

The impact of Type I eco-labelling schemes to improve the environmental performance of products

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Summary

As with every environmental policy instrument it is applied to achieve certain objectives. The key objective of Type 1 eco-labelling schemes is to realise environmental gains related to products. Unfortunately the evidence available of the performance of many environmental policy instruments is very incomplete; type 1 eco-labelling schemes are not an exception. This deliverable is part of a research-project where we focus on the impact of type I eco-labelling schemes to improve products environmental performance. Two directions have been hailed as means to achieve this; when manufacturers possible reformulate own products when adopting eco-label criteria; and when already eco-labelled products are given revised (more stringent) criteria that must be lived up to. The main focus of this research will be to assess the impact of the aforementioned strategies on products in a time perspective (since revisions of criteria occur typically every third year). Have these strategies of type I eco-labelling schemes proven to be functional, i.e. have they had any impact? Secondly, have the eco-labelling schemes impacted the products in a way that improves the overall environmental performance? I.e. assure that environmental performance has not been sub-optimized etc.

The impact that the eco-label criteria of type 1 eco-labelling schemes have had to improve products environmental performance could not be given a generalized answer considering the great number of product groups for which eco-label criteria has been developed. To get a manageable research project, but still able to say something about the impact of type 1 eco-labelling schemes more generically, we chose to include two product groups (paper products, laundry detergents), for which three different Type 1 eco-labelling schemes (EU eco-label, Good environmental choice, Nordic Swan) have developed eco-label criteria. Each product group has been subject for a case study. The purpose for each case study has been to identify the impacts that type one eco-labelling schemes has had on the environmental performance of the product groups. In this deliverable we present one of these case studies, laundry detergents.

Case study - laundry detergents

This case study has been conducted to provide the data needed in the synthesis where the findings of this case study will feed into the final synthesis of this research. Its purpose has more specifically been to identify the impact of the strategies in which type I eco-labelling schemes could improve products environmental performance. All empirical material used has been derived through interviews. No data was readily available so interviews with companies having eco-labelled products as been our only source of information. This study includes answers given by six companies distributed among the included eco-labelling schemes (EU eco-label, Good environmental choice, Nordic Swan), on how eco-label criteria have impacted their products, both when joining the eco-labelling scheme and when given more stringent criteria through revisions.

We have seen that type I eco-labelling schemes have had a direct impact on the ingredients used in the product formulation and to a lesser extent its packaging. Noticeable are that nearly all companies when joining an eco-labelling schemes has taken two similar actions; substituting the surfactant LAS and that they removed optical brighteners. This reflects that there are great similarities how each eco-labelling scheme during the years have defined environmentally friendlier laundry detergents in its criteria. Our result support the claim made by other studies that there are a direct impact between eco-labelling criteria and reduction of certain chemicals. We have also identified uncertainties that could underestimate the direct impacts if the criteria. For example, the interviewees might not remember every impact that the criteria has had, especially those that where made a long time ago. There are manufacturing companies not part of our study, still having eco-labelled products which could have stated alternative actions taken. Our intention is not either to

claim that we provide the complete picture of the impacts; rather this should be seen as examples that will add to the understanding of type I eco-labelling schemes potential to impact products and in particular, laundry detergents.

The result also point out criteria categories that have not had any direct impact at all on powder-based laundry detergents. Many obvious reasons for this exist. For example, limit the quantity of ingredients in relation to a wash. As it appears, this would rather be required to send out a signal to consumers that eco-labelled products should be compacts rather than pursuing an objective to achieve a direct impact, e.g. altering their laundry detergents.

The strategy of continual improvements by revising criteria seems not to have had that much of an impact. The most impacts have been associated with alterations in the perfumes. In the light that many companies have been part of several revisions scattered over longer period of time (depending on the eco-labelling schemes in which they are associated with) this strategy seem not to have proven that functional within this product group. Our impression is that revisions of criteria (for those companies being part of an eco-labelling scheme for longer period of time) become a way of ensuring that a product fulfils old requirements rather than continually introduce new relevant. In this light, the eco-label function becomes more like safety net ensuring that a manufacturer does not alter their laundry detergent in the “wrong” direction. Considering methodological constraints (optimisation problem etc.), the fact that product must maintain its function, and, be able to impose criteria that improves the environmental performance of the products, the objective to support continual improvements seem not easy achievable.

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1 Introduction

The array of policy instruments to protect the environment has since the early 1970s evolved from direct so-called “command and control” regulations to a complex mix including, in particular, an increasing use of economic instruments such as charges, taxes and tradable permits. The list of instruments has also expanded to so-called voluntary approaches (VAs) (ten Brink 2002).

One such voluntary approach is eco-labelling which entered mainstream environmental policy-making in 1977, when the German government established the Blue Angel programme. Since then, eco-labelling has become one of the more high-profile market-based tools for achieving environmental objectives (UNEP 2005). Among the types of eco-labels that International Organisation for Standardization (ISO), Type 1 eco-labels in particular have gained an increasing interest among policy-makers.

Type I eco-labels, compare products with others in the same product category, awarding labels to those that are environmentally preferable throughout their life cycle. The criteria are set by an independent body, and are monitored through a certification or auditing process. This helps ensure that the consumer receives credible third-party information of the environmental performance of products (UNEP 2005).

1.1 Environment benefits associated with type I eco-labelling schemes

The ultimate objective of Type I eco-labels are to reduce environmentally relevant flows such as air emissions, chemicals consider to be harmful etc related to products. To achieve this, eco-labellers construct criteria with life cycle considerations typically based on the environmental performance of the top 30% of companies operating on the market for a specific product group. Ideally, the companies with the best environmental performance join an eco-labelling scheme because they see a competing advantage of marketing their products as environmentally friendlier than its competitors. If there simultaneously exists; a) an interest among consumers to act on their environmental concern; and, b) them recognizing and trusting the information of the eco-label a reduction of environmentally relevant flows (impacts) could occur when the market share of eco-labelled products increase (through market mechanism of demand and supply) relative to more environmentally harmful competitors. This presuppose that the total quantity of demand for a given product (both eco-labelled and standard) remains unchanged (i.e. the rebound effect is minimal).

There is also a possibility that eco-label criteria could function as a way for improving products environmental performance directly. Firstly, this has the potential to occur in a situation where the market share of “green” products grows. This could create pressure for other manufacturers (in theory being part of the remaining 70% of the companies) to reformulate their own products or processes such that they adopt the eco-label criteria (Harrison 1999). Secondly, eco-labels could be used to improve products environmental performance by continual revision of the eco-label criteria with stricter criteria over time. If a company wishes to maintain its competitive advantage new criteria enhancing their products environmental performance would need to be continually revised (Harrison 1999). Revisions are the strategy of type 1 eco-labelling schemes to: a) account for technical progress within the product group that could alter the environmental performance of the

product; and, b) tighten the criteria to gradually reduce the environmental impact of products. Various type I eco-labelling schemes have stated objectives linked to improve environmental performance through revisions. For example, Nordic Swan states that; “*approximately every third year the criteria are reviewed and the Swan-labelled products are given a new and more stringent standard that must be lived up to. In this way we support continual improvement of environmental performance*” (Nordic eco-labelling 2009). Another example is Good environmental choice (Sweden) stating that “*requirements are sharpened on a regular basis and in that way labelled products must continually develop towards reducing environmental impact*” (Swedish Society for Nature Conservation, 2009).

It is also suggested that eco-labels could have the potential to be indirectly beneficial for the environment (see ÅF-IPK 2000; AEAT in Confidence 2004). Indirect environmental effects are more diffuse and defined as environmental effects that occur when non-eco-labelled products change as a result of the requirements set by eco-labellers. An indirect effect could be to transfer knowledge from eco-labels to other actors. This could occur when purchasers in organizations use requirements (complete set of criteria or a single criterion), as guidelines for purchasing more environmentally preferable goods. Another suggested indirect effect of eco-labelling schemes could be that eco-labels contribute to set a general focus on the environment. This could affect consumers, purchasers or producers to take actions for the environment that is not promoted by the eco-labels (Nordisk Miljömärkning, 2000).

1.2 Assessment of environmental benefits

As with every policy instrument it is applied to achieve certain objectives. In the case of eco-labels its key objective is to realise environmental gains related to products. Unfortunately the evidence available of the performance of many policy instruments is very incomplete; type 1 eco-labels are not an exception. Consumer awareness, consumer trust, changes in consumer behaviour, and changes in manufactures behaviour is proposed by US EPA (1994) as indicators that relate to the realisation of environmental gains of eco-labels. Rubik & Frankl (2005) comment on these indicators saying that it is “*striking that many resources have been used to document results relating to the first four indicators an less to follow up on the last important question, the realisation of environmental gains*”.

What is referred to as environmental gains could differ. Type I eco-labels (Nordic Swan etc.) define their direct environmental gains as reduction of environmentally flows (air emissions, harmful chemicals etc.) considered being relevant for improving the environmental performance of a product. Environmental gains could also be a more complex matter. It could comprise to derive a reduction of an environmentally relevant flow (i.e. air emissions) realised through eco-labelling to its actual impacts in environmental quality (extinction of species, climate disasters etc.).

As described in *section 1.1*, eco-labels could realise direct environmental gains in three different ways which could be divided accordingly. First, when the market share of eco-labelled products increases (through market mechanism of demand and supply) relative to more environmentally harmful competitors. Studies have also been undertaken to evaluate such impacts posing research questions like; what are the reductions in emissions to air and water if the market share of certain eco-labelled products would increase compared to market average products? (see: ÅF-IPK 2000; AEAT in Confidence 2004). These studies are typically produced in the form of case studies directly by (or in cooperation with) the relevant labelling organization. Although studies link direct and indirect environmental gains of eco-labels, the result is mainly based on assumptions and extrapolations, which therefore limit the external validity of the findings (UNEP 2005).

There is also a possibility that eco-label criteria could realise environmental gains through improvement of products environmental performance directly. First, environmental gains of eco-labels (criteria) could be related to manufacturers when they reformulate their own products or processes such that they adopt the eco-label criteria. Second, environmental gains could also relate to the impact of continual revision of the eco-label criteria with stricter criteria over time. UNCTAD (1994a) concluded that there is not a clear idea of how many producers have actually changed production processes to meet eco-labelling criteria. It would however be possible to use life-cycle analysis and other assessment methodologies to at least establish quantifiable data reflecting the marginal environmental improvement associated with compliance with certain types of eco-labels (e.g. reduced emissions). OECD (1997) suggest that such an analysis would demand either a very costly data collection exercise or create difficulties because access to proprietary market data is typically closely guarded by manufacturers.

2 Scope of the research

Assessing the impacts of type 1 eco-label is clearly a complex matter which would not be manageable within any single research project. Although there are difficulties in obtaining data, there is evidently a need for independent assessments of the impact of Type I eco-labelling schemes. This research will focus on the impact of type I eco-labelling schemes to improve products environmental performance. Two directions have been hailed as means to achieve this;

- a) when manufacturers possible reformulate own products when adopting eco-label criteria; and
- b) when already eco-labelled products are given revised (more stringent) criteria that must be lived up to.

First and foremost, the main focus of this research will be to assess the impact of the aforementioned strategies on products in a time perspective (since revisions of criteria occur typically every third year). Have these strategies of type I eco-labelling schemes proven to be functional, i.e. have they had any impact? Secondly, have the eco-labelling schemes impacted the products in a way that improves the overall environmental performance? I.e. assure that environmental performance has not been sub-optimized etc. From there we will seek to make some generalisations regarding the impact of type eco-labelling schemes to improve the environmental performance of products.

2.1 Limitations

- We are only considering direct impacts of eco-label criteria meaning that the products must have undergone changes that could be directly linked to the requirements in criteria.
- No attempts will be made to quantify possible impacts in detail or map out the effect that impacts could have in the environment. Instead we are going to identify impacts and on a theoretical level (through literature) discuss what the impact implies for improving the overall environmental performance of products.

3 Methodology

The impact that the eco-label criteria of type 1 eco-labelling schemes have had to improve products environmental performance could not be given a generalized answer considering the great number of product groups for which eco-label criteria has been developed. To get a manageable research project, but still able to say something about the impact of type 1 eco-labelling schemes more generically, we chose to include two product groups (paper products, laundry detergents), for which three different Type 1 eco-labelling schemes (EU eco-label, Good environmental choice, Nordic Swan) have developed eco-label criteria. Each product group has been subject for a case study. The purpose for each case study has been to identify the impacts that type one eco-labelling schemes has had on the environmental performance of the product groups. The result of the case studies will be synthesised as a final report where we will generalise the findings of the two case studies to say something about the impacts of type on eco-labelling schemes more generically. From there, we will assess, on the basis of impacts, if eco-labelling schemes impacted the products in a way that improves the overall environmental performance. Derived from this, we will be able to say something more generically what the impact of type I eco-labelling schemes has been to improve the environmental performance of products.

3.1 Selection of product groups

A fundamental condition in our selection of each product group was that more than one eco-labelling scheme had the product group covered in its criteria. This was to ensure that we could say something about the impact of type I eco-labelling schemes more generically in that particular product group. Criteria should also have been available within each eco-labelling scheme for a longer period of time. This was important since we wanted to study the impact of revisions which takes place approximately every third year within the eco-labelling schemes. Consideration was also taken to find product groups with different characteristics; product groups that could be perceived to be more easy to influence and those who are not. By choosing one of each kind (two extremes) the impact of type one eco-labelling schemes could be understood more nuanced when brought together in the synthesis. Last but not least, we considered that each eco-labelling scheme must have a satisfying sample of companies that have been granted eco-labelling licences for one or more of their products. This was important since companies have been our only alternative to obtain the needed information about the impact of eco-label criteria on products.

3.2 Case studies

As explained above, paper products and laundry detergents have been chosen as subjects for two case studies. Each case study has consisted of a desktop study of criteria development and interviews. In this deliverable we present one of these case studies, laundry detergents.

4 Case study: Laundry detergents

4.1 Description of the product group

Laundry detergents fulfil a number of different functions such as cleaning, bleaching, softening, and disinfection for different water qualities and temperatures. Laundry detergents are often categorised in special- and regular laundry detergents. Special detergents are optimised for washing delicate materials such as wool and silk etc while regular laundry detergents is optimised for machine wash in different temperatures. There are also laundry detergents that combine regular detergent with bleaching agents or rinsing agents. The aforementioned types of laundry detergents could be in the form of powder, liquid, gel, tablets or as granulate. Powder-based detergents and liquid laundry detergents could also be more concentrated and such detergents are referred to as compact laundry detergents. Laundry detergents are also distinguished if they apply for coloured or white textiles. The difference is that laundry detergents for white textiles contain bleaching agents (Swedish cosmetic, toiletry and detergent association, 2005). Most of the different types of laundry detergents contain roughly the same types of ingredients even though there could be differences with regard to its exact chemical structure, levels of content and combinations to grant the specific qualities of the laundry detergent. More concentrated product formulations could often be used by professional users like institutional/industrial users than those detergents intended purely for consumer use. The most common ingredients of laundry detergents and there function are shown in *table 1*.

Table 1 - *The most common ingredients used in laundry detergents and there function.*

Type of ingredient	Function
Alkaline substances	Increase the efficiency of surfactants and bleaching agents.
Protective colloids	Prevent the dirt that is removed from the clothing from reattaching itself.
Bleaching agents	Remove a type of stain that is not removed by the surfactants, e.g. red wine
Enzymes	Break down particularly difficult stains.
Colouring agents	Added for aesthetic reasons or to aid the marketing of the products.
Colour preserving substances	Prevent the colours in textiles from bleeding into each other.
Fillers	To give the product structure.
Complexing agents/builders	Allows the surfactants better access to clean the clothes.
Preservatives	Prevent the growth of bacteria in the product and thereby extend its durability
Corrosion-inhibiting substances	Protect the washing machine against corrosion.
Optical brighteners	Gives an impressing of whiteness and accordingly cleanness.
Fragrances	Give the product a particular smell
Foam inhibitors	Reduce the quantity of foam in the washing machine.
Surfactants	Remove soils from the clothing and keep it suspended in the washing solution.

Except the mixture of ingredients the second part of the product are its packaging. Laundry detergents are packaged in cardboard (powder), bottles (liquid), bags (tablets) and various refill packages.

4.2 Why investigate laundry detergents?

Laundry detergents for consumer use have proven to be one of the most optimal for our case study bases on the preconditions set up in *section 3.1*. Firstly, it fulfilled our requirement that more than one eco-labelling scheme had the product group covered in its criteria. Secondly, requirements for laundry detergents have existed in Good Environmental Choice for about 20 years, Nordic Swan for 18 years, and EU eco-label for 13 years. The time perspective was important since we wanted to study the impact when already eco-labelled products are given revised (more stringent) criteria that must be lived up to. These revisions takes place approximately every third year within the eco-labelling schemes. Laundry detergents are also perceived (by us) to be easier to influence than paper products (the other product group in our research). By choosing one of each kind (two extremes) the impact of type one eco-labelling schemes could be understood more nuanced when brought together in a synthesis. This type of laundry detergent has also had a satisfying sample of companies that have been granted eco-labelling licences for one or more of their products. This was important since companies have been our only alternative to obtain the needed information about the impact of eco-label criteria on products.

4.3 Scope of the case study

This case study has been conducted to provide the data needed in the synthesis where the findings of this case study will feed into the synthesis of this research. Its purpose has more specifically been to identify the impact of the strategies in which type I eco-labelling schemes could improve products environmental performance. Two directions have been hailed as means for type I eco-labelling schemes to achieve this;

- a) when manufacturers possible reformulate laundry detergents when adopting eco-label criteria; and
- b) when already eco-labelled laundry detergents are given revised (more stringent) criteria that must be lived up to.

Consequently, these are the strategies in which we will seek to identify the impact of type one eco-labelling schemes.

4.3.1 Limitations

- We are only considering direct impacts of eco-label criteria meaning that the products must have undergone changes that could be directly linked to the requirements in criteria.
- No attempts will be made to quantify possible impacts in detail or map out the effect that impacts could have in the environment. Instead we are going to identify impacts and later on in the synthesis on a theoretical level (through literature); discuss what the impacts implies for improving the overall environmental performance of products.
- As have been presented the product group of laundry detergents consist of a variety of product types. The limitation of product type within the product group of laundry detergents has simply been done by identifying what types of products companies, within each eco-labelling scheme, for which they have been granted the eco-label. Powder-based laundry detergents for coloured respectively for white textiles are by far most represented among all companies. Only some of the companies had liquid detergents eco-labelled. To grant the best precondition to collect data we chose to limit ourselves to powder-based products.

4.4 Methodology

4.4.1 Desktop study of criteria development

The desktop study of was done for two reasons: a) to create easy accessible summaries of each eco-labelling scheme's criteria documents in chronological order. The summary was compiled to get a structured mode of procedure in the interview situation where the summaries functioned as a reminder for the interviewee, e.g. to what criteria were posed when; b) to understand more generally how type I eco-labelling schemes has tried to distinguish and influence the environmental performance of laundry detergents. In this way, we could say something about the potential impact of type I eco-labelling schemes criteria on products environmental performance and put in relation to its actual impact. The basis for this study has been to review all criteria documents that have been launched for laundry detergents within each eco-labelling scheme.

Table 2 – Overview of criteria documents that has been the basis in the desktop study.

Eco-label	Criteria documents
EU eco-label	<ul style="list-style-type: none"> - "95/365/EC": Commission decision of 25 July 1995 establishing the ecological criteria for the award of the Community eco-label to laundry detergents: - "1999/476/EC": Commission decision of 10 June 1999 establishing the Ecological Criteria for the award of the Community Eco-label to Laundry Detergents - "2003/200/EC": Commission decision of 14 February 2003 establishing revised ecological criteria for the award of the Community eco-label to laundry detergents
Good environmental choice	<ul style="list-style-type: none"> - "Miljökriterier för hushållstvättmedel" (Miljökriterier nr 2), Naturskyddsföreningen (1990) - "Miljökriterier för hand och maskintvättmedel" (Miljökriterier nr 7), Naturskyddsföreningen (1991) - "Miljökriterier för tvättmedel", Naturskyddsföreningen (1995) - "Tvättmedel, fläck och blekmedel 2002", Naturskyddsföreningen (2002) - "Bra Miljöval kriterier – Kemiska produkter", Naturskyddsföreningen (2006)
Nordic Swan	<ul style="list-style-type: none"> - "Miljömärkning av tvättmedel för textilier" – Standardiseringskommissionen i Sverige (1992) - "Miljömärkning av tvättmedel för textilier" – Standardiseringskommissionen i Sverige (1994) - "Miljömärkning av tvättmedel för textilier", Nordisk miljömärkning (1995) - "Miljömärkning av textiltvättmedel", Nordisk miljömärkning (2001) - "The Swan-labelling of laundry detergents and stain removers" Nordic Environmental Labelling (2006)

4.4.2 Interviews

All empirical material is derived through interviews. No data was readily available so we saw interviews with companies having eco-labelled products as our only source of information. Three types of companies could be distinguished among the companies having eco-labelled products. The first type of company (which we refer to as type 1) manufactures and market their own brand. The second type of company (type 2) consists of retailers that collaborate with manufacturer for developing and manufacturing their brands. The third type of company (type 3) is a combination of the two aforementioned. They manufacture most products to retailers but many also manufactures and market own brands. We limited ourselves to companies that manufacture and market their own brands (type 1 & 3). In this way, we could get in contact directly with the manufacturer instead of consulting the retailer and their respectively manufacturer. Since we are targeting those companies having own manufacturers we from this point refer to they as manufacturers.

Consideration was also given to companies that have been part of the eco-labelling scheme over a longer period of time (although not always possible). The reason for this was because this has allowed us to study how the revisions of the eco-label criteria have impacted their product/products. For our ability so say something about the impact of type I eco-labelling schemes criteria we choose a sample of manufacturer based on the aforementioned conditions

within each scheme. For various reasons all proposed companies has not been able to participate resulting in fewer companies than we intended. All sizes of companies are represented in this study, i.e. large, midsized and small companies.

The interviewees within the companies have been those with main responsibility of eco-labelling (technical managers etc.). Most interviews have been conducted at the head office of the companies but some has also been carried out by telephone (due to the geographical position of a manufacturer). We acknowledge that the interviewee might not remember every change that has been made to the products due to requirement in eco-label criteria since some of the changes have occurred long time ago. For this reason, we used easy accessible summaries of the criteria documents compiled to function as a reminder for the interviewee, e.g. to see what criteria that were posed when. For the telephone interviews, the same summaries were sent out in advance of the interview. Some of the interviewees have also supported their claims with documents of product formulations. We have also been fortunate that the interviewees (in almost every case) are the ones that have worked with eco-labelling since it was introduced.

Table 3 – *The number of interviewees in this study per eco-labelling scheme.*

Eco-labelling scheme	Number of interviewees
EU eco-label	3
Good Environmental Choice	1
Nordic Swan	2

The interviews has been recorded and transcribed to grant that the information could be reproduced as correctly as possible to grant that the compilation of the information could be done in a structured mode of procedure. A basic condition for participating in the interviews was to grant the anonymity of the companies included in this research. Therefore, the result is presented as the number of manufacturers per eco-labelling scheme who has stated a certain action taken due to requirements in the criteria documents. It has not either been in our interest to analyse the amount of impacts that could be associated with individual companies. The result should instead be seen as examples that will add to the understanding to how type I eco-labelling schemes more generically could impact powder-based laundry detergents.

4.5 Environmental impacts of laundry detergents

4.5.1 Historical background

Laundry detergents have historically been associated with environmental impacts for its content of certain chemical compounds. In 1950s to 1960s certain surfactants used in laundry detergents were linked to the presence of stable foam that began to build up in the vicinity of weirs, locks, and other constructions in waterways. The discovery that many surfactants could emerge unchanged even from a modern sewage treatment plant and thus enter surface waters a new criterion soon appeared for surfactants; the biodegradability of the products. The criteria of certain levels of biodegradability could reduce their surface activity (including their foaming properties) and their aquatic toxicity (Smulders 2002). Phosphates were another compound found in laundry detergents that was debated in the 1960s. This was because phosphates had proven to cause eutrophication which turned rivers and lakes green and choking with aquatic plant growth (Knud-Hansen, 1994). Sweden is one example of a country that successfully managed this problem due to large-scale

introduction of sewage treatment plants (STP: s) and in particular the introduction of tertiary chemical treatment (Kemikalieinspektionen 2006).

4.5.2 Life Cycle Assessment (Laundry detergents)

Life Cycle Assessment (LCA) has grown to be the accepted way in which products environmental performance are assessed. LCA is used to a variety of purposes; i) to find out where improvements possibilities exist in the life cycle of the products; ii) which activities in the life cycle that contribute the most to the environmental impact associated with the product iii) what environmental consequences of changing certain processes or using another material in the product manufacturing; and, iiiii) find out the environmentally preferable choice among different products. The basis of the life cycle assessment is to follow a product from its “cradle” where raw materials are extracted from natural resources through production (in this case the laundry detergent), to use and to its “grave”, the disposal (Baumann & Tillman, 2004). Each life cycle stage could also be divided into different subcategories. For example, the use phase of laundry detergents could consist of product dosage, wash temperature distribution and transportation from retailer to consumer's house. It is important to have in mind when interpreting the results of LCA the environmental impact could differ depending on how the life cycle is defined (system boundaries). Looking at LCA case studies for laundry detergents (see: Saouter et al, 2002¹; Saouter & van Hoof, 2001²) the life cycle stages and their subcategories could consist of:

1. **Manufacturing of detergent ingredients** – could include extraction of raw materials; transportation and manufacturing of final chemicals; and, transportation from chemical suppliers to detergent manufacturer,
2. **Packaging** – could include manufacturing of packaging raw materials, additional packing materials used for the transportation of product to retailers, manufacturing of the pack; packaging solid waste disposal practice; and, transportation to detergent manufacturer,
3. **Manufacturing of product** – could include formulation of finished detergents and transportation from product manufacturer to different countries; and, distribution of the products inside the country to all retailers,
4. **Consumer use** – could include product dosage and wash temperature distribution and transportation from retailer to consumer's house,
5. **Disposal (wastewater treatment plants)** – could include collected sewer (Untreated, primary, secondary and tertiary treatment), and other type of treatments (septic tank, etc.).

Within an environmental life cycle assessment a (incomplete)³ mass and energy balance is calculated. This mass balance, found in the life cycle inventory (LCI) part of the LCA-assessment, is based on environmental relevant flows. These flows typically consist of the use of scarce resources and emissions of substances considered being harmful. The environmentally relevant flows in the LCI are always related to a functional unit (e.g. one standard wash), which is used to allow a fair comparison between products with the same function. Depending on the purpose of the analysis the resources used and the emissions produced (LCI-data) could either be presented as a sum for the product or separately for each stage of the life cycle.

¹ The study compare environmental profile of three granular laundry detergents; (1) regular and (2) compact formulations

² The study identify activities in the life cycle making the largest contributions to the environmental impact for a hypothetical powder-based laundry detergent

³ In the sense that only environmentally relevant flows are considered

4.5.2.1 Environmentally relevant flows in the life cycle of laundry detergents

In the LCA-studies conducted by Saouter et al (2002) and Saouter & van Hoof (2001), the LCI-data is classified in the subcategories; energy use, air emissions, solid waste and water emissions. The majority of total energy use in the life cycle of laundry detergent (applies to all types of laundry detergents) occurs during the consumer use. Saouter et al (2002) show that ~80% of the energy consumption occurs during the consumer use phase. This is driven by the heating of the water and the operation of the washing machine. The same study show that the second largest contributor to the energy use occurs in the manufacturing of the ingredients (~16%). The formulation process, the disposal of spent wash water and the manufacturing of packaging raw materials constitute only a minor fraction of the energy used. It should be said that the results from Saouter et al (2002) is based on Belgian conditions. This means that certain assumptions has been made of the country's efficiency of the electricity grids, consumer habits etc, parameters that are country specific. As a consequence, the energy use in the life cycle stages of the same laundry detergent, consumed in another country, could be different. Similarly results of consumer energy use are presented in Saouter & van Hoof (2001). The study shows that the consumer energy use (for both regular and compact laundry detergent) accounts for 70-85% of total energy.

The second LCI subcategory, *air emissions*, is almost exclusively a consequence of the share of fossil fuels in the energy used in the laundry detergents life cycle. Consequently, a 100% share of fossil fuels used to produce the energy used means that the air emissions will be distributed according to the energy use in each stage of the life cycle (Saouter et al, 2002). Since this correlation exists the emissions in, e.g. the consumer use stage, would be expected to be much lower in countries that derive most of their energy from nuclear or hydro-energy. The third LCI subcategory, *solid waste*, is also mainly linked with the use of fossil fuel energy, more specifically as a result from the production of ashes from energy generation. According to Saouter & van Hoof (2001) ~64% of total solid waste occurs in the use stage (for both regular and compact laundry detergent). The two next largest contributors are the disposal (due to sludge from wastewater treatment plants) and ingredient supply stages. The final LCI subcategory, *water emissions*, is highly dependent on the chemical considered. According to Saouter & van Hoof (2001), water emissions occur almost exclusively in the disposal phase of a laundry detergent life cycle. This is not surprising, since almost 100% of the chemicals used during the wash are discharged to the sewer.

4.5.2.1 Environmental impacts in the life cycle of laundry detergents

In an LCA, environmentally relevant flows are translated into information of environmental impact. Typically, the information of emissions and resource use is classified according to the type of environmental impact (i.e. greenhouse gases). These impacts may then be aggregated into one indicator. Following the example of greenhouse gases this means that all such emissions are aggregated to global warming potential (GWP) (Baumann & Tillman 2004). There is more or less a default list of impacts to consider in LCAs, including for example resource use, global warming, acidification and eutrophication, but it could vary depending on the characteristics of the product. In the case of laundry detergents, Saouter et al (2002) and Saouter & van Hoof (2001) also use impact assessment categories; aquatic toxicity, human toxicity, ozone depletion and photochemical smog. The role of the LCA in this context is to relate emissions into associated environmental themes or impact. This means that the methodology doesn't map the actual effects in the environment of the emissions (Saouter & van Hoof, 2001).

According to both Saouter & van Hoof (2001) and Saouter et al (2002) the energy use (fossil fuels) drives the impact in five out of seven impact assessment categories; greenhouse effect (GWP), acidification, ozone depletion, human toxicity and photochemical smog. The largest contributor to the first four aforementioned impact assessment categories is the use stage due to the heating of the water in the washing machine. In Saouter & van Hoof (2001) the use stage accounts for ~60% (as a mean value) of the environmental impact across the four categories. The raw material supply accounts for ~35% of the impact with only minor contribution from manufacture disposal and packaging. The fifth energy related impact assessment category, photochemical smog, has the supplier stage as the largest contributor (66%). The impact occurs through emissions from VOC (dust particle emissions) from the use of fuel in the processes (Saouter & van Hoof, 2001). Manufacturing and consumer use contributes nearly the rest of the VOC emissions. As a consequence of energy being the main driver in the above specified impact assessment categories: a laundry detergent could be expected to have a smaller environmental impact in countries that derive most of their energy from renewables like hydro-power etc.

The final two impact assessment categories (*aquatic toxicity* and *eutrophication*) are related almost exclusively to the disposal stage of the life cycle. However, the environmental impact related to these impact assessments categories depends on how the wastewater from the wash is treated after being discharged to the sewer. Using modern wastewater treatment consisting of primary could remove a large fraction of certain chemicals/chemical characteristics which lowers the environmental impact considerably, for example phosphates could be completely removed using modern sewage treatment plant. There are also more or less in every European country, households that are not connected to any type of wastewater treatment. Consequently, the potential environmental impact related to water emissions would increase considerable. However, emissions to water have a totally different profile. Their distribution among the different stages is highly dependent on the chemical considered. According to Saouter et al (2001), it is difficult to allow a fair LCA-assessment of water emissions of the environmental impacts of laundry detergents ingredients: first because inventory data on a number of ingredients used in the laundry detergent is not available.

4.6 How Type I eco-labelling schemes have tried to influence the development of environmentally friendlier laundry detergents

Seen from the eco-labellers perspective they has since the launch of the first criteria document constantly tried to revise the criteria (typically every third year) to make criteria more stringent. This development has been somewhat different depending on which of the included eco-labels is referred to. In *table 4*, an overview is presented when respectively eco-labelling scheme introduced its first criteria and when the revisions⁴ have been introduced.

⁴ It should be mentioned that Nordic Swan also has conducted minor revisions within the validity period of its third, fourth and fifth generation of criteria and launched them as version 3.1, 3.1, 3.3 and so on. These revisions have more or less only comprised elucidative, explanatory and/or editorial changes.

Table 4 - Introduction and revisions of laundry detergents criteria presented per eco-labelling scheme.

Year	EU eco-label	Good Environmental Choice	Nordic Swan
1990		1 st generation of criteria	
1991		2 nd generation of criteria	
1992			1 st generation of criteria
1994			2 nd generation of criteria
1995	1 st generation of criteria	3 rd generation of criteria	3 rd generation of criteria
1999	2 nd generation of criteria		
2001			4 th generation of criteria
2002		4 th generation of criteria	
2003	3 rd generation of criteria		
2006		5 th generation of criteria	5 th generation of criteria

In sections 4.6.1 - 4.6.3, we summarize how each eco-labelling scheme through its criteria (in chronological order) has defined environmentally friendlier laundry detergents. The summary has been done based on the criteria documents listed in *table 2 (section 4.4.1)*. For more detailed description of the criteria we refer to the criteria documents found in *table 2 (section 4.4.1)*.

4.6.1 Summary of EU eco-label criteria

The EU eco-label introduced its first criteria for laundry detergents in **1995**. The main emphasis of this criteria document was placed on certain ingredients of laundry detergents. More specifically, the criteria defined⁵ an environmentally friendlier product as one that need less quantity of ingredients in relation to a wash⁶ and; do not contain/has limited quantities of certain ingredients considered to be unnecessarily harmful for environment (aquatic) and health. Limitations were assigned to the total amount of detergent per wash. This aimed to promote compact laundry detergents, a more concentrated they requires less packaging which accompanies a reduction in manufacturing waste and more efficient transportations. Regarding ingredients considered being harmful a limitation was imposed to the use of a complexing agent (phosphonates, EDTA). The criteria also excluded the use of; i) surfactants from the alkylphenoethoxylates family (APEO), ii) perfumes containing the aromatic nitro compounds, and iii) ingredients classified as carcinogenic, toxic to reproduction and mutagenic. The key considerations of ingredient harmfulness were based on the inherent properties of the ingredients; in particular, its biodegradability; bioaccumulability and toxicity to aquatic organisms since the laundry detergents after use are discharged into water. These considerations were also integrated in another criteria system aimed for the ingredients. The system was built upon the scoring principle. This is characterized as a system that allows for some weighting among different environmental criteria. In this way a product could compensate for the failure of the product for some eco-label requirement with success in other ones (Rubik & Frankl 2005). This combined some hurdle criteria that specify limit values that must be complied together with weighting principles for a set of environmental parameters⁷ (toxicity characteristics of ingredients etc.).

⁵ It should be said that the definition (of an environmentally friendlier laundry detergent) is not stated explicitly in the criteria documents but it could indirectly be understood through the criteria.

⁶ All eco-labelling schemes express limitations in grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness.

⁷ (1) total chemicals (2)phosphates; (3) soluble/insoluble inorganics (4) non-biodegradable (aerobic/anaerobic), (5) Biological Oxygen Demand (BOD) (6) toxicity

Beside this main direction of the criteria emphasis was also placed on minimising waste through limitations in the amount of packaging used for delivering a dose to the consumer. Criteria regarding consumer information were also found in this first criteria document to influence the use phase in the laundry detergents life cycle. This criterion required that certain information should appear on the packaging, for example, “low-temperature washing saves energy” and instructions on how to dose correctly (thereby reduce the amounts of laundry detergents used). Another segment in the first criteria document was the washing performance test, added to ensure an adequate quality on laundry detergents.

The second version of the criteria launched in **1999** was in its structure very similar to the old criteria. Here, some overall objectives for the criteria were stated. The criteria aimed to promote; i) reduction in water pollution by reducing the quantity of detergent used to perform a laundry and limiting the quantity of harmful ingredients; ii) minimisation of waste production by reducing the amount of primary packaging and facilitate reusability and/or recyclability of the packaging; iii) reduction of energy use by promoting low temperature detergents; and iiiii) reduce the environmental impact in the use phase through information on packaging. Compared with the 1st version of criteria some criteria were made more stringent. First, the criteria system built upon a scoring principle had across all of its parameters more stringent hurdle criteria. Second, limit values for the amount of packaging were tightened. Refill packaging was also imposed with similar requirements. Criteria were also introduced to promote recycled material in cardboard packaging. Finally, the criteria segment of consumer information was enhanced with clarifications and further requirements of information to enhance the consumer awareness and thus aiming to reduce the environmental impact in the use phase.

In **2003**, the third version of laundry detergent criteria was launched. The main emphasis continued to be placed on promoting reduction of the quantity of detergent used (compact laundry detergents) and limiting the quantity of harmful ingredients. The changes that were made in this version of criteria mostly occurred in the criteria segment aimed to target the ingredients. The most significant change was that the point based system was dropped along with some of its environmental parameters⁸. The remaining environmental parameters⁹ of the system were kept as hurdle criteria, now with some more stringent limitations. Some more ingredients¹⁰ were also added to the list of substances that are not allowed in laundry detergents. The complexing agent had its limit value tightened. Other new ingredient-related criteria were; i) fragrances shall be manufactured/handled following the Code of Practice of the International Fragrance Association; and, ii) the product shall not be classified as “may cause sensitising by inhalation”. Criteria continued pursue minimising waste production, consumer information on packaging. The washing performance continued to be a recurring element to ensure an adequate function of eco-labelled laundry detergents.

⁸ (1) soluble/insoluble inorganics; (2) Biological Oxygen Demand (BOD)

⁹ 1) total chemicals; (2) phosphates; (3) non-biodegradable (aerobic/anaerobic); (4) toxicity

¹⁰ HHCB, AHTN and NTA, quaternary ammonium salts,

4.6.2 Summary of Good Environmental Choice criteria

Lunched in **1990**, the first criteria document targeted environmental aspects considered by the SSNC¹¹ to be most prioritized in defining a more environmentally friendly detergent. This involved them developing a set of minimum requirements (B-standard) that involved prohibition of some ingredients¹²; The reason for prohibiting the use of a substance or group of substances varied but was based on one or a combination of; an ingredients eco-toxic property (aquatic), its biodegradability, and/or its potential to be bioaccumable. Some was also prohibited since it did not add any particular benefit for the function of the product. The minimum level also required that the agreement of limitations in laundry detergents phosphorus content between Swedish authorities and the businesses should be followed. A category (A) was also defined with somewhat stricter requirements, if fulfilled, would grant an advantage in the fulfilment of requirements in the next criteria to come. This criteria document also pursued the objective to promote more compact/concentrated laundry detergents promoted by not allowing more than a certain dosage used for one wash¹³. Other types of requirements concerned that data to verify that compliance with criteria is met should be done according to certain standardised procedures.

The second version of criteria was launched in **1992**. The changes being made mainly concerned the ranking system (A & B-levels) which had undergone some structural changes as well as changes in its content. The A-& B-level in this version of criteria contained allowed substances. Consequently, substances considered to be most environmentally friendly were found in the A-level. Also added to the A respectively B-levels, was a new criterion that allowed no more than a certain content of fillers per dosage. It was introduced to promote compact laundry detergents even further since regular non-compact laundry detergents contained reasonable amounts of fillers. Additional levels (C & D) were introduced where SSNC specified substances that they considered not belong in an environmentally friendlier laundry detergent. The changes being made in the ranking system meant that SSNC, in the light of own assessments, expanded the list both allowed and not allowed substances¹⁴ than previous criteria within ingredients groups; surfactants, complexing agents and bleaching agents. Outside the ranking system SSNC also underlined the importance of health aspects and toxicity for non-aquatic organisms by prohibiting substances with carcinogenic or genotoxic properties in eco-labelled products.

The third generation of eco-label criteria for laundry detergents were introduced in **1995**. The criteria document appears to have undergone big changes but most changes were made because stain removers and bleaching agents were included. There were just a few changes being made (relevant for laundry detergents) in this third generation of criteria, and it concerned some of the laundry detergent ingredients. Instead of assessing a surfactant environmental performance based solely on its inherent properties (human- and aquatic toxicity & biodegradability) SNCC also comprised the use of renewable raw material in the manufacturing of the surfactants. The purpose was to promote reductions in the use of petroleum. The requirements for complexing agent did also undergo some changes. First, a limitation was imposed of the total amounts of complexing agents used in a laundry detergent. In spite of the low toxicity the SNCC stated it may cause problems with sludge. Second, certain prohibited complexing agents could under certain

¹¹ Swedish Society for Nature Conservation

¹² One surfactant, two complexing agents, one bleaching agent, and complete ban of the chemical compound group optical brighteners and colouring agents.

¹³ All limitation found in the criteria document are dose related and expressed as grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness.

¹⁴ LAS (surfactant), perborate (bleaching agent), and phosphonates (complexing agent) were prohibited

circumstances be allowed although restricted with limitations¹⁵. Beside some clarifications and some introduced exceptions (as explained above), requirements were imposed to enhance that criteria to be correctly and credibly controlled.

The fourth generation of eco-label criteria (**2002**) for household laundry detergents came with part reformulated/more specified, part renewed version of its environmental objectives. Added in the objective were to promote; i) the use of renewable raw material in ingredients as well as packaging; ii) reduce the use of bioaccumable and poorly biodegradable perfumes; and iii) facilitate recycling of packaging. Here the SNCC has expanded the criteria outside the ingredients when accounting for the use of renewable material in packaging and the facilitation of the recycling of packaging. The criteria segment aimed to promote reduction of the use of harmful chemicals and quantity of chemicals has undergone some changes that concerns; first, tightening of a requirement related chemical compound group complexing agents saying that a substance must not be hazardous to health; and a limitations in the amounts of perfume in laundry detergents a long with phase out the use of perfumes considered to be poorly biodegradable and a high potential for bioaccumulability. The criteria continued to promote compact laundry detergents by tightening of the maximum dosage of laundry detergents per wash. Packaging requirements were also introduced to promote the share of recycled paper and FSC-certified raw material in cardboard packaging material. To facilitate recycling SNCC requirements were introduced that products must carry instructions on how the packaging should be sorted for recycling in accordance with the document “REPA’s instructions”. Criteria were also introduced that targeted the company rather than the product itself. These requirements were added to ensure that the licensee has an environmental policy, an appointed representative for environmental work, and that the company complies with safety regulations, environmental regulation, and legislation in manufacturing countries.

This criteria document, launched in **2006**, comprised the chemical consumer products in general making it possible to eco-label everything from cosmetics to laundry detergents. The criteria therefore appear to have undergone big changes but added requirements is mostly not relevant for laundry detergents. However, changes have also occurred specifically for laundry detergents. Since SNCC recognized that cultivation of palm oil (used for manufacturing surfactants) is leading to the irreversible loss of biodiversity and cultural diversity around the world, the criteria where complemented with a requirement saying that the surfactant manufacturer or the palm oil supplier must be a member of the Roundtable on Sustainable Palm Oil, RSPO. Phosphates are another ingredient of the laundry detergent which criteria has undergone changes. Previously restricted with limitations, it was now prohibited to use in GEC labelled products. This is in line with the national legislation in Sweden which does not allow phosphates in laundry detergents. In this fifth version of criteria the promotion of compact laundry detergents continued to be tightened. SSNC also introduced, for the first time, requirements of consumer information on packaging to promote correct dosing. It was intended to prevent excessive or incorrect use of the product. SSNC continued to expand the criteria directed to the company-level requiring that companies that wish to use the GDC-label must have an environmental policy that also covers transport. Additional requirements are also placed on fulfilment of one out of ten transports related requirements. Requirements were also further enhanced to grant that criteria are complied with.

¹⁵ This condition applied when percarbonate (bleaching agent) are used in order to manage long-term storage.

4.6.3 Summary of Nordic Swan's criteria documents for household laundry detergents

In 1992, Nordic eco-labelling launched its first criteria document for environmentally friendlier laundry detergents. The main focus of this first criteria document was ingredients. One of the key objectives that could be distinguished was to prohibit or limit the use of ingredients that was considered to be unnecessarily harmful to the environment. Key considerations were placed on the ingredients inherent properties regarding biodegradability; bioaccumulability and toxicity to aquatic organisms. This where considered important since laundry detergents after use are discharged to water (mostly first treated in sewage treatment plants). The other key objective of the criteria was to limit the quantity of chemicals per wash¹⁶. The limitations in quantity of ingredients was imposed to promote more concentrated products and thereby get more efficient transportation and reduce amount of packaging. The other key objective, prohibit or limit the use of ingredients that where considered to be unnecessarily harmful (health and environment). First, added substances in the product could not be classified as carcinogenic, allergenic, teratogen or genotoxic. Second, the product could not have pH above a certain threshold value since it could pose a health risk to the consumer of the product. Nor could products classified as environmentally harmful get labelled.

Criteria were also targeting specific components potentially used in laundry detergents. Criteria aimed to limit the use of certain surfactants imposing threshold values for a substance eco-toxicity, biodegradability and bioaccumability. The criteria also targeted some other type of ingredients; prohibition of certain complexing agents¹⁷ and limitations of certain bleaching agents¹⁸, prohibition of optical brighteners and colouring agents. As with the GECs criteria, this criteria document grated an exception to use prohibited complexing agents under certain circumstances although being restricted with limitations¹⁹. Another segment of the criteria aimed to reduce the environmental impact in the consumer use phase by providing information on the packaging regarding dosing and recommended washing temperature. It was also underlined in the criteria that the entire product should conform to all requirements on the working environment and the outdoor environment specified by the authorities at the relevant location of manufacturing (ingredients and product). In 1994, the second version of criteria was introduced but the 2.0 series was just a prolonging of the same requirements as in first generation of criteria.

The third version of eco-label criteria for laundry detergents was launched in 1995. This version of criteria had undergone quite some changes, both editorial such as simplifications and clarifications of criteria but also in the actual criteria. Quite many changes were made in the segment related to ingredients. New health related requirements were imposed. Firstly, ingredients were not allowed in laundry detergents if they had danger classifications toxic, very toxic corrosive, hygienically harmful. Secondly, enzymes was given some condition in which it must be handled (in manufacturing) since some enzymes may cause sensitisation by inhalation. Beside the health-related criteria a new requirement has been introduced to limit the use of ingredients per wash having a combination of environmental harmfulness classification²⁰. Criteria were also introduced for perfumes stating that

¹⁶ All limitation found in the criteria document are dose related and expressed as grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness.

¹⁷ EDTA, NTA, phosphates, phosphonates

¹⁸ Borate compounds

¹⁹ The use of the bleaching agent percarbonate requires certain types of complexing agents in order to manage long-term storage.

²⁰ Toxic to aquatic organisms (R50) Very toxic to aquatic organisms (R51); Harmful to aquatic organisms (R52); May cause long-term adverse effects in the aquatic environment (R53)

the International Fragrance Association Code of Practice of recommendations for which types of perfumes to use. Nordic Eco-labelling also continued to add substances that should not be used or used with limitations in the detergent formulation²¹. Prohibition was lifted for some complexing agents and replaced with limitations.

A major change in the criteria document was the introduction of a criteria system built upon a scoring principle. This is characterized as a system that allows for some weighting among different environmental criteria. In this way a product could compensate for the failure of the product for some requirement with success in other ones (Rubik & Frankl 2005). This combined some hurdle criteria that specify limit values that must be complied together with weighting principles for a set of environmental parameters²² (toxicity characteristics of ingredients etc.). It was intended to promote limitations of the quantity of detergent used for a wash, limiting the quantity of ingredients considered to be unnecessarily harmful (for health and environment), and stimulate packaging being light. Regarding the ingredients key considerations continued to be placed on the ingredients inherent properties regarding biodegradability; bioaccumulability and toxicity to aquatic organisms. Nordic eco-labelling also introduced a wash performance test which the laundry detergent must comply with. It was considered important that consumers' expectations, of having a satisfactorily working detergent as well as an Eco-labelled product, are fulfilled. The segment of consumer information in the criteria document was further facilitated when stating that the EU Commission directive (89/542/EEC)²³ for detergent packaging should be followed. A requirement in excess to this was that the quantity of phosphorus on the basis of percentage by weight should be clearly specified on the product packaging. It was added in the criteria document that that all national rules of recycling systems for products and packaging are followed within the Nordic countries where such items are for sale. During the validity period of the third eco-label criteria the criteria was revised no less than nine times. No significant change was made during any of these requirements. Some of the changes being made were; a calculation procedure was changed in version 3.1; an elucidation on which surfactants shall be readily and anaerobically degradable was changed in version 3.2 contained; minor change in the washing performance test in criteria version 3.3 etc.

The fourth generation of eco-label criteria for laundry detergent was introduced in **2001**. Both minor and more significant changes were made in the segment to promote the reduction of the use of harmful (to health and environment) chemicals and quantity of chemicals. A minor change was made in the health aspects criteria not allowing labelled product to contain risk phrase (irritating) To further limit the use of certain substances a threshold value was imposed to substances with environmentally harmful classifications. The criteria system based on the scoring principle did undergo some more significant changes in this version of criteria. First, owing to the large difference in the hardness of water in the Nordic countries, parts of the requirements in the criteria system was differentiated. This is since hard water needs more chemicals (Builders) to maintain a good function of the detergent. This meant in principle that the laundry detergent manufacturer should develop detergent formulations applicable to soft respectively hard water which also differ on a country-level. The environmental parameters had also undergone some major changes; environmental parameters had been removed; another has been revised; another has been lifted out; and, some parameters have been introduced see appendix for detailed description). The

²¹ Surfactant (alkylphenoethoxylates) and the family of reactive chlorine compounds were prohibited.

²² (1) Total quantity of chemicals; (2) Toxicity and degradability; (3) Phosphorus quantity; (4) Poorly soluble inorganic compounds; (5) Easily soluble inorganic compounds; (6) Not ultimately degradable compounds; (7) Not anaerobically degradable compounds (8) Quantity of organic compounds; (9) Packaging: weight/utility ratio (with factor for recycled material)

²³ This directive provides consumers with product composition information as well as optimal dosage instructions - the aim of which is to protect the environment.

segment of consumer information in the criteria was also revised to further enhance the possibility for the consumer to dose correctly. This included among other things that the recommended dosage/wash in ml for a defined size of machine should appear on the packaging as well as the water hardness divided into appropriate intervals for the area in which the consumer live. To ensure that an eco-labelled have an equally or even better than competing products the washing performance test continued to be a central part of the criteria. Some minor changes where made in the test. The fourth generation of criteria has during its period of validity 2002-2007 undergone nine revisions. The revisions comprised changes such as; editorial changes (4.1, 4.8), minor change in function test (4.3) etc.

In **2006**, the latest version of the laundry detergent was launched. For the most part, the fifth version of criteria is a minor revision of version of the fourth. Of important changes from criteria version 4 to 5 could be mentioned that the functional unit has been changed from laundry of 3.5 kg wash to laundry of 1 kg wash. This was done as part of the strategy to harmonise Nordic Swan and the EU eco-label. As a consequence threshold values appear to be modified but this is just due to the change in functional unit. Another overall change in this version of criteria was that requirements in the criteria only accounted for one type of laundry detergent, not divided into hard and soft water. A minor change was made in the health aspects criteria not allowing labelled product to contain risk phrases may cause sensitisation by inhalation (R42) or skin contact (R43). New criteria were also introduced targeting perfumes which are considered to be another health aspect. The first added requirement in the perfumes criteria rules out specific perfume substances and a second one requires the content of perfume to be declared on the product or the quantity contained in the product to be limited. The aim with requirements as to allergenic perfume substances is that Swan-labelled products as far as possible should not contribute to more problems with allergy than necessary. As regard to specific substances, a bleaching agent (perborate) and a complexing agent (NTA) was prohibited to use in eco-labelled laundry detergents. The point based system was again altered. The system now only contained three parameters. The other parameters were for various reasons not considered relevant anymore. The segment of consumer information in the criteria document was also further enhanced to have the best preconditions to dose correctly. The washing performance test continues to be a central part of the criteria. Some minor changes where made in the test. The fifth generation of criteria also underwent some minor revisions. The revisions comprise changes such as; information text (5.1), change in the function test (5.2).

5 Results

5.1 Desktop study of criteria development

The result presented does not go into specific criteria, rather it could be seen as a way to understand more generally what type I eco-labelling schemes criteria targets. In this way, we could say something more generically about the potential impact of type I eco-labelling schemes criteria on products environmental performance. By comparing the main messages of each eco-labelling scheme’s criteria documents (see table 5) we have been able to find many similarities in how the criteria has distinguished an environmentally friendly laundry detergent.

Table 5 – The matrix illustrates the aspects that different criteria documents comprises to distinguish an environmentally friendlier laundry detergent.

	Criteria document	Year	Criteria coverage							
			Ingredients		Packaging				Other	
			Limit the quantity of ingredients /wash*	Prohibit/ limit** the use of certain harmful ingredients	Limit** quantity of pack. /dose	Follow recommendations/ standards facilitates recyclability/reusability	Min. share of recycled material	Require consumer info on pack.	Limit transport related emission	Grant function of product
EU eco-label	1 st version	1995	x	x	x			x		x
	2 nd version	1999	x	x	x	x	x	x		x
	3 rd version	2003	x	x	x	x	x	x		x
GEC*	1 st version	1990	x	x						
	2 nd version	1991	x	x						
	3 rd version	1995	x	x						
	4 th version	2002	x	x		x	x ^{***}			
	5 th version	2006	x	x		x	x ^{***}	x	x	
Nordic Swan	1 st version	1992	x	x				x		x
	2 nd version	1994	x	x				x		x
	3 rd version	1995	x	x	x	x	x	x		x
	4 th version	2001	x	x	x	x	x	x		x
	5 th version	2006	x	x	x	x	x	x		x
<p>* Good environmental choice ** All limitations found in the criteria document are dose related and expressed as grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness. *** In addition to impose a requirement to promote renewable material (cardboard packaging must contain at least 80% recycled fibre), Good environmental choice also require that (if virgin fibre is used for rest of packaging) that the rest of the cardboard must consist of 30 % FSC certified raw material.</p>										

As shown *table 5*, the earliest criteria documents was launched in the early 1990s (Good environmental choice 1990, Nordic Swan 1992). These criteria distinguished an environmentally friendlier laundry detergent solely based on its ingredients. More specifically, the criteria defined²⁴ an environmentally friendlier product as one that need less quantity of ingredients in relation to a wash²⁵ and; do not contain/has limited quantities of certain ingredients considered to be unnecessarily harmful for environment and health. As shown in the matrix, these ingredient-related aspects has been a recurring feature across all schemes criteria documents since they where introduced. Following the first part of the aforementioned, eco-labellers motivated this with enviromental benefits linked to a certain type of laundry detergent referred to as *compact* laundry detergents. Since “compacts” are more concentrated they requires less packaging which accompanies a reduction in manufacturing waste and more efficient transportations. One potentially negative aspect of this compacts was that they could create an over dosing problematic since consumers back then where used to regular laundry detergents. What we have seen is that, with new versions of criteria documents, the limitations have gradually been tightened.

A product that does not contain/has limited quantities of certain ingredients was the other part of how an environmentally friendly laundry detergent was defined. The key considerations of ingredient harmfulness have been on the inherent properties of the ingredients, in particular, its biodegradability; bioaccumulability and toxicity to aquatic organisms. These inherent properties have since introduction of first eco-label criteria for Nordic Swan respectively GEC, been the norm in which eco-labellers (also EU eco-label) assesses ingredients of laundry detergents. Consequently, the criteria across all eco-labelling schemes has prohibited or imposed limitations to roughly the same ingredients. The ingredient related segment found across the schemes criteria documents has with time also been enhanced with new criteria. Restrictions (prohibitions/limitations) have been imposed of certain danger classifications (health- and environment related).

The strategy of the eco-labels (Nordic Swan, Good enviromental choice) was in their first criteria documents to target some of the environmental aspects of laundry detergents considered be more prioritized within the product group. The plan was then to account for more environmental aspects through revisions of the criteria as time goes by. This is also what we have seen, namely that criteria has gone from targeting ingredients only to account for other environmental aspect related to the product. As shown in *table 5*, all eco-labelling schemes began in 1995 to target criteria outside the segment of ingredients (packaging). Packaging related criteria were another way for the eco-labelling schemes to distinguish an environmentally friendly product in the criteria documents of the eco-labelling schemes. Nordic Swan and the EU eco-label introduced criteria aimed to limit the amounts of packaging. A similar criterion has been targeting packaging refill in the latest version of the EU eco-label criteria. All eco-labelling schemes introduced at this time a criteria to grant a minimum share of recycled material in cardboard packaging (cardboard used for powder-based laundry detergents). As shown in *table 5* the same criteria documents also pursued the objective to that amended manufacturers to follow certain recommendations & standards that facilitates recyclability/reusability. Another packaging related criterion is found in criteria documents as “Consumer information”. This as well as other packaging criteria became a permanent feature of the 1995s criteria of the EU eco-label respectively the Nordic Swan. The criteria aimed to specify what information where required on the packaging. The criteria were to fulfil instructions commended by consumer authorities of what information that should appear on the packaging of

²⁴ It should be said that the definition (of an environmentally friendlier laundry detergent) is not stated explicitly in the criteria documents but it could indirectly be understood through the criteria.

²⁵ All limitations found in the criteria document are dose related and expressed as grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness.

laundry detergents. For example, information about product composition information as well as optimal dosage instructions (the aim of which is to reduce the amount of chemicals used). Some additional requirements on consumer information on packaging have also been required by the eco-labelling schemes in the criteria to come. For example, the EU eco-label requires in the 2nd generation of criteria that information text shall appear on the packaging; “contributes to the reduction of water pollution, waste production and energy consumption”.

Following the 1995 criteria documents EU eco-label and Nordic Swan included criteria to grant the function of the product. Its purpose was to guarantee that those laundry detergents that were subject to eco-labelling would have a sufficient efficiency in cleaning textiles according to the current state of product efficiency. The requirements of washing performance were based on the methodologies found in certain accepted European and international standards. The EU commission stated that one reason for introducing the function test was because manufacturers potentially could recommend too low dosage for the laundry detergents in full knowledge that sufficient washing performance is not achievable. As a consequence of insufficient function higher dosages would need to be used by the consumer in order to achieve the required sufficient performance (EU commission 2009). At the same time the applicant more easily fulfil some of the dose related eco-label criteria. During the 2nd criteria document of the EU eco-label (1999) and the 4th criteria document of the Nordic Swan (2001), more comprehensive frameworks for the washing performance were introduced. EU eco-labels have also stated (in its third criteria document) that they promote low temperature detergents i.e. detergents that could perform the same efficient laundry in lower temperature. How that is pursued is not clear. Laundry detergents capable of getting laundry clean in lower temperatures (seen from an LCA-perspective) require less production of energy to heat the water and consequently reduce energy-related emissions. Similar function test are also found in the latest version of each eco-labelling schemes criteria.

Across all eco-labelling schemes criteria the main principle for setting criteria had up to this point in time (1995) been the hurdle principle, characterized by a number of minimum standards that all have to be lived up to at the same time (prohibition and/or limitations). The criteria setting in EU eco-label and Nordic Swan also emphasised the scoring principle. This is characterized as a system that allows for some weighting among different environmental criteria. In this way a product could compensate for the failure of the product for some eco-label requirement with success in other ones (Rubik & Frankl 2005). Nordic Swan motivated the introduction of this system by stating (in its third version of criteria) that the system could stimulate detergent manufacturer under less constrained forms to promote detergents that are less environmentally harmful. Nordic Swan and EU eco-label introduced almost identical scoring system including among other things aspects such as ingredients aquatic toxicity, biodegradability, and biological oxygen demand (BOD) as well as packaging (reduction). Toxicity was by far given the highest weighting factor to reflect the eco-labellers viewpoint to stimulate a development towards less toxic ingredients. EU eco-label used the same system in its 2nd version of criteria but with tightened thresholds. However, this system was dropped in the latest version of criteria but some of the systems parameters has been kept and imposed with again stricter threshold values. As regard to the point-based system in the Nordic Swan it is still part of the criteria system and now only contains parameters related to the inherent properties of ingredients. However, for each new Nordic Swan criteria document this system has been altered, parameters have been added and/or removed and/or revised etc. The Criteria setting system based on a scoring principle system has been of a complementary nature to the hurdle-based requirements that products still have needed to comply with.

As shown in the matrix GECs criteria also targets transport-related emissions. This is a new segment that none of the eco-labelling schemes in this study has targeted. The requirement is

however not to reduce to transport emissions in direct relation to the product but rather on a company-level. The transport criteria require that one out of 14 possible measures to reduce the emissions related to transport need to be undertaken. The measures described in the criteria document comprise among other things: 10 of the company's pool cars and company cars must be green vehicles; the company must have a scheme for encouraging staff that choose not to drive to work; 10 of the employees who drive a car on company business must have taken a course in economy driving etc. GEC started off with company requirements already in the 4th generation of criteria imposing requirements that the manufacturer/licensee must have a have an environmental policy agreed by company management and an appointed representative for environmental work. With such requirements one could say that the eco-labelling scheme distinguish environmentally friendlier companies, rather than products.

5.2 Direct impact of eco-label criteria (Industry perspective)

The result presented in this section consists of the answers given by six interviewees each representing a manufacturer having powder-based laundry detergents that are eco-labelled. Recipes of product formulations have occasionally been used to support the claims made by the interviewees. The impacts reported by the manufacturers are the changes made in laundry detergents formulations and/or its packaging due to the requirements imposed in eco-label criteria. To guarantee the anonymity of each manufacturer the result is presented as the number of manufacturers per eco-labelling scheme who has stated a certain action taken. This division will give us the opportunity to see if impacts are similar to type 1 eco-labelling in general or if it is linked to a particular eco-labelling scheme. A consequence of such result presentation is that it does not show if one manufacturer is responsible for more than one alteration in the product formulation. It is not in the scope of this study to link direct impacts to specific companies, rather it should instead be seen as examples that will add to the understanding to how type I eco-labelling schemes generally could impact products. The impacts are divided as changes that have been made when joining an eco-labelling scheme (introduction-phase) and impacts when already eco-labelled products must comply with revised criteria (revision-phase).

Table 6 – The matrix shows alterations that manufacturing companies has made in their laundry detergent formulation and its packaging due to requirements in the eco-label criteria.

	Criteria category	Description of impact	Number of interviewees		
			EU eco-label	GEC	Nordic Swan
INTRODUCTION-PHASE	Prohibit/limit ¹ the use of certain “harmful” ingredients	LAS ² (S)	2/3	1/1	2/2
		Optical brighteners (R)	-	1/1	2/2
		NTA ³ (S)	1/3	1/1	-
	Limit ¹ the quantity of ingredients/dose	<u>none</u>	-	-	-
	Limit ¹ quantity of packaging/dose	<u>none</u>	-	-	-
	Ensure that recommend./standards for recyclability/reusability is followed	<u>none</u>	-	-	-
	Increase share of recycled material in cardboard	Other cardboard packaging are used	2/3	-	-
	Require consumer information on packaging	<u>none</u>	-	-	-
Limit transport related emissions ⁴	<u>none</u>	-	-	-	
Grant function of the product ⁵	Increased use of wash active substances ⁶	1/3	-	-	
REVISION-PHASE	Prohibit/limit ¹ the use of certain “harmful” ingredients	Optical brighteners (R)	-	-	-
		Perborate (S)	-	1/1	-
		Perfumes classified R43 ⁷ (L)	-	-	1/2
		Perfume component (R)	-	1/1	1/2
	Limit ¹ the quantity of ingredients/dose	<u>none</u>	-	-	-
	Limit ¹ quantity of packaging/dose	<u>none</u>	-	-	-
	Ensure that recommend./standards for recyclability/reusability is followed	<u>none</u>	-	-	-
	Increase share of recycled material in cardboard	<u>none</u>	-	-	-
Require consumer information on packaging	<u>none</u>	-	-	-	
Limit transport related emissions ⁴	<u>none</u>	-	-	-	
Grant function of the product ⁵	<u>none</u>	-	-	-	
1) All eco-labelling schemes express limitations in grams per wash. This relates to the quantity of laundry detergents needed to get a satisfactory washing work with a load of x kg of normally soiled laundry in water with certain hardness. 2) Linear Alkyl Benzene sulphonate (Surfactant) 3) NitriloTriAcetic Acid (complexing agent) 4) Criteria exist only in GEC 5) No criteria exist in GEC 6) Surfactants 7) May cause sensitization by skin contact			(R) = Removed (S) = Substituted (L) = Lowered level		

As shown in the matrix above, most segments of the criteria have not had any direct impact on the products. It should however be mentioned that there has been additional impacts (mentioned by 1 manufacturer) of the criteria a part from the ones stated in the table. This manufacturer has because of requirements imposed by the point-based system (found in Nordic Swan and EU eco-label) has made them do small alterations in the levels of some substances in the product formulation. Such

small changes have however not been possible for the interviewees to remember and answer adequately and have therefore been included in the results.

As shown in *table 6*, companies have made alterations of ingredients that the eco-labellers consider to be harmful. These impacts have mainly occurred in what we refer to as the introduction-phase of the criteria; when a company joins an eco-labelling scheme. Interesting is also that companies associated with different eco-labelling schemes has made some similar alterations in their product. This suggests (as showed in the criteria analysis) that eco-labelling schemes has quite similar criteria and that the product group is relatively homogenous product group (i.e. same ingredients used). The changes that span across different eco-labelling schemes is the substitution of the surfactant LAS. Six of the interviewees declared that they, when joining one of the eco-labelling schemes, substituted the surfactant LAS in the detergent formulations for their eco-labelled products. Requirements that directly/indirectly have ruled out the use of LAS and other similar surfactants (criteria of surfactants aerobic and anaerobic biodegradability) have been part of all the included eco-labelling schemes for a long period of time; Good environmental choice since 1992 (2nd version of criteria), Nordic Swan since 1992 (1st version of criteria) and EU eco-label since 1995 (1st version of criteria). A similarly high share of interviewees (4) declared that they removed optical brighteners. The exclusion of optical brighteners in the eco-label criteria has also been part of the eco-labelling schemes Good environmental choice since 1990 (1st version of criteria), Nordic Swan since 1992 (1st version of criteria) for a long period of time. The reason for not seeing any impacts on companies representing EU eco-label is because is allowed optical brighteners. The result also shows impacts associated to a specific eco-labelling scheme. One manufacturer associated with EU eco-labelling scheme stated that he substituted the complexing agent NTA. The use of NTA has also for a long time been prohibited or limited within the criteria of the included eco-labelling schemes.

Packaging is another criteria category where certain criteria have had impact on some of the products. The requirements of a minimum share of recycled cardboard in the packaging have made two manufacturers to substitute their previous packaging to cardboard with ones with higher share of recycled material. All included eco-labels have had criteria to support this objective since; 1999 (EU eco-label) and in 2002 (Nordic Swan & Good environmental choice).

A more controversial finding is the related to the washing performance test found in the Nordic Swan and EU eco-label. One manufacturer claimed that the performance test makes them add more wash active substances (surfactants) than “needed”. The reason for this is that the manufacturer believes that the performance test demands of cleanliness are much higher than the mainstream consumer needs - less dosage of wash active substances also does the job. This is controversial in the sense that the eco-labelling schemes at the same time seek to reduce the amounts of chemicals used for laundering. This result however lies beyond our scope to further investigate and besides, no other manufacturer has made the same statement.

If we instead look into the impact of the criteria in the revision-phase (when already eco-labelled products have been introduced with new criteria), we can see, regardless of which eco-labelling scheme the manufacturer is associated, that revisions only have had a minor impact, if any, on the manufacturers. The revision strategy is to tighten criteria. It should be mentioned that Eco-labellers define “tightening” not only as a stricter threshold value but also when criteria expands to cover new segments, i.e. packaging. Alterations that have been done are found in the criteria segment of ingredients. This comprises; substitution of bleaching agent perborate, lowered levels of perfumes classified as “may cause sensitization by skin contact”; and, removed certain components in the perfumes. Perfumes have been the target for the most of the alterations. Other companies appear

to have passed the revisions without making a change in their products. The interviewees that has experienced revisions of criteria has witnessed that the revisions becomes a way of ensuring that a product fulfils old requirements rather than imposing impacts of the products.

The result also point out criteria categories that have not had any impact on powder-based laundry detergents. These are; i) limit the quantity of ingredients in relation to a wash; ii) limit quantity of packaging; iii) follow recommendations & standards facilitates recyclability/reusability; require consumer info on packaging; iiiii) limit transport related emissions. Since this study only covers a sample of companies (although a large share of manufacturers) within each eco-labelling scheme we can of course not rule out that these criteria segments have impacted other companies.

6 Discussion

6.1 Eco-label criteria – limitations and relevance

On the one hand, environmental aspects addressed in the criteria reflect the agenda (priorities and objectives) of each scheme (something that we in fact have found to be quite similar among the schemes in this research); on the other hand, it also reflects limitations of the methodology. Although the eco-labelling schemes throughout the years have expanded its criteria to address more environmental aspects, it is not possible to directly target every aspect in the products life cycle that contributes to the products environmental impact. From an LCA point-of-view, the use stage of laundry detergents is where a big proportion of the environmental impact occurs (Souter & van Hoff 2001, Souter et al 2002). Most of these impacts are generated during the production of energy to heat the water in the washing machine (Souter et al 2002). Consequently, a consumer that performs laundering in lower temperature would contribute to an improved environmental performance of the product; especially in countries where energy that is used to produce the electricity is based on fossil fuels. However, no eco-label criteria could directly affect how consumers chose to do their laundering. Criteria that somehow could be linked to this aspect are; a) to promote low temperature laundry detergents (stated by EU eco-label in its 3rd criteria); and, b) provide information on the packaging so that consumer can be informed on how to wash in lower temperature (criteria found in Nordic Swan and EU eco-label). These criteria must assume that there are laundry detergents that do not clean effectively in lower temperatures and that sufficient information is not readily available on packaging. Regardless if such criteria have had any impact (either through consumer enhances the market share of those detergents in favour for other types of detergents that don not comply with such requirement and/or making manufacturers reformulate their products), consumer could still choose to perform their laundering at the same temperature. At its best, it might be possible for eco-label criteria to provide some basic preconditions so that consumer has the possibility to lower temperatures.

Beside the use phase in the life cycle of the laundry detergent the disposal stage is also a life cycle step where environmental impact has the potential to occur. After being use the wash liquid is in the best case discharged to the sewage system and the recipient after having completed its work in the washing machine. In the worst case, the wash liquid is discharged directly into the recipient. Ingredients are a segment well supported within the criteria documents of the eco-labelling schemes. According to Saouter et al (2001), it is difficult to allow a fair LCA-assessment (aquatic toxicity) of the environmental impacts of laundry detergents ingredients. This is because inventory data on a number of ingredients used in the laundry detergent is not available. The criteria documents of the included eco-labelling schemes have also a share of packaging related criteria aimed to; reduce the amount of packaging used to deliver a dose to the users. Again, in relation the result of an LCA, manufacturing of packaging raw materials only constitutes 0.4% of the total energy used in a laundry detergents life cycle; therefore, it is not linked to a large proportion of the environmental impacts. It is difficult to say something about other criteria; e.g. the possible relevance from an LCA-perspective that comes with following recommendations & standards to facilitate recyclability/reusability.

The ISO standard for this type of third party labelling prescribes that guidelines have to consider the entire life cycle of a product. For obvious reasons as described above criteria could not target all

relevant environmental aspects in the products life cycle. The methodology is also constrained to environmental aspects in the life cycle of the product where differences could be indicated among products. This is self-evident in this type of methodology since its purpose is to distinguish product (in the same product group) based on their environmental performance. Consequently, if differences in environmental impact are none or considered to insignificant, important aspects in the products life cycle could be left out. Although this is rarely the case, aspects where significant differences do exist, must also have potential for improvement. Ultimately, such an improvement potential must be manageable by means of eco-labelling.

The strictness of the criteria is where the eco-label methodology is imposed with another potential problem. Harrison (1999) and Rubik & Frankl (2005) define this problem as the “Optimisation problem”. The substance of the problem is that too strict criteria may act as a barrier to adoption of the eco-labelling scheme while criteria that are too easy to fulfil makes all products qualify without reformulation. Consumers may then well buy products bearing the logo, but in most cases they will be the same products that they bought before, and there will be negligible environmental benefit (Harrison 1999).

6.2 Direct impacts of the eco-label criteria

What we seen in the introduction-phase (when a products joining the eco-labelling scheme) is that some elements recurs; substitution of the surfactant LAS and optical brighteners are removed. LAS have been removed from eco-labelled products across all eco-labelling schemes. With optical brighteners the situation is almost the same with the exception that companies associate with the EU eco-label has not been impacted since optical brighteners are allowed. The SNCC (organisation behind GEC) initiated a study where they studied correlations with requirements in criteria and changes in type of chemicals used in chemicals consumer products (Laundry detergents included) on the Swedish market (Scandiakonsult 1999). They claimed that criteria of GEC (also Nordic Swan which has had similar requirements imposed) have impacted the phase out of certain chemicals, e.g. optical brighteners which is also supported by our results. Although this correlation clearly exists, one should be aware that alterations in product formulations could be taken for other reasons. To give an example, a manufacturer included in this study stated that they removed ingredients some years before joining the eco-labelling scheme (supported by product formulations). The action taken by the manufacturer has in this case been taken for other reasons than as a direct consequence of the criteria. The point being made, since an eco-labelling schemes could have had criteria that prohibit the use of this substance during a period of time it is tempting to say that a correlation exists between the criteria and the changes in the product. On the other hand one might argue that this manufacturer has begun to prepare its product in order to achieve the eco-label criteria. If this would have been the case it appears that criteria have not had any direct impact although criteria being the indirect reason for the change. In such case, our results could underestimate the impact of the criteria.

While every product were altered when joining an eco-labelling scheme the same frequency of impacts is not detected in the revision-phase; i.e. when already eco-labelled products must comply with stricter criteria. We have only found some scattered alterations made by a few manufacturers. Perfumes have been the target for the most of the alterations. Other manufacturers appear to have passed the revisions without making a change in their products. Here to, one might argue that some manufacturer has begun to prepare its product in order to achieve the next criteria to come eco-label criteria. This could be the case if there has been a dialogue between the manufacturer and eco-labellers. Of course we cannot rule out that some manufacturer for whatever reason have chosen to

not state such action as a direct impact of the criteria although it is. In such case, it could further underestimate our results.

As seen from the result, we distinguish impact of the criteria when possible reformulate their products when joining an eco-labelling scheme and through revisions of criteria. This is important to distinguish since these are two separate strategies for type 1 eco-labelling schemes to impact products environmental performance. This could also be somewhat deceptive for the distribution of stated actions in respectively phase. Since eco-label criteria are subject to “dynamisation” the content of each criteria within a particular eco-labelling scheme will continually be altered. Accordingly two similar products might experience different impacts depending on what point in time it joins a particular eco-labelling scheme. Accordingly, this means that one products stated impact when joins an eco-labelling scheme could be another ones impact due to revisions. Due to the anonymity of companies we has not had the possibility to state when the respectively manufacturer joined the eco-labelling schemes which had clarified this uncertainties impact on our results on our results.

The interviewee that has experienced revisions of criteria has with time stated that less action, if any, is taken for every revision. In this way the revisions becomes a way of ensuring that a product fulfils old requirements rather than imposing impacts of the products. The revisions function becomes more like a safety net ensuring that a manufacturer does not alter their product in the “wrong” direction. This poses a potential dilemma since the included eco-labelling schemes are marketing themselves as a way to continually improve the products environmental performance. Being just a safety net does not comply with this statement. It is important to point out that these are discussions related to one product group out of many that eco-label criteria exists and therefore one could not attempt to say anything of the potential for continual improvements in other product groups. However, this is not the same as saying that eco-label is not needed, in markets where only a limited share of product is labelled it will still remain to have a function because manufacturer outside the eco-label could chose to adapt to eco-label criteria.

Derived from the result presented in this study the question becomes what direct impact is reasonable to expect from type 1 eco-labelling schemes? Although we have seen impacts many segments of the criteria has not had any impact at all. One recurring segment across the included eco-labelling schemes is the criteria aimed to limit the quantity of ingredients/wash. This aspect is one that has aimed to promote compact laundry detergents. A potential direct impact would be if a manufacturer developed a compact laundry detergents based on the criteria. The reason why this has not have had any impact is that all manufacturers included in this study had already at the time of joining the eco-labelling scheme developed compact laundry detergents. This development is widely recognized to be a milestone in innovation for achieving environmental benefits in the sector of laundry detergent manufacturing and it appeared on a large scale before eco-labellers addressed it. With this in mind eco-label criteria have rather tried to conserve a particular type of powder-based laundry detergent since it has still existed those types of detergents that were not compact. This would send out a signal to consumers that eco-labelled products should be compacts rather than pursuing a direct impact to make producers develop new types of products. Other criteria segments are even more far fetched for the criteria to impact directly. For example the impact related to ensuring that that recommendations & standards facilitates recyclability/reusability are followed.

A criteria segment that attracted out attention in particular among the eco-labelling schemes was the GECs transport related criteria. This is more associated with transport in the company as a whole and might e fulfilled because other already planned improvements on a company-level is

taken. Being such a new criterion this means that the companies associated with GEC has given period of time in which to fulfil the requirements. Consequently, this could not have had any impact up to this point in time.

There are also some other reasons which can explain why the impact of criteria has not been greater. In theory we could have included manufacturers in our study that belongs to 30 % of the products having the best environmental performance in which criteria typically is based on. But if this was applicable, why have all included manufacturers more or less made the same alterations to their products? There are also criteria that manufacturers think of as fundamental to fulfil wheatear or not the criteria imposes it. For example, the surfactants alkylphenolethoxylates is not allowed according to eco-label criteria but has at the same time been prohibited to use by law requirements since 1989. These requirements could however not be seen as of anything related to what the eco-labelling want to achieve since one need to assume that such basic requirements are fulfilled anyhow. It would only function as a guarantee that eco-labellers have very aspects considered.

The fact that all empirical material is derived through interviews makes out some uncertainties since certain changes have being made in the products long time ago. For example, the point-based system (found in Nordic Swan and EU eco-label) has also made one manufacturer do small alterations in the levels of some ingredients in the product formulation. These have been minor alterations done long time ago and therefore have not been remembered. Another limitations is that one can not rule out that some manufacturers of various reasons has chosen to leave out information out making the impact of the criteria appear to be more insignificant that it actually is. These uncertainties could underestimate the direct impacts if the criteria. Our intention is not either to claim that we provide the complete picture of the impacts; rather this should be seen as examples that will add to the understanding of type I eco-labelling schemes potential to impact the environmental performance of laundry detergents.

6.3 Options for the future

The main emphasis in the eco-labelling schemes criteria system has been placed on limitations and substitution of ingredients based on their inherent properties. The effect of having a substance substituted to one with, e.g. better biodegradability could be considered an achieved improvement of the products environmental performance regarding that aspect. One risk that could limit the methodology in its potential to improve the overall environmental performance is to pay too much attention to details and lose sight of the overall environmental performance, i.e. risk for sub optimization.

Risk assessment has been hailed by the industry to assess ingredients environmental burden. This methodology compares an ingredient's ecological effects to its estimated exposure concentration in the environment, in order to ensure that those concentrations are well below levels that could cause harm. In this way, small amount of such substance considered not ok from an inherent property perspective could be allowed if it could be linked to other indirect enhancements in the products environmental performance. In such case the flexibility of the eco-labellers to not only considers an inherent property is crucial for attaining overall improvements in the product environmental performance.

Improvements of the environmental performance of products must also be broadened outside the scope of one particular type of product within the product group of laundry detergents. In the product group of laundry detergents major improvements of its environmental performance has

occurred through the introduction of new types of laundry detergents. For example, the introduction of laundry detergents in the form of tablets has the environmental benefit that it offering more certainty in dosage for optimum results resulting in less use of chemical (Unilever 2000). Although tablets also have major environmental benefits criteria document is not constructed to grant licensees of such type of laundry detergents. Fortunately, eco-labellers have showed a willingness of flexibility here too. For example, Nordic Swan has an initiative called “Environmental pioneers” that have been formed to be able to quickly if they are convinces of that product environmental benefits grant them to be eco-labelled. In this way the whole procedure of constructing criteria does not need to first be undertaken and the environmental benefits could quickly be signalled to the consumer of the environmental benefits of a certain type of laundry detergent.

7 Conclusions

We have seen that type I eco-labelling schemes have had a direct impact on the ingredients used in the product formulation and to a lesser extent its packaging. Noticeable are that nearly all companies when joining an eco-labelling schemes has taken two similar actions; substituting the surfactant LAS and that they removed optical brighteners. This reflects that there are great similarities how each eco-labelling scheme during the years have defined environmentally friendlier laundry detergents in its criteria. Our result support the claim made by other studies that there are a direct impact between eco-labelling criteria and reduction of certain chemicals. We have also identified uncertainties that could underestimate the direct impacts if the criteria. For example, the interviewees might not remember every impact that the criteria has had, especially those that where made a long time ago. There are manufacturing companies not part of our study, still having eco-labelled products which could have stated alternative actions taken. Our intention is not either to claim that we provide the complete picture of the impacts; rather this should be seen as examples that will add to the understanding of type I eco-labelling schemes potential to impact products and in particular, laundry detergents.

The result also point out criteria categories that have not had any direct impact at all on powder-based laundry detergents. Many obvious reasons for this exist. For example, limit the quantity of ingredients in relation to a wash. As it appears, this would rather be required to send out a signal to consumers that eco-labelled products should be compacts rather than pursuing an objective to achieve a direct impact, e.g. altering their laundry detergents.

The strategy of continual improvements by revising criteria seems not to have had that much of an impact. The most impacts have been associated with alterations in the perfumes. In the light that many companies have been part of several revisions scattered over longer period of time (depending on the eco-labelling schemes in which they are associated with) this strategy seem not to have proven that functional within this product group. Our impression is that revisions of criteria (for those companies being part of an eco-labelling scheme for longer period of time) become a way of ensuring that a product fulfils old requirements rather than continually introduce new relevant. In this light, the eco-label function becomes more like safety net ensuring that a manufacturer does not alter their laundry detergent in the “wrong” direction. Considering methodological constraints (optimisation problem etc.), the fact that product must maintain its function, and, be able to impose criteria that improves the environmental performance of the products, the objective to support continual improvements seem not easy achievable.

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EU eco-label

- 95/365/EC: Commission decision of 25 July 1995 establishing the ecological criteria for the award of the Community eco-label to laundry detergents:
- 1999/476/EC: Commission decision of 10 June 1999 establishing the Ecological Criteria for the award of the Community Eco-label to Laundry Detergents
- 2003/200/EC: Commission decision of 14 February 2003 establishing revised ecological criteria for the award of the Community eco-label to laundry detergents

Good environmental choice

- "Miljökriterier för hushållstvättmedel" (Miljökriterier nr 2), Naturskyddsföreningen (1990)
- "Miljökriterier för hand och maskintvättmedel" (Miljökriterier nr 7), Naturskyddsföreningen (1991)
- "Miljökriterier för tvättmedel", Naturskyddsföreningen (1995)
- "Tvättmedel, fläck och blekmedel 2002", Naturskyddsföreningen (2002)
- "Bra Miljöval kriterier – Kemiska produkter", Naturskyddsföreningen (2006)

Nordic Swan

- "Miljömärkning av tvättmedel för textilier" – Standardiseringskommissionen i Sverige (1992)
- "Miljömärkning av tvättmedel för textilier" – Standardiseringskommissionen i Sverige (1994)
- "Miljömärkning av tvättmedel för textilier", Nordisk miljömärkning (1995)

- *“Miljömärkning av textiltvättmedel”*, Nordisk miljömärkning (2001)
- *“The Swan-labelling of laundry detergents and stain removers”* Nordic Environmental Labelling (2006)

Abstract

As with every environmental policy instrument it is applied to achieve certain objectives. The key objective of Type 1 eco-labelling schemes is to realise environmental gains related to products. Unfortunately the evidence available of the performance of many environmental policy instruments is very incomplete; type 1 eco-labelling schemes are not an exception. This deliverable is part of a research-project where we focus on the impact of type I eco-labelling schemes to improve products environmental performance. Two directions have been hailed as means to achieve this; when manufacturers possibly reformulate own products when adopting eco-label criteria; and when already eco-labelled products are given revised (more stringent) criteria that must be lived up to. The main focus of this research will be to assess the impact of the aforementioned strategies on products in a time perspective (since revisions of criteria occur typically every third year). Have these strategies of type I eco-labelling schemes proven to be functional, i.e. have they had any impact? Secondly, have the eco-labelling schemes impacted the products in a way that improves the overall environmental performance? I.e. assure that environmental performance has not been sub-optimized etc.

The impact that the eco-label criteria of type 1 eco-labelling schemes have had to improve products environmental performance could not be given a generalized answer considering the great number of product groups for which eco-label criteria has been developed. To get a manageable research project, but still able to say something about the impact of type 1 eco-labelling schemes more generically, we chose to include two product groups (paper products, laundry detergents), for which three different Type 1 eco-labelling schemes (EU eco-label, Good environmental choice, Nordic Swan) have developed eco-label criteria. Each product group has been subject for a case study. The purpose for each case study has been to identify the impacts that type one eco-labelling schemes has had on the environmental performance of the product groups. In this deliverable we present one of these case studies, laundry detergents.

ENTWINED's objective is to provide scientific knowledge and tools to support Swedish and other stakeholders in integrating environmental aspects into the international trade regime. More information on our research programme is available online at www.entwined.se

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