comprehensible? If not, do you have any suggestions?
b) Which denomination between Environmental Cost and Environmental Impact do you consider the most appropriate. Do you have any suggestions?
c) Is the use of colors adequate and useful? Can you explain?
d) Is the information in the label positioned in an adequate manner?

4) Would a label like this help consumers to consider environmental impacts in their purchase decision?

5) After having looked at the benchmarks in the different propositions, you see two products with a small label (see labels J and K, board 4) because there is no space on the product to put the entire label. Would you understand the label? Can you explain?

NB: The numbers used in the benchmark and to illustrate the environmental impact in the various propositions are fictional. In this current research, the idea is not to give a precise number, but rather to give an idea about the level of impact related to the numbers. However, to keep the benchmarks realistic and credible, the numbers have been based on CO_2 emissions.

Appendix C: LCA stages



Source: ISO 14043: Environmental Management - Life Cycle Assessment - Life Cycle Interpretation (Lecouls, 1999)

Appendix D: Example of graphical representation of an EPD

Chair I						
Product category	Seating					
Seating maintained for 15 years						
Number of seats	1					
Period [year]	15					
Disposal scenario	Scenario II					
Product lifetime	15 years					
Product composition						
Description	**Material/ process**	**Amount**	**Material Specif- ication**	**# of parts**	**Waste [%]**	**Total**
Frame						
Chair legs	Steel I	1.4	Steel		1	1.414 kg
Backrest	Aluminium	0.6	Aluminium		1	0.506 kg
Seat						
Upholstery	Textile, wool	0.65	Textiles		8	0.702 kg
Nails	Steel II	0.029	Steel		2	0.03 kg
Production	Prod	3.5				3.5 hrs

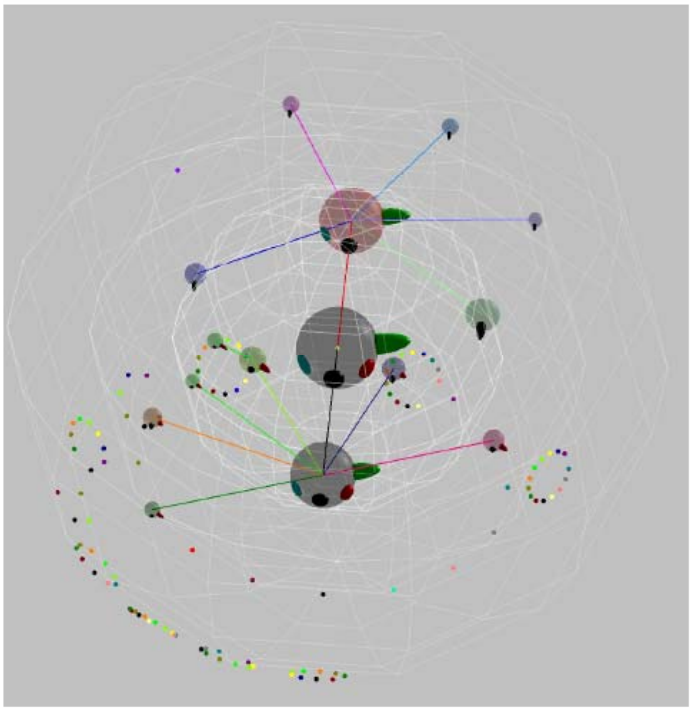
Fig. 2: Creating a furniture model

Table 1: Comparison of two products

	Chair 1	Chair 2
Ozone depletion potential (ODP)	5.64E-05	3.78E-05
Eutrophication potential (EP)	0.21	0.32
Global warming potential (GWP100)	384.87	445.81
Acidification potential (AP)	1.29	2.00
Photochem. Ozone Creation Potential (POCP)	0.25	0.24
Heavy metals (EI95)	0.16	0.16

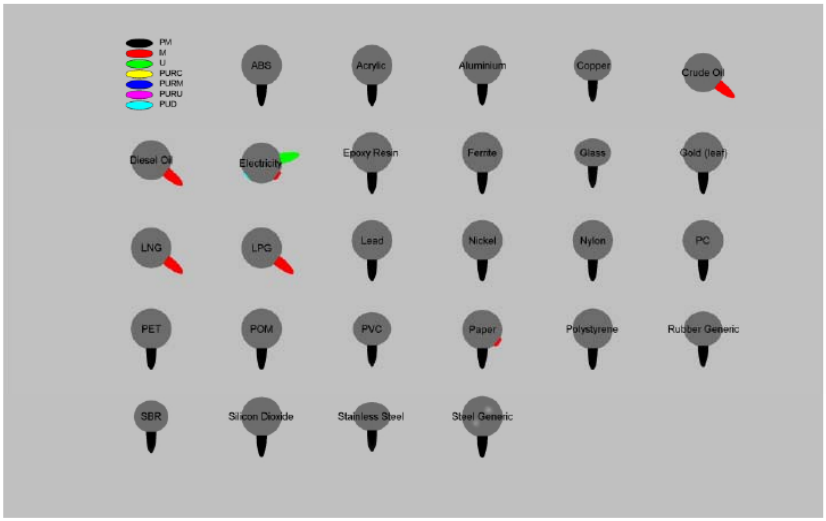
Source: Eco-labeling, Product Category Rules and Certification Procedures Based on ISO 14025 Requirements (Fet and Skaar, 2006)

Appendix E: 3D visualization of LCA data



Spherical glyph cluster for carbon dioxide emissions

Source: Efficient Information Visualization in LCA: Application and Practice (Otto et al., 2004)



Glyph matrix as related to inventory items and life cycle phases

Source: Efficient Information Visualization in LCA: Application and Practice (Ibid)

Appendix F: Novel proposition of visual representation of EPDs

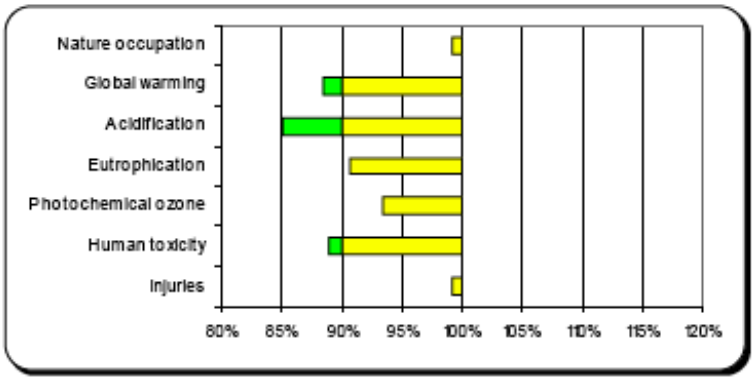


Figure 1. Impacts from Product A relative to the impacts of spending the same amount of money on an average product of this product group.

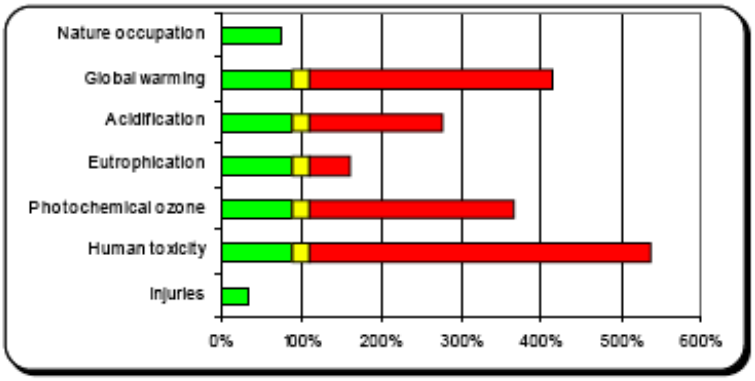


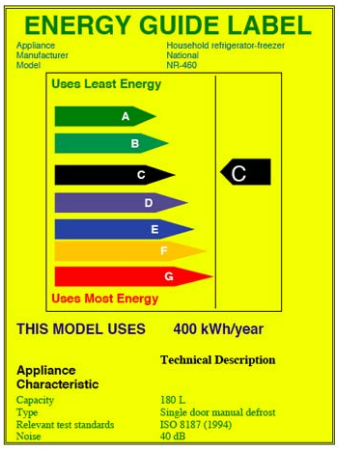
Figure 2. Impacts from Product A (same product as in Figure 1) relative to the impacts of spending the same amount of money on "average consumer goods".

Legend for Figure 1 and 2
Green: 10% lower than the reference
Yellow: Close to the reference
Red: 10% higher than the reference

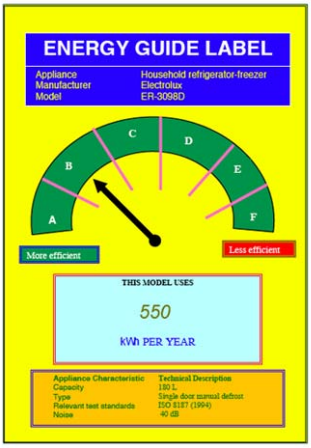
Source: Consumer demands on Type III environmental declarations (Christiansen et al., 2006)

Appendix G: Samples of designs - Malaysian energy-efficiency label

Labelling type A (star labelling)



Labelling type B (letter bin labelling)



Labelling type C (speedometer)

Source: Labeling design effort for household refrigerator-freezers in Malaysia (Saidur et al., 2005)

Appendix H: Sample of early potential nutritional labels

Option A: Simple Traffic Light

Option B: Extended Traffic Light

Option C: Heathy Logo

Option D: Key Nutrients

Option E: GDA Key Nutrients (traffic light version)

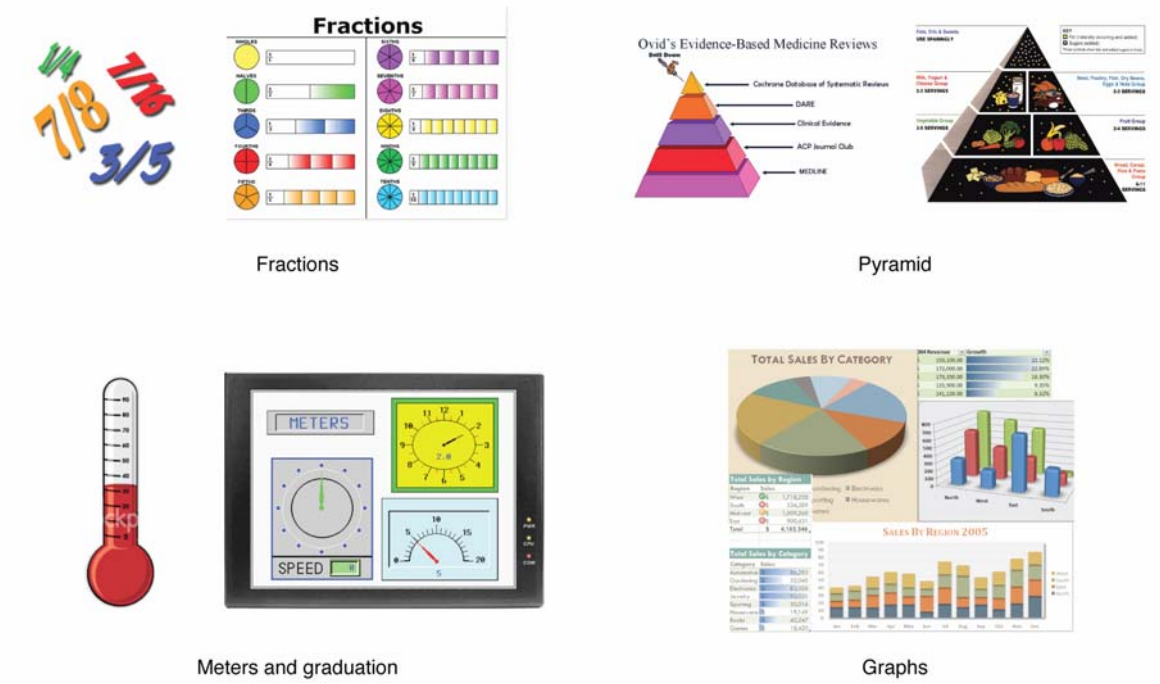
Option E: GDA Key Nutrients (monochrome version)

Source: (FSA, 2004, ; FSA, 2006b)

Appendix I: Example of sample boards

Eco-label Type I

Visual representation of comparison



Fractions

Pyramid

Meters and graduation

Graphs

Appendix J: Survey template

Visual representation survey

1. Abstract

This survey is part of a research about the development of a system intended for individual consumers, which displays comprehensible environmental information about products and services. The goal of this survey is to sound out the consumers' attitude towards visual representations of environmental impacts of products and services. This survey is made for educational purposes only. The identity of participants will remains confidential.

This survey has been prepared by Camille Ouellette.
If you have questions or comments, please contact me via this e-mail address:
camilleouellette@yahoo.ca

2. Demographic information

1. Please, fill in this form

Name	
Nationality	
Gender	
Age	
Occupation	
E-mail	

3. Beginning of the survey

			
A) ipod	B) Bicycle	C) Washing machine	D) Transatlantic flight

1. Between the products and services presented above, which one do you think creates the highest impact on the environment? Place in order from 1: lowest impact to 4: highest impact.

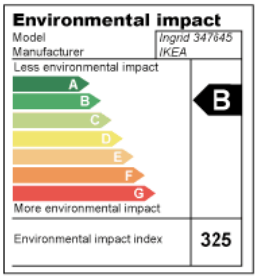
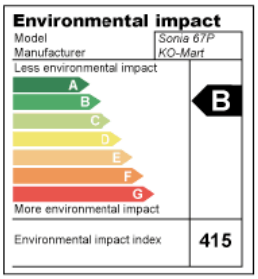
	Product or service
1 Lowest impact	
2	
3	
4 Highest impact	

Page 1

Visual representation survey

6.

You are shopping for a new sofa. You hesitate between two similar models in two different stores. Before you buy, you would like to compare the environmental impacts of the two models and choose the one with the lowest environmental impacts.

	Sofa Ingrid 347645 IKEA	Sofa Sonia 67P KO-Mart
		
Eco-label 1		
Eco-label 2		

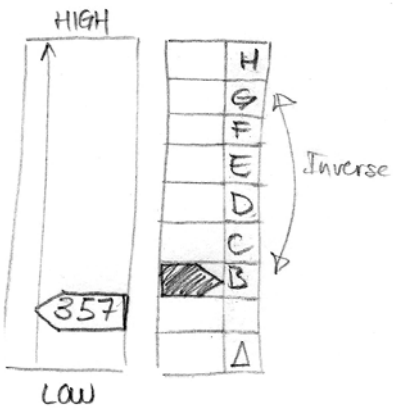
1. Which eco-label helps you the most to make your decision?

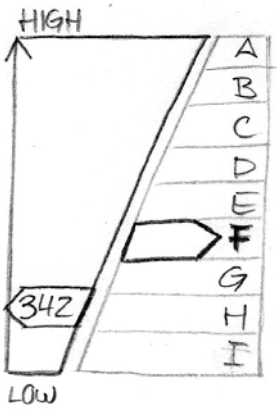
- ◯ Eco-label 1
- ◯ Eco-label 2

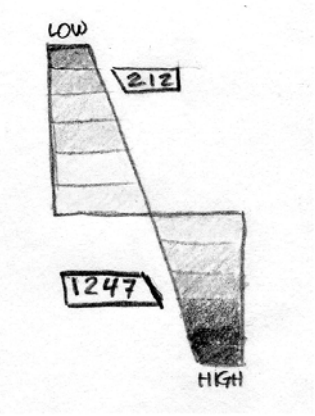
2. Can you explain why? (e.g. color, shape, symbol, text...etc.)

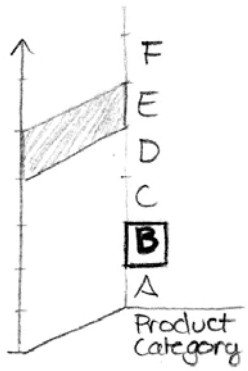
Page 3

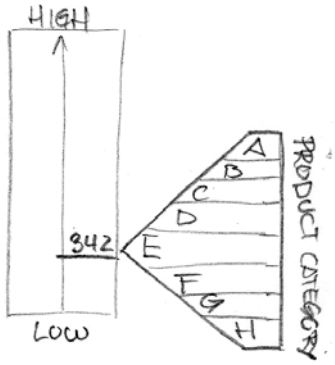
Appendix K: Sample of sketches - first iteration

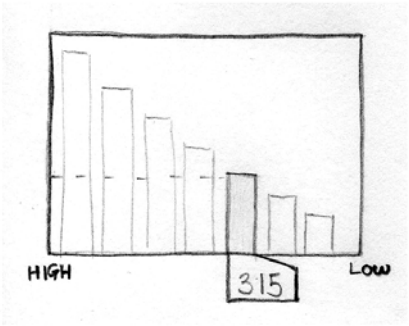


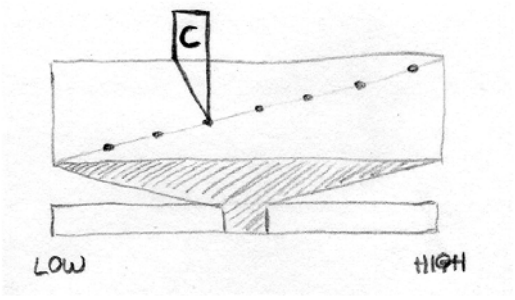


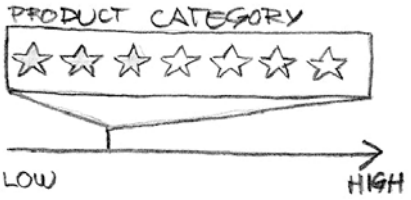


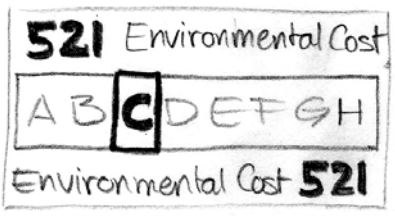


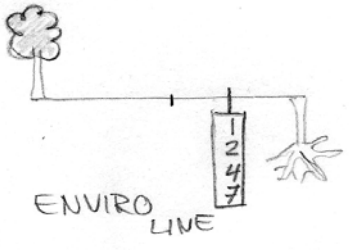




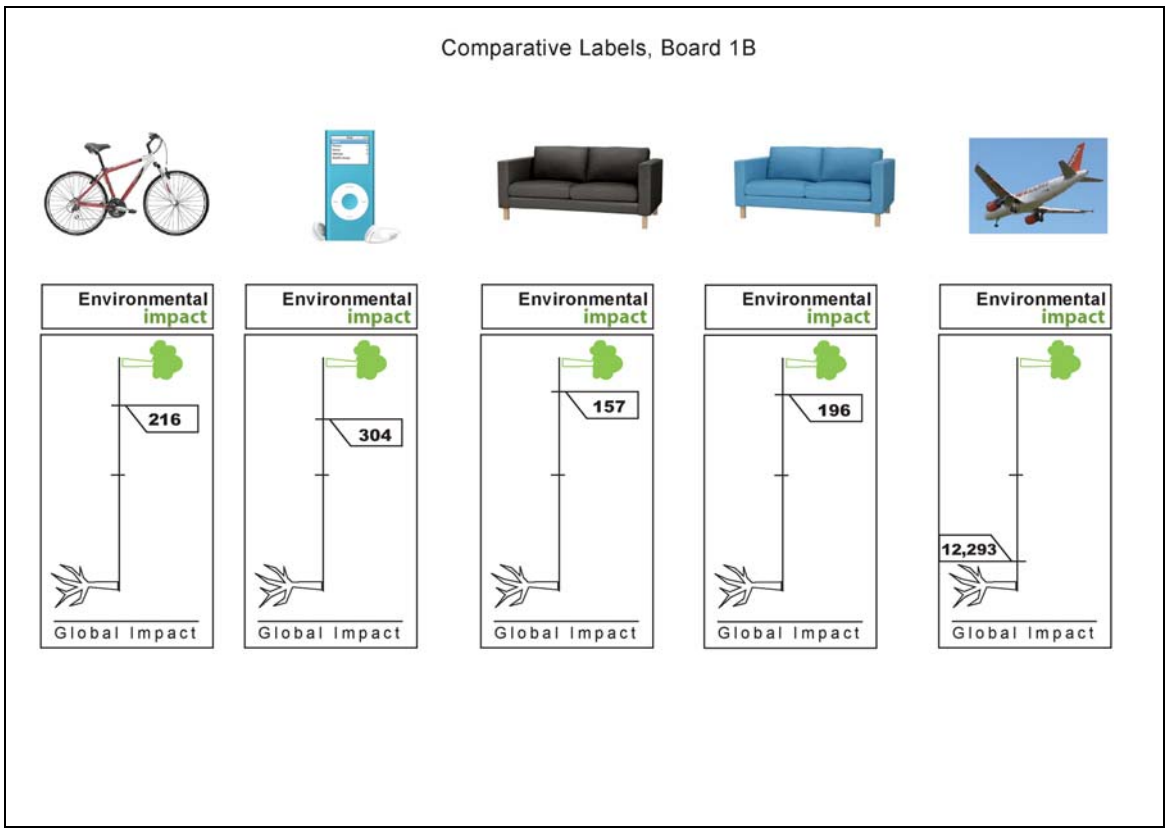


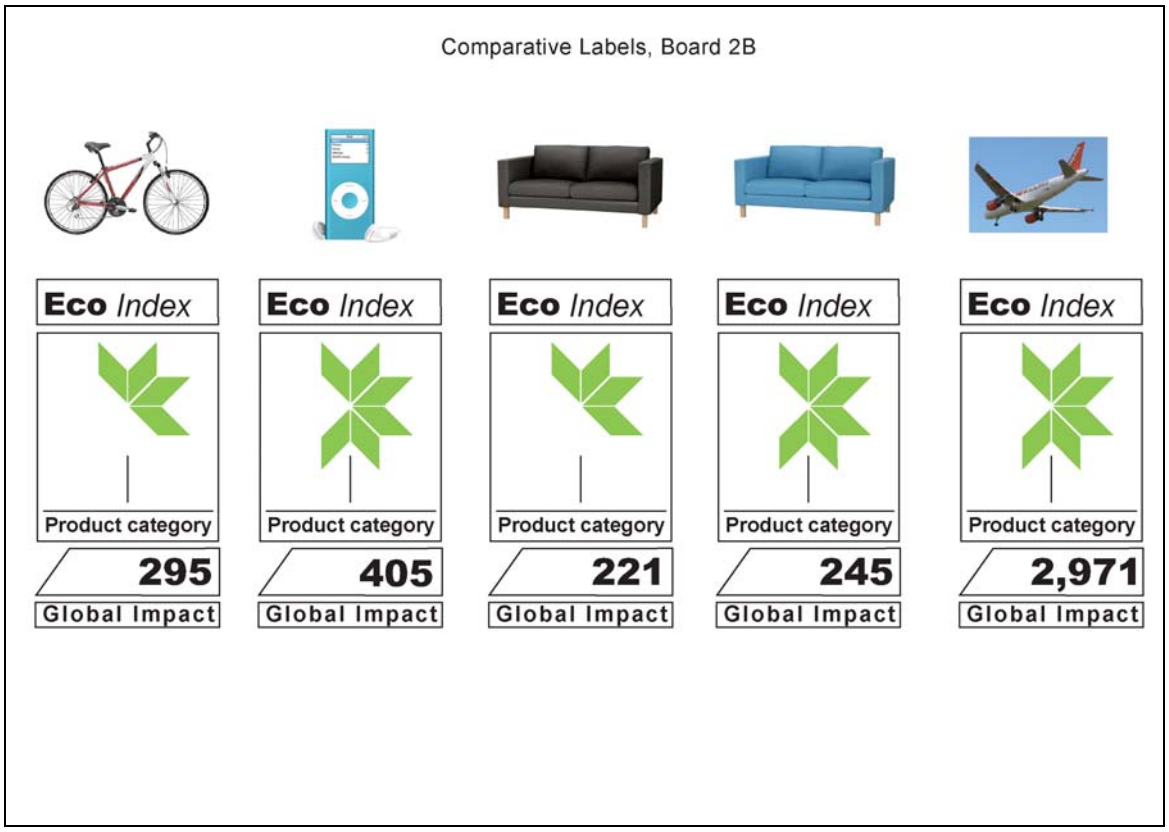




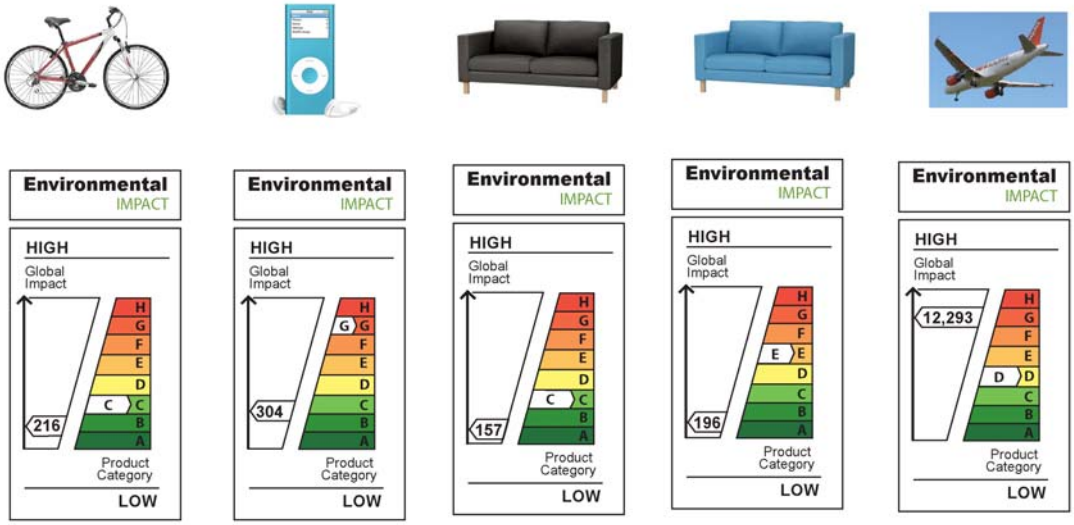


Appendix L: Three concepts - first iteration

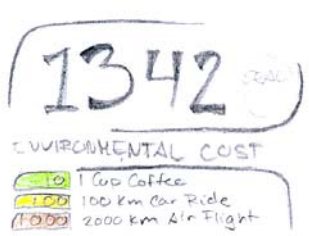


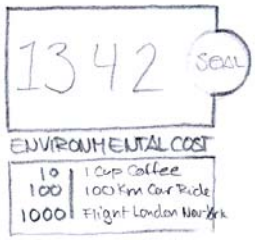


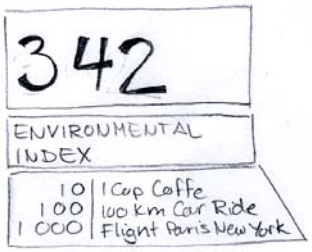
Comparative Labels, Board 3B

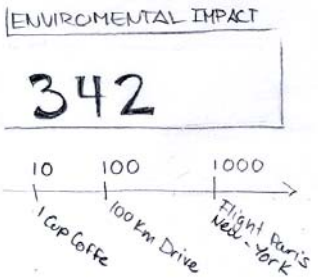


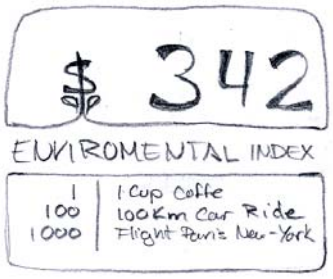
Appendix M: Sample of sketches, second iteration

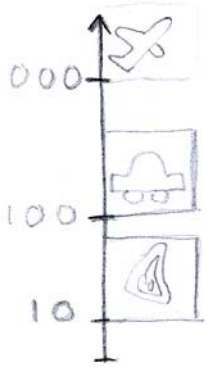


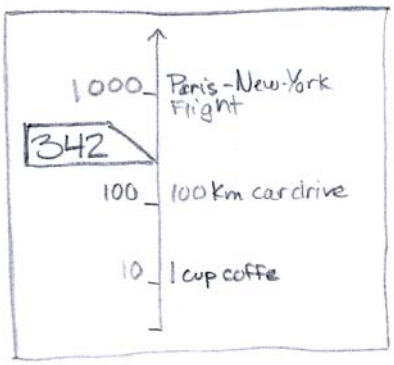


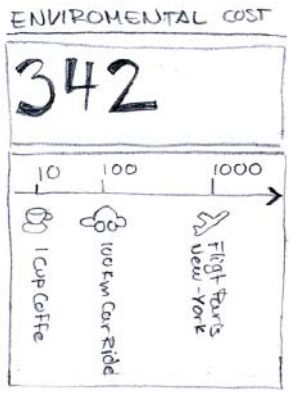




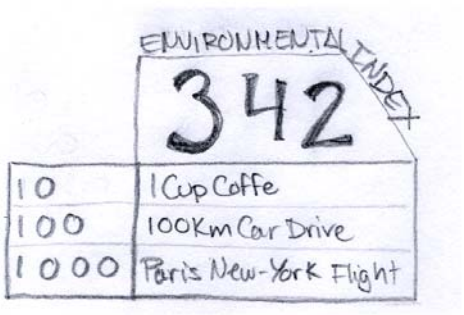








342	ENVIROMENTAL INDEX
10	1 cup coffe
100	100 km car drive
1000	Paris-New-York Flight



Appendix N: Three concepts – third iteration

Board 1

98
Environmental Cost

10	Boil 1 cup water
100	100 Km car ride
1000	2500 Km air flight

A

105
Environmental Cost

10	Boil 1 cup water
100	100 Km car ride
1000	2500 Km air flight

B

120
Environmental Cost

10	Boil 1 cup water
100	100 Km car ride
1000	2500 Km air flight

C

Board 2

D

EU Certified
9811
Environmental Impact

10	Boil 1 cup water
100	100 Km car ride
1000	Flight London-Moscow

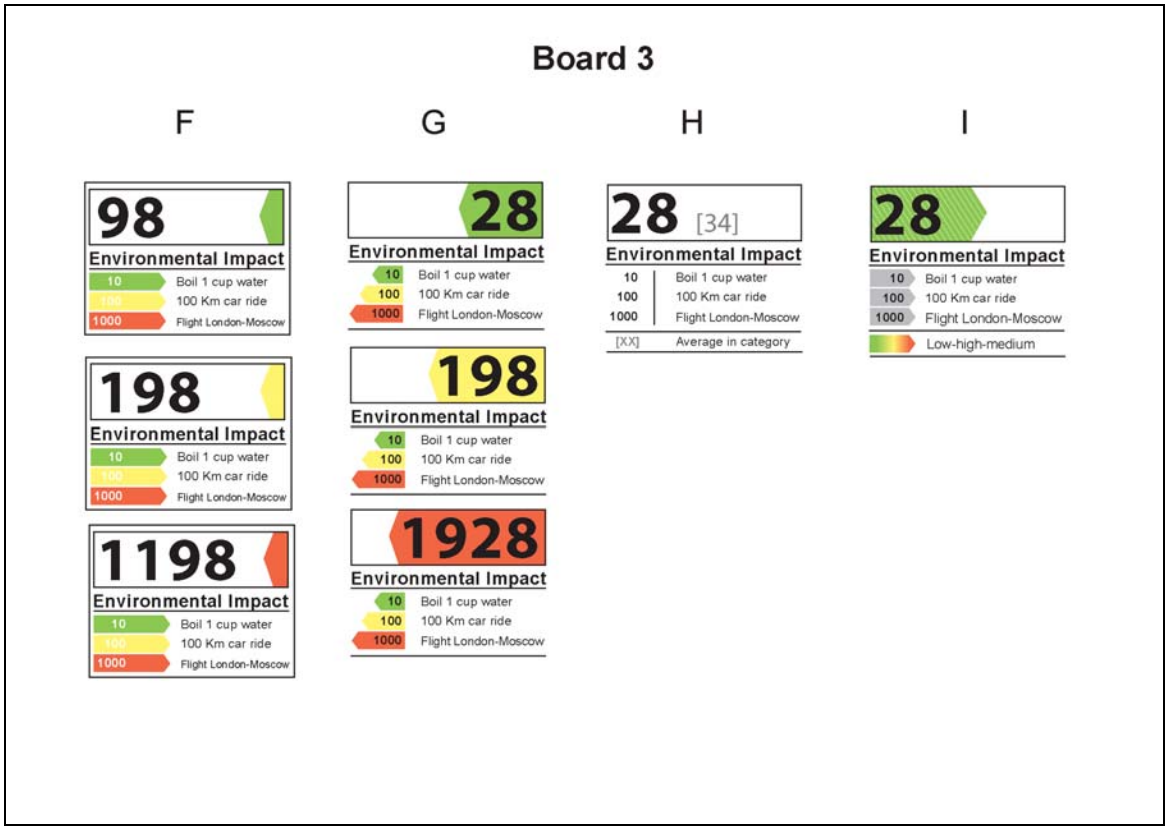
E

EU Certified
9811
Environmental Impact

10	Boil 1 cup water
100	100 Km car ride
1000	Flight London-Moscow

E (1)

EU Certified
9811
Environmental Impact


Board 3
F
G
H
I
98
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
198
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
1198
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
28
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
198
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
1928
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
28 [34]
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
[XX] Average in category
28
Environmental Impact
10 Boil 1 cup water
100 100 Km car ride
1000 Flight London-Moscow
Low-high-medium

Appendix O: Samples of graphical branding