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Quality and integrity in food: a challenge for chain communication and transparency research

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D 4.1: State of the art on information use in food chains with relevance for environmental concerns

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D4.1 State of the art on information use in food chains with relevance for environmental concerns

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Authors	Karin Östergren (SIK) Ulf Sonesson (SIK) Katarina Lorentzon (SIK) John Hermansen (AARHUS)
Editing	UBO, Germany
Version and date	V1 / 17 December 2010
Approved by	Prof. Dr. Schiefer, Gerhard (UBO) PD Dr. Fritz, Melanie (UBO)

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EXECUTIVE SUMMARY

Transparency within the food sector is of crucial importance to the development of the food sector. This report provides a state of art on existing information use in food chains with relevance for environmental concerns together with appropriate background information on the environmental impact of food production and initiatives taken.

Environmental impact “history” cannot be measured in a product. Thus the traceability of environmental data must be secured all along the process in order to obtain transparency. Transparency for environmental impact relies on a proper and transparent communication along the food chain, business to business as well as business to consumer. To get an overview a large number of instruments relevant for the communication of environmental concerns were examined.

It is noteworthy that standards and methodologies are generally very recently developed. There are basically three major foci; those that relate to good farming practice, those that relate to organic farming and those that relate to climate labelling.

A number of schemes were selected for a more detailed examination based on a combination of hierarchy to cover different approaches and levels of legal status. These schemes were: Bio Suisse, Coop Änglamark, EU regulation on organic production, Union Eco Flower, EMAS, ISO 14001, Environmental Product Declaration (EPD) according to the International EPD System, Environmental reports (SE), Global G.A.P. (environmental issues), MSC Fishery Standard Principles and Criteria for Sustainable Fishing, Svenskt Sigill, Approved by Climatop, L'indice carbone (Casino), Max climate declaration, GWP information from E Leclerc, PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services, WBCSD/WRI GHG Product Protocol - the Product Lifecycle Accounting and Reporting Standard and the Scope 3 (Corporate Value Chain) and Svenskt Sigill climate certification.

The major conclusions so far are summarised below.

Today, environmental performance is commonly assessed/accomplished by different *process-oriented approaches*. The development of major standards as Global G.A.P. and the harmonization of national standards with major standards as EU organic are important as they lead to conformity in the information flow which facilitates transparency.

Environmental information from many systems is not openly accessible, but kept by either producing companies or by certification organizations. Criteria may be open, but the result from an audit or certification process is seldom open. A particular complication with respect to transparency is when standards e.g. Global G.A.P uses different levels of compliance criteria (e.g “Major Musts” “Minor Musts” and Recommendations).

Environmental impact data, when quantified, are generally based on a very large number of data that are classified and weighted to describe the potential impact for a given environmental category (e.g. Resource utilization, Green House Gases Acidification etc) according to given rules (LCA ISO14040, 14044). Background data are provided in some cases but only to a certain level of detail. In addition the system boundaries have a great

impact on the analysis. Thus a reported value, e.g. the amount of greenhouse gases (GHG) associated with a product, needs to be supported by a large amount of data and meta-data to be fully transparent. The development of common and harmonised calculation rules for a specific product group, so called Product Category Rules (PCR), would probably facilitate transparency.

Environmental data are often calculated as an average, from a number of farms, a country or region and sometimes also for an average of several years. *Hence the information as used in product-oriented approaches today is generally aggregated and can rarely be used to distinguish between similar products.*

Manufacturing Operation Systems (MOS), linking the processing with the business systems and initiatives like the SCORE- model linking business processes and supply chain, may be key factors for developing systems for more segregated environmental information, thus creating options for increased transparency.

An important factor for achieving transparency is the *achievement of consensus on how to communicate environmental information*. As consensus is reached indicators can be defined and a standardised way of collecting information can be set up. Good examples for creating consensus are the European Food Sustainable Consumption and Production Round Table initiative and the development of *open access databases* e.g. International Life Cycle Database (ILCD).

Besides the established schemes examined there are numerous of ongoing activities that may greatly influence the future transparency of environmental information along the food chain.

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LIST OF ABBREVIATIONS

ADEME	French Environment and Energy Management Agency
CC	Cross Compliance
CDP	Carbon Disclosure Project
CSR	Cooperate Social Responsibility
DG ENV	Directorate General Environment
DG SANCO	Directorate General for Health and Consumer Affairs
EMAS	Eco-Management and Audit Scheme
EMS	Environmental Management System
EPD	Environmental Product Declaration
FAO	Food and Agriculture Organization of the United Nations
GEDnet	Global Type III Environmental Product Declarations Network
GHG	Green House Gases
GM	Genetically Modified
GMO	Genetically Modified Organisms
GWP	Global Warming Potential
IEC	International EPD Consortium
IEC	International Electrotechnical Commission
ILCD	International Life Cycle Database
ISO	International Organization for Standardization
JRC	Directorate-General Joint Research Centre
KPI	Key Performance Indicator
LCA	Life Cycle Assessment
LRF	The Federation of Swedish Farmers
MOS	Manufacturing Operation Systems
MSC	Marine Stewardship Council
MSCI	Marine Stewardship Council International
NGO	Non -Governmental Organisation
PCR	Product Category Rules (in relation to e.g. an EPD)
PDO	Protected designation of origin
PGI	Protected geographical indication
QMS	Quality Management System
SCOREmodel	Supply Chain Operations Reference model
TSG	Traditional speciality guaranteed
UNEP	United nations environment programme
WBCSD	The World Business Council for Sustainable Development
WRI	World Resources Institute

1. INTRODUCTION

The growing environmental awareness has raised a demand for information on environmental and eco-system impacts from food products along with information on contents, nutritional value and social and ethical aspects. To create a transparent food chain is a challenge due to the complexity of the food chain and the dynamics of the focus of what information consumer consider as relevant for the moment of time. To be able to improve transparency and develop tools for transparency which are able to adapt to changes in societal and consumer focus it is necessary to understand this complexity of the food system as well as the background of actions already taken.

As a *background* for suggesting innovations in order to improve transparency of environmental impacts related to food in future, it is the objective of this work to provide a state of the art on existing information use in food chains with relevance for environmental concerns together with appropriate background information on the environmental impact of food production and initiatives taken.

2. THE EVOLVEMENT OF AN ENVIRONMENTAL CONCERN

The awareness of the environmental impacts from food production systems has evolved over time. Starting in the early 1960-ies the concerns were mainly over local effects such as nitrate in drinking water and eutrophication of local streams caused by nitrogen and phosphorous leaching from farm land. Another example of early concerns about agricultures' environmental impact was the direct effects of biodiversity, notably birds, which was brought to the public mainly by Rachel Carsons book "Silent Spring" which dealt with the rapidly decreasing populations of singing birds in the agricultural landscape as a result of the use of different pesticides. Over time the focus has shifted in many directions; the increasing oil-dependency in the 1970-ies, the large scale eutrophication of lakes and seas, emissions of ozone depleting substances from refrigeration and the issue of food transports and packaging mainly in the 1980-ies. In recent years the climate issue has risen to the top of many agendas, public, private as well as corporate. At the beginning of this process the focus was more or less only on use of fossil energy, but as knowledge developed it was realised that food production contributes significantly to global emissions of greenhouse gases (GHG), perhaps the most prominent contribution was the FAO-Report "Livestocks long shadow" (Steinfeldt et al., 2006), but a number of research reports has been published on the same subject. Lately the interests have been more balanced, including not only climate change, but also the effect of pesticide use, land use (including deforestation), water use and depletion of phosphorus.

Analysing environmental impact from food production requires a systems approach; food supply chains are complex and environmental impact at one node in the chain is often affected by activities in another node. Moreover, the range of different environmental impacts needs to be covered simultaneously, it is not sufficient to look at just possibilities to reduce GHG emissions, since it might lead to a worse situation for other impacts, as pesticide use. The most wide-spread method used is Life Cycle Assessment (LCA), but there are related methodologies as ecological foot printing which also have gained interest. Both approaches

use similar approaches in making the inventory of the production system, what differs is mainly how the results are calculated and presented. In the following report we mainly use LCA as a knowledge basis. A “classical” LCA provides a snapshot of the environmental impact from a product, from production of raw materials, through agriculture, transports, processing and preparation, also including production and waste management of packaging material. For a general overview of LCA in the food sector we refer to Sonesson et al. (2010).

Results from LCA studies can be, and has been, used as decision support both within business and in the political arena. Some environmental labelling schemes are based on life cycle insights and thinking but not all. However, LCA has so far mostly been used for mapping purposes, hence knowledge building. More recently LCA methods and data have been incorporated into tools and methodologies aimed at improving present production systems (e.g Johansson et al, 2008.). By combining traditional production modelling with environmental data on products and processes derived from LCA-studies food producers can improve the efficiency in their production while simultaneously reduce the environmental impact per product. The same approach can also be applied in food chains, not only production units, which open up possibilities for even larger improvements, both economically and environmentally. Generally the focus in environmental awareness and research in the food sector has moved from mapping and understanding the environmental impacts of products towards improving the production both in short and long term, and including a broader range of aspects such as economy, food safety and quality. Another observation is that food chain actors as industry, retail and authorities interact in the research and development more actively which is a prerequisite for the research to focus on things possible to do in the short term and at the same time involve industry in approaching the long term grand challenges. For an overview within Carbon Footprinting see Bolwig and Gibbon (2009) and Ernst &Young and Quantis for the European Commission DG Environment (2010).

3 ENVIRONMENTAL IMPACTS IN THE FOOD CHAIN

As mentioned in the Introduction, a life cycle approach is needed when identifying and implementing environmental improvements in food systems. LCA has proven to be a powerful tool, even though the method is still under development. In the following sections a short review of the environmental profiles of different food product groups is presented.

Food chains around the world account for very large shares of the total impact on some of the most serious global environmental problems. According to Rockström et al. (2009) three areas of environmental degradation closely associated to food production have already gone beyond what can be considered safe limits, and these are; loss of biodiversity (loss of species), global nitrogen flows, and emissions of greenhouse gases. The food system is responsible for 20 to 30% of all emissions of greenhouse gases, and is the dominating user of chemically synthesised nitrogen, which causes disruptions in ecosystems by eutrophication of waters and soils. Agriculture is the absolutely dominating land use and the dominating driver for deforestation and transforming permanent grasslands into arable land. So the loss of biodiversity is obviously strongly connected to food production. For resource use, food production is the largest user of fresh water and a significant user of energy. Finally, food

production is the dominating user of phosphorous, which is a limited and definitely essential element for all living organisms.

3.1 Foods' Environmental Impact

Food production systems as a group are very heterogeneous, the range of products is huge and production systems vary within product groups as well. However, there are some common traits. We will elaborate this by going through different products groups and their impact from primary production, covering all environmental impacts for that group. Then a description of post-farm and post-fishery/-aquaculture activities is given, the reason being that in those stages the differences are not between raw materials but more on other aspects across product groups. In agriculture the environmental impact is often dominated by emissions from biological processes in soil, from manure and animals, and it also has a range of impacts such as eutrophication, pesticide use and biodiversity loss. There are also large differences between production regions and also between years. This makes environmental impacts from agriculture difficult to measure and control. For post farm links in the chain impacts are mainly connected to energy and water use, effluents, waste of raw materials and methods for waste management or upgrading. For some products packaging and transport can contribute significantly to the products total environmental impact.

A very general statement is that animal products have the biggest environmental impact, vegetable lower and seafood are extremely diverse in level of impacts. Moreover, primary production is the most important step for at least animal products but is also important for vegetable products. Later steps, processing, packaging and transports, are often of less importance, but there are many exceptions.

3.2 Primary production of animal products

Environmental impact from animal products is generally dominated by the agricultural phase. This is a result of that a relatively large amount of feed is used per kg of meat or milk produced. Hence feed production is important, both for resource use and all emissions. Most greenhouse gas (GHG) and eutrophying emissions, impact on biodiversity, water and land use as well as use of pesticides are dominated by feed production. Obviously feed conversion efficiency is critical for the final impact of products, as well as how manure is managed. When it comes to emissions of greenhouse gases, there is one important exception. For ruminants (cattle, sheep) methane (CH₄) is often the dominating greenhouse gas, being produced during feed conversion in the rumen of animals. At the same time this is the prerequisite for ruminants' ability to utilise roughage feeds as grass which in turn make ruminants valuable for utilising resources otherwise not available for food production.

Food production generally demands land, animal products need more land per kg product than plant products, since a lot of feed production is required for animals. Fertile land is a scarce resource. Hence a high land use per unit food produced, i.e. low yield, is negative even if the direct emissions per kg product are low. This is a result of the fact that if the yield were higher the land could have been used for alternative production such as biofuels or forest. Hence, how land is managed is also important for the environmental impact of food products. A severe impact of food production and the connected land use is deforestation. In a report from FAO (Steinfeldt et al., 2006) around one third of the 18% of GHG's allocated to animal production is due to emissions caused by deforestation, especially in developing countries. A large share of global deforestation is driven by need for more arable land.

The environmental impact of primary production of seafood differs a lot from other animal foods. For wild caught fish the most important aspect is the energy use for the fishing vessel. This varies very much between fishing methods and fishing gear which in turn depends on how the species caught lives; school-forming pelagic fish as herring or anchoveta can be caught very energy efficiently, whereas species living more dispersed and close to the seafloor as flatfish and cod requires more energy intense fishing methods. The most energy efficient methods deliver some of the most environmentally efficient animal protein, but at the other end we find some of the most environmentally demanding ones. Another specific aspect with seafood is the discussion of overfishing which leads to depleted stocks. Other important aspects are leakage of refrigerants from cooling equipment on-board ships and use of anti-fouling agents on hulls. For farmed fish the situation is similar to that of poultry and pig production; the feed represents the dominating contribution to environmental impact. In addition there are issues with local effects as emissions of organic matter and nutrients, escapes of fish and parasites and diseases transferred from farmed to wild fish. It should also be mentioned that farming of carnivorous fish as salmon and cod requires a large share marine-based feed. Hence, also fish farming is connected to the discussion of overfishing of the oceans.

3.3 Primary production of vegetable products

Environmental impact from primary production of vegetable products is mainly driven by the following aspects; yield per hectare, fertiliser use per kg produced, energy use in farming and finally pesticide use. The emissions from grain production are fairly well investigated. Even though there are some differences in the impact between different grains, mostly depending on the yield level, there is a common pattern of the most important aspects when it comes to environmental impact. First, the production and application of nitrogen fertiliser is a very important contributor to the overall impact. Production of nitrogen fertiliser generates fossil CO₂, but also nitrous oxide. Secondly, the use of diesel for agricultural operations (ploughing, harvesting etc) and for drying the grain results in CO₂ emissions. Rice is a special grain crop in the sense that most of it is grown in paddy systems, where the land is flooded part of the growing season. This gives rise to emissions of methane which is a greenhouse gas, and in turn gives a significantly higher “carbon footprint” for rice than for most other grains.

Pulses are efficient sources of protein compared to animal protein, i.e. they do not require the same amount of inputs per kg protein as compared to the inputs required to produce 1 kg of animal protein. Pulses’ ability to fixate nitrogen from air means that only small, if any, nitrogen fertiliser is applied in the cultivation, which often benefits the environmental profile of these products. Potatoes and tubers as well as most fruits and field grown vegetables are efficient in the cultivation, since the yield level is so high per hectare, resulting in low emissions per kg product. However when producing these types of products, pesticide use can sometimes be high. For protected cultivation in greenhouses the energy use for heating the greenhouse is critical; if fossil fuels are used it will dominate the GHG emissions, and also contribute to acidification and use of fossil resources.

3.4 Industrial processing

A large share of food products are processed to some extent. Reasons for processing are to increase digestibility, preservation and also to enhance taste and texture. Processing requires energy and water and can cause large emissions of nutrients causing eutrophication. In general the main issue is related to energy use and wastage, but there are many exceptions.

Within food industry there are large opportunities to reduce energy and water use and wastage by technology but also by more efficient management. How a product is processed and packed often affect down-stream activities as storage and preparation in retail and households. It might also affect demands on raw materials; hence affect how primary production is performed. It is important to consider this when assessing environmental impact of food processing; it needs to be analysed in a food chain perspective and not only from a food processing plant perspective.

3.5 Transports

The food sector is transport-intense; a lot of inputs to food production as well as food products themselves are transported in large volumes and sometimes long distances. This can sometimes be of great significance for the total life cycle GHG emission of a product, but often transports contribute relatively little in a life cycle perspective. There are some important aspects when discussing transports. One thing is the transport mode, what type of vehicle is used. For some high value, perishable foods airfreight is used, but for most foods truck, rail or sea transport is the most common. These transport modes differ significantly in energy intensity and hence in GHG emissions. The GHG emissions per ton*km for different transport modes vary more than 20-fold between air freight and trans-oceanic ship. This is still a simplification, for many reasons. Foods often need refrigeration which increases the use of energy and also introduces leakage of refrigerants into the GHG emissions equation (refrigerants are often high in climate impact). Foods are often, but not always, high volume goods, so the maximum load is not determined by weight but by volume. Therefore, fewer tons can be transported by one truck, which increases the emissions per ton*km. Finally, distribution of foods from warehouses to retail stores are often less energy efficient, due to slow driving with a lot of stops combined with low load factor. The last link in the transport chain, between retail stores and households are probably the least efficient, at least for industrialised countries where a significant percentage of these transports are performed by car.

3.6 Food Wastage

Food is wasted in all nodes in the food chain. Data on what percentages of food being wasted in different parts of the world are scarce, no overview has been found. According to Stuart (2009), who summarised a vast volume of data from literature combined with own investigations, the possible savings amount to 33% of global food supply, meaning that 33% of food produced is avoidable waste, globally. Reasons for wastage differ: many foods are perishable by nature, which in combination with poor co-ordination along the supply chain, inadequate packaging and storage conditions, important storage in retail to prevent empty shelves and finally consumer's lack of meal- and purchase planning generate waste. In agriculture most wastage is due to harvest and storage. In industry food is wasted due to cleaning but also production planning, which in turn depends on lacking coordination along the supply chain. Since some food products carry a heavy "environmental backpack" when entering the industry (notably products of animal origin), reduced wastage is often the most efficient improvement potential for food industries. For food of animal origin the wastage might not be as important as primary production on a per kg base, but vegetable products, especially vegetables and fruit show large losses, and the waste management might cause considerable emissions. If food waste is being put into landfill large quantities of methane is formed.

3.7 Retail

The retail sector's direct impact on total life cycle environmental impact is often limited. In retail, energy use, mainly for freezers and refrigerators, and refrigerant leakage are the most important sources for direct emissions, but probably more important are the emission caused by wastage in the sector for reasons mentioned above. The retail sector also has an extremely important role in the coordination of activities in the food chain and in the selection of products offered to the market, being placed between the consumers and producers.

3.8 Packaging

Food packaging is often thought of as detrimental for the environment, with excessive use of plastics and paper. However, packaging has important roles to play in the food chain; it protects the food thus keeping it safe and healthy. But packaging also reduces wastage, which is very important from an environmental point of view, and packaging can be used to transform information along the supply chain which facilitates efficiency improvements. What type of packaging being used influences the transport efficiency since it has its own weight but it also affects the weight/volume ratio of the product. So, the environmental impact of packaging is a trade-off between the positive functions (reduce wastage, facilitate communication) and the negative impacts (increased volumes and weight to transport, emissions caused by production and waste management of packaging materials).

3.9 Consumption

The most important impacts from the consumer stage in the chain, as already mentioned, are wastage and home transports. But cooking can also be an important contributor to total life cycle emissions and resource use, especially for vegetable products (with low emissions in earlier stages) that require long boiling times.

3.10 Summary of food's life cycle environmental impact

- Products of animal origin cause more environmental impact than do vegetable products.
- Agricultural emissions are largely caused by biological processes (animals, soil, and manure) and production of fertilisers.
- Emissions from post-farm stages are mainly driven by energy and are smaller, but there are important exceptions.
- Seafood is a very diverse group, ranging from very low to very high environmental performance.
- Wastage along the food chain is an important aspect for environmental impacts of foods.
- Products that are transported by air generally have a high climate impact.
- The last step in the chain, consumers, can have large life cycle impact from transports with private cars, home-storing and cooking.

Of course the statements above are very coarse generalisations with numerous exceptions, but they can serve as rules-of-thumb. It should be emphasised that the very important issue of biodiversity is poorly covered by the above list.

4. TRANSPARENCY AND ASSESSING TRANSPARENCY

Transparency in the food chain aims towards providing everybody with stakes and interest in the food production and food consumption with relevant information for making informed decisions on an objective basis. (Transparent Food Deliverable D7.2)

The scope of the concept transparency within the food chain is gradually increasing to respond to society's and consumers' demands for addressing environmental, ethical and social concerns. This development thus reaches beyond traditional food safety and quality attributes and will become even more dominating in the future. It is the objective of D4.1 to identify information that relates to environmental impacts of actions and processes in the food chain and to evaluate how existing information is used in food chains in the context of transparency.

The definition of Transparency applied in the current work is:

“Food Transparency is concerned with the forms and flows of information and access to the information about 1.the food chain practices relating to the food product and 2. the final composition, characteristics (and history) of the product”

5. TRANSPARENCY INSTRUMENTS

Environmental impact “history” cannot be measured in a product. Thus the traceability of environmental data must be secured all along the supply chain to obtain transparency. This is a major difference from e.g. health claims based on composition and to some extent food safety claims that can be confirmed by direct measurements. Even though the authenticity of a claim regarding the origin of a food product can be checked by e.g. the isotope ratio, this can still not be used as a measure of the environmental impact. Consequently, transparency for environmental impact relies on accurate and transparent information flow along the food chain, business to business as well as business to consumer.

5.1 Screening for transparency instruments

A large number of instruments relevant for communication of environmental concerns and/or environmental performance, both from industrial and/or agricultural activities and processes and from products and services were screened from a European perspective. The result is found in Appendix 1.

It is noteworthy that standards and methodologies are generally very recently developed. There are basically three major foci for the schemes; those that relate to good primary production practices, those that relate to organic production and those that relate to climate labelling and/or carbon footprinting. Environmental management systems contribute less to transparency since they do not specify any level of environmental performance.

Regarding “good agricultural practice types of schemes”, the schemes certify that the production to a large extent follows legal rules and regulations and other criteria for good agricultural practices – the benefit from the transparency point of view being that farms and

businesses are routinely inspected to certify compliance with the requirements. In addition a learning element is included aiming at constantly improving practices. Many schemes relating to good farming activities are based on/partly based on the GLOBAL G.A.P standard. In a similar way the MSC Fishery Standard states criteria for sustainable fishing.

Regarding organic agriculture the production has to follow certain practices and criteria where some (otherwise legal) production techniques are not allowed. A particular feature is that no substance can be used as input unless explicitly approved – i.e. only those appearing on a positive list. Provisions for organic production, labelling and control are laid down in the EU regulations EC 834/2007 and EC 889/2008.

In contrast to the schemes that relate to good agricultural practices and organic production, that are based on compliance with specific criteria, the carbon foot printing approach is an attempt to for individual businesses to quantify and communicate the actual greenhouse gas emissions caused by the production. However, one example of criteria based climate labelling scheme has been found (Svenskt Sigill Climate Certification Scheme).

Criteria for PDO (Protected designation of origin), PGI (Protected geographical indication), and TSG (Traditional speciality guaranteed) were initially looked into. It was concluded that neither of them is useful for communicating environmental aspects.

5.2 Selected schemes serving environmental transparency

A number of schemes were selected for a detailed examination based on a combination of hierarchy to cover different approaches and levels of legal status. Table 1 presents an overview of these schemes. Although the Product Life Cycle Accounting & Reporting Standard and Scope 3 (Corporate Value Chain) Accounting & Reporting Standard from WBCSD/WRI are still under development, available information and existing draft are used as a basis for the assessment below.

Table 1 Overview of the schemes evaluated

	Year of origin	Origin	Primary aim (as defined in the scheme)	Secondary aim (s) if relevant
Bud label	1981	The Association of the Swiss Organic Agriculture Organisations (Bio Suisse).	The "bud" label stands for natural diversity on the organic farm, ethologically sound livestock management and feeding, no use of chemically synthesized pesticides or fertilizers, no use of genetic engineering, no use of unnecessary additives such as flavourings and colourings, non-aggressive processing of foodstuffs and inspection of organic production and processing. <i>Explicit aims of the scheme cannot be found.</i>	
Coop Änglamark	1991	Sweden, KF (Kooperativa förbundet), owner of Coop	Änglamark is Coop's private label brand for organic products and environmentally labelled products. Coop's objective is to be a leader in	

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	Year of origin	Origin	Primary aim (as defined in the scheme)	Secondary aim (s) if relevant
			sales of ecological and environmentally labelled products on the Swedish market.	
Euro-leaf	1991	EU regulation on organic production , the European Commission	The aim is to harmonise the legislation of the member states and define what organic production is and protect labelling of organic product from fraud	
Union Eco Flower	1992	EU (the European Commission)	To encourage businesses to market products and services that is better to the environment.	
EMAS	1993 (operative since 1995)	EU (the European Commission)	Evaluation, management and continual improvements in the environmental performance of companies and other organisations	
ISO 14000 series	1996	International (International Organization for Standardization)	To enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. It does not itself state specific environmental performance criteria. (www.iso.org . (accessed October 2010))	
Environmental Product Declaration (EPD) according to the International EPD System	Late 1990s	Sweden, The EPD system was initiated by the Swedish government and Swedish industry in the late 90s. Since March 2007, the system is international, managed by the International EPD Consortium	The overall goal of an Environmental Product Declaration, EPD, is to provide relevant, verified and comparable information to meet various customer and market needs.	The international EPD®system has the ambition to help and support organisations to communicate the environmental performance of their products (goods and services) in a credible and understandable way.
Environmental reports (SE)	1999	Swedish Government	Show compliance with given permit. Strengthen the business self-monitoring program. Basis for control. Basis for international reporting	

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	Year of origin	Origin	Primary aim (as defined in the scheme)	Secondary aim (s) if relevant
Global G.A.P. (environmental issues)	2007	Euro-Retailer Produce Working Group British retailers in conjunction with European supermarket were driving forces (EUREPG.A.P. late 1990).	To regulate product safety, environmental and labour conditions PRE FARMGATE. One harmonised standard.	
MSC Fishery Standard Principles and Criteria for Sustainable Fishing	2002	Marine Stewardship Council. The MSC environmental standard was developed following an international consultation with stakeholders between 1997 and 1999.	The mission is to use an eco label and fishery certification program to contribute to the health of the world's oceans by recognising and rewarding sustainable fishing practises, influencing the choices people make when buying seafood, and working with partners to transform the seafood market to a sustainable basis.	
Svenskt Sigill	2003	Sweden. Sigill Kvalitetssystem AB, owned by the Federation of Swedish Farmers (LRF).	The purpose of the label is to simplify for consumers to make informed choices and thus to contribute to develop the consideration for human beings, animals and nature of Swedish agriculture (in order to make it cleanest in the world).	Five promises: 1 Safe food, 2 Animal welfare, 3 Environmental responsibility through resource efficiency, 4 Open landscape, 5 Certified products
Approved by Climatop	2008	Climatop, Switzerland; The two non-profit organisations Ökozentrum Langenbruck and Myclimate created the idea of the label and decided to found a independent non-profit organisation	Assists customer's decision making for a climate friendly product.	
L'indice carbone (Casino)	2008	Casino, France (retail company)	Carbon footprint	
Max climate declaration	2008	Sweden	To reduce the business overall impact on climate by driving the consumers toward a more climate friendly choice.	Based on the data the overall impact by Max can be calculated and based on this information, Max climate compensates by

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	Year of origin	Origin	Primary aim (as defined in the scheme)	Secondary aim (s) if relevant
				planting trees in Africa.
GWP information from E Leclerc	2008	E Leclerc, France (retail company)	The primary objective is to help customers to reduce the GWP from shopping.	The primary objective is to reduce the contribution from food to climate impact.
PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	2008 (In review 2010)	UK, British Standards Institute, Defra, developed by the Carbon Trust	Reduce GHG emissions. Enhancing business	Incite producers to participate in a competition for production techniques with reduced GHG emissions
WBCSD/WRI GHG Product Protocol - the Product Lifecycle Accounting and Reporting Standard and the Scope 3 (Corporate Value Chain)	2010 - 2011?	World Resources Institute & World Business Council for Sustainable Development	Standardised methods for reporting GHG emissions for products and for companies, including up- and downstream activities.	
Svenskt Sigill climate certification	2010	Sweden. A Swedish initiative was started in 2007 by KRAV and Swedish Seal (Svenskt Sigill) in order to develop a climate certification for the food chain. Currently, the project is managed in cooperation with several major Swedish food companies:	The purpose is to create a certification system, which will reduce the negative climate effects in food production and give consumers a chance to make a conscious climate choice as well as strengthening the competitiveness of the food producers.	

Coverage

The geographical coverage of the schemes are summarised in Table 2 and the economic coverage are summarised in Table 3.

Schemes with an international reach include ISO 14000 series of standards, Global G.A.P., the PAS 2050 standard, the MSC standard, the International EPD® system as well as the WBCSD/WRI GHG Product protocol and the label Approved by Climatop. On the European level there are the Eco-leaf (regulations on organic production), the Union eco flower and the EMAS standard. Then there is a number of national eco labelling and GHG labelling initiatives as well.

Generally, the process-oriented schemes have been in place longer and are thus more widespread than the product-oriented schemes (Table 3). Global G.A.P is the world's leading pre-farm gate scheme with nearly 100000 certified producers in more than 100 countries. The ISO 14001 is implemented in 155 countries and the growth rate 2008 was about 35000 new certificates a year (all type of organisations). About 200 food and drink companies of totally 4500 organisations have an EMAS registration. The MSC standard covers about 200 fisheries worldwide. The National Schemes Bio Suisse has 5700 farmers' registered and Svenskt Sigill 4000 farmers.

Although the great focus on climate labelling, generally few products are labelled. The most successful initiative so far is the Carbon Reduction Label (based on PAS2050), which passed a value of £2 billion 2010¹. E Leclerc carbon label comprises 20000 food items while Casino has about 100 product labelled. The International EPD register include only 12 food products of totally 100 (approx) and Climatop covers 3 certificates valid for 8 food products. (Table 3)

Reach

A scheme could be used for business to consumer communication) or business to business communication, business internal and societal/ legislative, the latter referring to schemes e.g. aimed at reporting to authorities. According to Table 4 the majority of the schemes are aimed for business to consumer communication. ISO14001, EMAS, Global G.A.P. and WBCSD/WRI cover the business to business level of the chain. The Environmental reporting is the only example having legislative reach (Table 4).

Table 2 Geographical coverage

	National. Specify	European	International
ISO 14000 series			x
EMAS		x	
WBCSD/WRI GHG Product Protocol			x
Coop Änglamark	Denmark, Norway, Sweden		
Union Eco Flower		x	
Bio Suisse	x*		
MSC Fishery Standard Principles and Criteria for Sustainable Fishing			x

¹ UK annual retail sales is between £300 and £400 billion

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	National. Specify	European	International
Global G.A.P. (environmental issues)			x
Svenskt Sigill	x		
Svenskt Sigill climate certification	Sweden		
IP Swiss	Switzerland		
GWP information from E Leclerc	x		
L'indice carbone (Casino)/ The Casino Carbon Index	x		(x)
Max climate declaration	x		(x)
PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	UK		x
Approved by Climatop		x	
Environmental reports (SE)	x		
Environmental Product Declaration (EPD) according to the International EPD System			x
EU Regulation on organic production		x	x

*Differentiate between product contain a minimum of 90% Swiss-grown raw materials and those containing less. In the latter case the Bud label is supplemented with the word "BIO". Instead of BIO SUISSE)

Table 3 Economic coverage

Scheme	Coverage/Implementation
ISO 14000 series	In December 2008, there were about 190 000 ISO 14001:2004 certificates worldwide, implemented in 155 countries. The annual growth in 2008 was about 35 000 certificates.
EMAS	At present, 4515 organisations (out of which 193 in the food and beverage sector) and 7740 sites have an EMAS registration with Germany, Italy and Spain as the top three countries
WBCSD/WRI GHG Product Protocol	There are no examples of certifications according to the standards, since they are under development (October 2010). However, among the companies participating in the "road testing" there are a number from the food and drink sector (Coca-Cola Erfrischungsgetränke AG, Danisco A/S, Kraft Foods, New Belgium Brewing, PepsiCo, and Swire Beverages).
Coop Änglamark	Within the Änglamark brand, there are about 250 products (not only food products) in Sweden, 40 in Norway (not only food products) and about 200 food products in Denmark
Union Eco Flower	No criteria exist for food products - no food products certified.
Bio Suisse	Today some 5700 Swiss organic farms are certified to Bio Suisse standards (representing 10% of all Swiss farms). Representative surveys show: More than 70% of the Swiss are already aware of the Bud label.
MSC Fishery Standard	By the end of the 2009/10 financial year 187 fisheries around the world were either certified or under assessment – up nearly 50 per cent on last year. These fisheries land over 7 million tonnes of seafood annually – 12 per cent of the global wild harvest for human consumption.
Global G.A.P. (environmental issues)	GLOBALG.A.P continued to be the world's leading pre-farm gate standard and to be a truly international standard with over 93.000 certified producers more than 100 countries. The scheme is controlled by more than 1400 inspectors/auditors of the 130 GLOBALG.A.P approved certification bodies.
Svenskt Sigill	There are about 4000 farmers producing under the Swedish Seal Label, out of which 2100 milk producers, 1100 producers of fruit, berries, vegetables and potatoes and about 300 grain producers. The number of certified products on the Swedish market

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Scheme	Coverage/Implementation
	is important, but no information on market share has been found.
Svenskt Sigill climate certification	At present (Oct 2010) and to our knowledge, there are two climate certified products: tomatoes and milk from two different farms in the middle of Sweden.
IP Swiss	Large part of Swiss family farms with a total number of 32,000 members (farmers and non-farmers)
GWP information from E Leclerc	Product labelling displayed on the counter and on the sales receipt. 20,000 food items now have CO2 labels in two Leclerc centres. 60,000 households are covered. Emissions are based on full life cycle analysis, but using generic data for each product group.
L'indice carbone (Casino)/ The Casino Carbon Index	105 products according to list on homepage (2010)
Max climate declaration	The menu on Max restaurant
PAS2050	The total annual retail value of consumer goods sold in the UK bearing the Carbon Reduction Label has reached £2 billion the Carbon Trust announced today (13 Oct 2010), as new research shows that 9 out of 10 households in the UK bought a carbon labelled product in the last year. The Label is achieved by following the PAS 2050 carbon foot printing methodology, which measures the carbon emissions of a product at every step of the supply chain, leading to valuable energy and cost saving opportunities for businesses. According to UK statistics (http://www.statistics.gov.uk/pdfdir/rs1010.pdf) the monthly retail sales of September 2010 was £30 billion.
Approved by Climatop	Covers all types of products. Only 7 food products registered covering fresh Asparagus sugar and salt.
Environmental reports (SE)	There are 4306 environmental reports within a electronic reporting system (database)
Environmental Product Declaration (EPD) according to the International EPD System	The international EPD® system has issued so-called "Climate Declarations" as the first example of single-issue EPDs, where only quantitative data on GWP is reported. So far there are in total 100 climate declaration reported (12 food products)

Table 4 Reach

	Business to Consumer	Business to Business	Business, internal	Societal/ Legislative
ISO 14000 series		X	X	
EMAS		X	X	
WBCSD/WRI GHG Product Protocol	X	X		
Coop Änglamark	X			
Union Eco Flower	X			
Bio Suisse	X			
MSC Fishery Standard Principles and Criteria for Sustainable Fishing	X			
Global G.A.P. (environmental issues)		X		
Svenskt Sigill	X			
Svenskt Sigill climate certification	X			
IP Swiss	X			

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	Business to Consumer	Business to Business	Business, internal	Societal/ Legislative
GWP information from E Leclerc	x			
L'indice carbone (Casino)/ The Casino Carbon Index	x			
Max climate declaration	x			
PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	x			
Approved by Climatop	x			
Environmental reports (SE)				x
Environmental Product Declaration (EPD) according to the International EPD System		x		
EU Regulation on organic production	x	x		

6 GENERAL TRENDS AND TIME LINE FOR THE SELECTED SCHEMES

The contents /focus relating to environmental aspects of the schemes looked into are summarised in Appendix 2.

The oldest schemes developed (Table 1) were related to organic farming and primary production e.g. Bud Label which came into effect already 1981. The initiatives came originally from the farming organizations (e.g. Bio Suisse). The development of national schemes was followed by the EU regulation on organic farming in the early 90s, aiming at harmonising the national schemes. Both European and national organic schemes and intended for communication to consumers. The driver is citizen concern and the willingness of the enterprises to answer this concern (product differentiation).

The union Eco Flower, now an umbrella scheme for a number of national European schemes for environmental labelling, was launched 1992, but does not include any criteria on food so far. However regulation (EC) No 66/2010 signals the intention of the EC to extending the Ecolabel scheme to include the category of food.

The voluntary schemes of ISO 14000 series and EMAS were introduced in the mid 90s, and they both represent standardised environmental management procedures for all types of organisations. ISO14001 and EMAS operate on an organisational level. EMAS is an extension of ISO14001 with respect to the requirements on publically available environmental information. EMAS has an open access to the background information which is not the case for the ISO14000 standards, where the private certification body owns the background information.

The Swedish Environmental Product Declaration (EPD) system was the first of its kind and was introduced in the late 90s. It is now a part of the International EPD system. The final reports on declared products are published in the format of an LCA report on the website showing selected background data.

The next “step in evolution” was the development of standardised good practices for pre-farm gate production of food. The retail sector in the UK initiated in the late 90s EUREP G.A.P),

which now is a part of Global G.A.P., the most wide spread pre-farm gate certification scheme. Other assessed schemes belonging to this group is Svenskt Sigill, which was launched 2003 by the Federation of Swedish farmers. Most schemes for good practices for pre-farm gate production of food are national, although several of them are partly coordinated with Global G.A.P. (See Chapter 7.8). Global G.A.P. operates only on a business to business level while others also operated on a business to consumer level (Svenskt Sigill). Coop Änglamark is a private label brand initiated by a major Scandinavian retail organisation and stands for “Organic food and environmentally labelled products”. It does not have its own certification scheme but certification from approved schemes is required (see 7.4). As a response to the climate debate Svenskt Sigill also introduced a climate certification system in 2010, building on the original standards.

A successful approach for developing schemes is “round the table discussions” /collaborative consultation between stakeholders in a specific sector. The international MSC environmental standard, which was established 2002 is one example of such initiative. The MSC standard acts business to consumer. It is owned by a non-profit consortium and the background information is open. The compliance with the standard is shown by a label.

The climate debate has accelerated the development of schemes aiming at reducing the GHG emissions. PAS 2050, the UK “standard” for calculating greenhouse gas emissions for a product, is the basis for the Carbon Reduction Label awarded by Carbon Trust. Climate declarations initiated by retail/restaurants (e.g. E Leclerc, Casino and Max) were all initiated 2008. In all cases the level of greenhouse gases communicated as a number or/and on a sliding scale (Casino). The background information of the number are however not publically available. The “best in class” label Approved by Climatop was also introduced 2008. In this case, a summary of the LCA is provided on the web. In addition of being “best in class” regarding GHG, the environmental assessment must be at least equal to all other analysed offers. In addition, a list of exclusion criteria must be complied with. Two standards, both with international reach, from ISO (not assessed) and WBCSD/WRI for the life cycle based calculation and communication of GHG is still under development. While the ISO development is fairly closed but for member organisations, the latter organisations have published draft versions of the rather “hands-on” type of standard, comments from the road-testing as well as on-line feedback forms to make additional revisions.

The only non-voluntary system assessed is “Environmental reports according to the Environmental Code in Sweden”. This reporting system is required for demonstrating compliance with legal permits and is thus a mandatory “business to authority” communication. The reports also serve as basis for environment reporting to international organisations and registers. The Swedish environmental reports *are public* according to the Swedish principle of free access to public records.²

² The implementation of EU Community environmental legislation is to be ensured in the first place by the Member States, thus the Environmental Code and reporting systems varies from country to country)

7 DETAILS OF CERTIFICATION SCHEMES BEING ASSESSED

7.1 ISO 14000 family

In 1996, ISO published the first versions of ISO 14001 and ISO 14004, two standards in the ISO 14000 family that deal with environmental management systems (EMS) (ISO 14001: requirements; ISO 14004: guidelines). The two standards were revised in 2004.

The other standards and guidelines in the family address specific environmental issues such as labelling, life cycle analysis, communication and auditing. However, these are not described here.

An EMS according to ISO provides a framework for the environmental policy, plans and actions of an organization. It makes the organization:

- identify and control the environmental impact of its activities, products or services,
- improve its environmental performance continually and
- implement a systematic approach to setting environmental objectives and targets, to achieving these and, through third party certification, to demonstrating that they have been achieved.

The identification of environmental impact from activities, products and services is followed by a ranking of significant environmental aspects that are to be addressed in an environmental management action plan including goals and timetables. ISO 14001:2004 does not specify levels of environmental performance – therefore, it can be implemented by an organization independently of its current level of environmental status. However, ISO 14001:2004 requires commitment to compliance with applicable environmental legislation and regulations as well as a commitment to continual improvement. According to ISO 14001:2004, the environmental policy must to be communicated externally, but there are no requirements on external communication of other elements in the EMS.

ISO, the International Organization for Standardization, is a network of the national standards institutes of 163 countries and the largest developer and publisher of international standards in the world. In December 2008, there were about 190 000 ISO 14001:2004 certificates worldwide, implemented in 155 countries. The annual growth in 2008 was about 35 000 certificates. (<http://www.iso.org/iso/survey2008.pdf> (accessed October 2010))

Since 2008, ISO is developing standards for quantification and communication of carbon footprint of products (ISO 14067-1: quantification and ISO 14067-2: communication). The standard is largely based on the existing ISO standards for life cycle assessments (ISO 14040/44) and environmental labels and declarations (ISO 14025). The new standard provides for the adoption of product category rules (PCR), where they have been developed in accordance with ISO 14025 and are consistent with ISO 14067. An updated timetable indicates that a decision on furthering the current so called committee draft to the next stage, draft international standard, will be taken in January 2011. A final draft international standard is predicted to be circulated in November 2011 and the international standard to be published in the beginning of 2012. (Wührl, K., pers.comm. 2010)

7.2 EMAS

The EU Eco-Management and Audit Scheme (EMAS) is a voluntary environmental management system (EMS) for companies and other organisations that want to evaluate, report and improve their environmental performance. EMAS has been operative since 1996. In the beginning, it was restricted to companies in industrial sectors, but since 2001 EMAS is open to all economic sectors, including public and private services. The provisions of the scheme are set down in a European regulation, which has been updated twice; the latest revision (EMAS III - Regulation (EC) No 1221/2009) came into effect on 11 January 2010.

In a perhaps somewhat simplistic comparison between an EMS according to ISO 14001:2004 and an EMS according to EMAS, the latter has an additional requirement of external communication. As part of the EMAS registration, an organization is required to provide an environmental statement, available to the public, of environmental impact and performance. Hence, the environmental statement linked to an EMAS registration adds an element of transparency as compared to an EMS according to ISO 14001:2004.

The logo ('Verified Environmental Management' in conjunction with the registration number) may be used only by registered organisations and only as long as their registration is valid. The EMAS logo shall neither be used on products or their packaging, nor in conjunction with comparative claims concerning other activities and services or in a way that may create confusion with environmental product labels.

Currently, more than 4,400 organisations and approximately 7,600 sites are EMAS-registered.

7.3 WBCSD/WRI GHG Product Protocol

- the Product Lifecycle Accounting and Reporting Standard and the Scope 3 (Corporate Value Chain) Accounting and Reporting Standard.

The Greenhouse Gas Protocol Initiative was launched by WRI and WBCSD in 1998 to respond to the necessity of an international standard for corporate GHG accounting and reporting. A standard was published in 2001, followed by the Project Protocol, an accounting tool for quantifying the greenhouse gas benefits of climate change mitigation projects. The WRI/WBCSD GHG Protocol is now developing two new standards:

- Product Life Cycle Accounting and Reporting Standard (referred to as "the product standard")
- Scope 3 Accounting (Corporate Value Chain) and Reporting Standard (referred to as "the scope 3" standard)

The new GHG Protocol standards will provide a standardized method to calculate the emissions associated with individual products across their full life cycles and of corporate value chains. In 2010, they were tested by a number of mainly large companies. After the testing period, the second draft of the standards was published in November 2010. The text will be finalized at the end of 2010 and the final publications will be published by spring 2011. Among the companies participating in the "road testing" there are a number from the food and drink sector (Coca-Cola Erfrischungsgetränke AG, Danisco A/S, Kraft Foods, New Belgium Brewing, PepsiCo, Swire Beverages).

The draft versions of the standards include requirements on and detailed descriptions of public reporting of GHG emissions. As far as conclusions based on the second draft can be made, the product standards “as is” will support performance tracking (GHG reductions), and, in combination with GHG communication programs (specifications are included in the standard), it will support purchasing decisions (e.g. by consumers or businesses), product labels and performance claims made by stakeholders. However, the standard will not support comparative assertion. (Brown-Smatlan, A., pers. comm. 2010)

In 2006, ISO (International Organization of Standardization) made use of the WBCSD/WRI corporate GHG standard as a basis for its *ISO 14064-1: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals*. According to representatives from the WBCSD and ISO, the two organizations communicate and they are mutually represented in the development processes, but the two standards will probably exist in parallel as long as methodologies are harmonized. (Brown-Smatlan, A., pers. comm. 2010)

WBCSD (The World Business Council for Sustainable Development) is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. WRI is a non-profit NGO, US Based.

7.4 Änglamark (Coop)

Coop Denmark, Coop Norway and Coop Sweden operate grocery retail shops in chains in three Nordic countries. Änglamark is Coop's private label brand for organic food and environmentally labelled products. Coop's objective is to be a leader in sales of ecological and environmentally labelled products.

Coop Änglamark uses existing schemes for organic food that are third party certified. These schemes are specific for the three countries:

- Norway: Debios Ø-label
- Denmark: Det danske økologimærkeand/ or EU Ecolabel
- Sweden: KRAV (except some meat products to which Coop, for product safety reasons, adds nitrite. However, the raw material for the meat products are KRAVlabelled) and/or has an EU Ecolabel

Coffee and tea is also certified according to Fair Trade. Some fish products are MSC certified.

7.5 Union Eco Flower

The European Ecolabel was established in 1992 to encourage businesses to promote products and services with lower environmental impact. Products and services awarded the Ecolabel carry the flower logo. Today the EU Ecolabel covers a wide range of products and services, but currently there are no labelling criteria for food and feed. However, in the Regulation (EC) No 66/2010, that was adopted in late 2009, the European Commission is commissioned to undertake a study, by 31 December 2011 at the latest, to explore the feasibility of reliable criteria covering environmental performance during the whole life cycle of these food and feed (including products of fishing and aquaculture). The study should consider the option

that only those products certified as organic would be eligible for award of the EU Ecolabel, to avoid confusion for consumers. One reason for extending the scope of the scheme is to avoid the proliferation and segmentation of environmental schemes.

7.6 The Bud-label (Bio Suisse)

In 1981, the Association of the Swiss Organic Agriculture Organisations (Bio Suisse) was founded and the first Swiss common standards on organic farming methods were adopted. The common logo, the "Bud" (German: Knospe) label, was created at the same time. The "Bud" represents natural diversity on the organic farm, ethologically sound livestock management and feeding, no use of chemically synthesized pesticides or fertilizers, no use of genetic engineering, no use of unnecessary additives such as flavourings and colourings, non-aggressive processing of foodstuffs and inspection of organic production and processing.

There are two different "Bud" labels:

- the Bio Suisse Bud, attributed to fully organic products of which more than 90% of the raw materials come from Switzerland;
- the Bio Bud, attributed to fully organic products of which more than 10% of raw materials imported but subject to equivalent organic standards.

Only such products may be imported that cannot be produced by Swiss organic farms at all, or not in sufficient quantity. Priority is given to imports from the nearest production regions or countries. Processing is carried out in Switzerland whenever this is possible and reasonable. No import of fresh produce from overseas (except for products that cannot be produced in European countries for climatic reasons) and no air freight are allowed. Traceability back to the producer of the raw material is checked for every import. Bio Suisse standards must be complied with.

A Bud labelled product bears the name of the licensee and the certification body. Bio Suisse is a private-sector umbrella organization and the federation of Swiss organic farmers.

7.7 MSC Fishery Standard Principles and Criteria for Sustainable Fishing

The Marine Stewardship Council (MSC) environmental standard was established in 2002 after an international consultation with stakeholders between 1997 and 1999. The mission of MSC is to use the ecolabel and fishery certification program to contribute to the health of the world's oceans by recognizing and rewarding sustainable fishing practices, influencing the choices people make when buying seafood, and working with partners to transform the seafood market to a sustainable basis.

The MSC environmental standard for sustainable fishing has three principles that every fishery must prove that it meets:

- Sustainable fish stocks (fishing activity at a level which is sustainable for the fish population)
- Minimising environmental impact (fishing operations to maintain ecosystem characteristics on which the fishery depends)

- Effective management (fishery must meet laws at all levels and have appropriate management systems)

These principles are further detailed in 23 criteria, supported by performance indicators and scoring guideposts. Any client that has the capacity to manage vessel behaviour can get certified. A unit of certification consists of a combination of species, fishing gear, geographical region and management.

The MSC environmental standard is supported by a chain of custody standard for seafood traceability, ensuring that fish sold with the MSC ecolabel comes from a certified sustainable fishery.

Compliance with the MSC framework is verified through third party verification. A list of fisheries in assessment currently displays all active assessments. Assessment documents (except pre-assessment reports that are confidential) can be downloaded the MSC web page.

By the end of the 2009/10 financial year 187 fisheries around the world were either certified or under assessment, which represents an increase by nearly 50 per cent on last year. These fisheries land over 7 million tonnes of seafood annually, equivalent to 12 per cent of the global wild harvest for human consumption.

Marine Stewardship Council is an international non-profit organization. The MSC ecolabel is issued by Marine Stewardship Council International Ltd (MSCI), the MSC's trading company which licenses the use of the ecolabel on behalf of the MSC.

7.8 Global G.A.P (environmental issues)

Global G.A.P. is a private sector body that sets voluntary standards for the certification of production processes of agricultural products. Its predecessor - EurepGap – was set up in the 1990s with the aim of harmonising standards set for producers by retailers. The change from EurepGap to Global G.A.P reflects the international reach of the standard. The standard is primarily designed to harmonise existing standard in agriculture worldwide and operates on a business-to-business level. Additional standards exist and cover crops, livestock and aquaculture, depending on the 'product application' required.

The Global G.A.P standard is primarily designed to reassure consumers about how food is produced on the farm by minimizing detrimental environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety as well as animal welfare.

Global.G.A.P serves as a practical manual for Good Agricultural Practice (G.A.P.) anywhere in the world. The Global G.A.P website gives a comprehensive knowledge base for all interested parties. The information available (in different languages) is about standards (control points and compliance criteria), companies connected, certifiers, certification body rules and benchmarking information.

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The certification integrates all agricultural products into a single farm audit, supplemented with detailed control points for presently 16 sub groups of products (plant based, livestock and fish). The certification is based on a physical inspection at the farm and must be renewed every 12 month. Control Points and Compliance Criteria consist of three types of control points: Major Musts, Minor Musts and Recommendations. To obtain Global G.A.P certification the following are required:

Major Musts: 100% compliance of all applicable Major Must and QMS control points is compulsory.

Minor Musts: 95% compliance of all applicable Minor Must control points is compulsory.

Recommendations: No minimum percentage of compliance

An example for fruit and vegetables is given below:

FV. 5.8.4	Is the technically responsible person for the harvested crop handling process able to demonstrate competence and knowledge with regard to the application of biocides, waxes and plant protection products?	The technically responsible person for the post harvest biocides, waxes and plant protection products applications can demonstrate sufficient level of technical competence via nationally recognised certificates or formal training.
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Global G.A.P certification is carried out by more than 100 independent and accredited certification bodies in more than 100 countries. It is open to all producers worldwide. The standard is subject to a three year revision cycle of continuous improvement to take into account technological and market developments.

Table 1 Compatible standards with Global G.A.P (IFA = Integrated Farm Assurance)

STANDARD NAME		SUB-SCOPE(S)
AMAGAP	Austria	IFA 3.0 Fruit and Vegetables
ASSURED PRODUCE	United Kingdom	IFA 3.0 Fruit and Vegetables
CERTIFIED NATURAL MEAT PROGRAM	Uruguay	IFA 3.0 Cattle & Sheep
CHILEGAP	Chile	IFA 3.0 Fruit and Vegetables
FLORVERDE	Colombia	IFA 3.0 Flower and Ornamentals
IP SIGILL GAP	Sweden	IFA 3.0 Fruit and Vegetables
MEXICOG.A.P.	Mexico	IFA 3.0 Fruit and Vegetables
MPS-GAP	Netherlands	IFA 3.0 Flower and Ornamentals
NATURANE	Spain	IFA 3.0 Fruit and Vegetables
NATURSENSE	Spain	IFA 3.0 Fruit and Vegetables
NEW ZEALAND GAP	New Zealand	IFA 3.0 Fruit and Vegetables
QS-GAP	Germany	IFA 3.0 Fruit and Vegetables
SWISSGAP HORTIKULTUR	Switzerland	IFA 3.0 Flower and Ornamentals
UNE 155RE000	Spain	IFA 3.0 Fruit and Vegetables
BANAGAP *	France	IFA 3.0 Fruit and Vegetables
KENYA GAP*	Kenya	IFA 3.0 Fruit and Vegetables - Flower and Ornamentals

STANDARD NAME		SUB-SCOPE(S)
KFC SILVER STANDARD*	Kenya	IFA 3.0 Flower and Ornamentals
SalmonG.A.P.*	Chile	IFA 3.0 Salmonids Species
THAIGAP*	Thailand	IFA 3.0 Fruit and Vegetables
* provisionally approved		www.globalgap.org (accessed October 2010)

7.9 Euro-leaf ,Organic food and farming- environmental issues

From a policy point of view, organic agriculture is recognized as a mean to support/facilitate quality production, alleviating of environmental hazards related to farming, high standards of animal protection and vitality of rural communities. Commission regulation EC 889/2008 sets the standards that should be fulfilled in order for a product to be recognized and labelled 'Organic'. The organic EU regulations have the aim to harmonise the legislation of the member states in order to reduce technical barriers for the free trade of organic products. Besides it has the aim to define what organic production is and to protect the labelling of certified organic products from fraud.

Organic production must respect natural systems and cycles. Sustainable production should be achieved insofar as possible with the help of biological and mechanical production processes, through land-related production and without the use genetically modified organisms (GMO). In organic farming, closed cycles with the use of the internal resources are preferred to open cycles with the supply of external resources. Ideally, external resources should be limited to organic resources from other organic farms, natural or naturally obtained materials and low soluble mineral fertilisers. In exceptional cases, however, chemical synthetic resources may be permitted if suitable alternatives are lacking. These are only authorised and listed in positive lists in the Annex of the Commission Regulation after a thorough investigation by the Commission and the Member States.

Important aspects in relation to environmental impacts are:

- No use of pesticides (with very few exceptions)
- Lower animal density (and use of organic manure) than is allowed in conventional production, thus minimizing risks of nutrient overloads
- No use of solvents in feed preparation (like fat extraction from oilseed)
- Heavy metal limits for use of composted or fermented household waste are lower than set by common regulation.
- No use of growth promoters and no prophylactic use of antibiotics
- No use of chemical fertilizer (limiting resource use connected to fertilizer production)
- Limits on use of feeds from off farm (limiting resources for feed transport etc.)

Certification and control carried out by public authorities or independent private bodies accredited to ISO 65/ EN 45011. The detailed information on requirement to be fulfilled is available through open access to the EU regulations on the internet in all languages of the member states.

7.10 Swedish Seal (Svenskt Sigill)

The Swedish Seal label is found on products that are produced under and certified in accordance to the IP Sigill standard, a standard for quality assurance of the food chain from primary production to processing. Compliance to the standard is verified by independent certification bodies.

The purpose of the label is to simplify for consumers to make informed choices and thus to contribute to develop the consideration for human beings, animals and nature of Swedish agriculture. The labelling criteria include Swedish primary production and traceability to Swedish farms, animal welfare, processing in Sweden, protection of water sources, no GM animals, plants or feed and independent inspection.

The Swedish Seal scheme consists of base rules complemented with rules for different product categories and for slaughter. Furthermore, there are two IP Sigill Gap schemes, one IP Food processing scheme and one IP Agriculture scheme. The schemes integrate Swedish legislation and almost all cross compliance (CC) requirements.

There are criteria on three levels:

- Critical points, crucial for the credibility of the standard. Therefore, they must be complied with for an approved audit. Deviation from the critical points can lead to exclusion.
- Other criteria
- Recommendations are checked at the audit, but they need not be complied with.

After auditing, the company/farm has 28 days for corrective measures. To pass the IP Sigill inspection, the production must comply with all of the critical points and comply with at least 90 % of the other criteria that apply to the production.

The standard is owned by Sigill Quality Assurance Ltd (Sigill Kvalitetssystem AB), a subsidiary of Swedish Farmers (LRF). There are about 4000 farmers producing under the Swedish Seal Label, out of which 2100 milk producers, 1100 producers of fruit, berries, vegetables and potatoes and about 300 grain producers.

7.11 Swedish Seal (Svenskt Sigill) climate certification

The purpose of the Swedish Seal climate certification is to create a certification system, which will reduce the negative climate effects in food production and give consumers a chance to make conscious climate choices as well as strengthening the competitiveness of the food producers. A climate labelled product represents a good climate alternative within each product category, guaranteeing to the consumer that improvements have been made.

The criteria have been developed taken the whole life cycle into account. The certification scheme covers Swedish and imported product, and it can only be used in combination with another certification scheme (criteria are specified in the standard) that certifies components of sustainable food production. Reports and results from the criteria development process are public and available for downloading on <http://www.klimatmarkningen.se/in-english/> (accessed October 2010).

The Swedish Seal climate label was launched for a number of product categories (open field production of vegetables, potatoes, fruit and berries; field crops; greenhouse production of vegetables, pot plants and flower bulbs; milk production) in mid-2010. The climate certification standards are to be combined with existing Swedish Seal schemes for different product categories. Products that are certified according to Swedish Seal and climate certification standards are labelled with a slightly modified version of the Swedish Seal label (the text “climate certified” is introduced under the label).

The Swedish Seal climate label is a result of the Swedish climate certification initiative, started in 2007 by KRAV (the main organic farming organization in Sweden, promoting the KRAV label) and Sigill Quality Assurance Ltd (the organization behind the Swedish Seal label) in order to develop a climate certification for the food chain. Today, the initiative is managed as a project run by KRAV and Sigill Quality Assurance Ltd in cooperation with major Swedish food companies (the dairy company Milko, the cooperatively owned group Lantmännen, the Federation of Swedish Farmers, the meat and cured meat company Scan and the dairy company Skånemejerier).

7.12 IP-SUISSE

IP-SUISSE is an organization of farmers that aim to support an environmental and animal friendly production through the marketing of labelled products. Presently the organization has 32,000 members.

The environmental performance is secured through

- Rules for crop rotation with focus on minimizing risk for Nitrate and P leaching
- Reduced levels of fertilizer
- Limited use of pesticides – i.e. often no pesticides allowed for weed control but in some cases pesticides are allowed for insects if the expected damage exceeds a certain limit
- Mandatory space at the farm for biotopes as place for insects, animals and plants in order to support biodiversity

There is an independent inspection and certification body (ProCert) which is EN 45011 accredited for certifying agricultural products. Each farm is inspected once a year. (<http://www.ipsuisse.ch/?id=143&fid=396>, accessed October 2010)

7.13 GWP information from E Leclerc

In 2008, the French Retail group E Leclerc started a test with GWP information on price labels (GWP per kg product) and on receipt (GWP of bought items). The primary objective is to help customers to reduce the GWP from shopping and to reduce the contribution from food to climate impact. 20,000 food items now have CO₂ labels in two Leclerc centres. According to a study on product carbon footprinting methodologies and initiatives from Ernst & Young, the GWP information from E Leclerc is based on full life cycle analysis, using generic data for each product group.

For the moment, the environmental information from E Leclerc is a mono-criterion approach (GWP), but the objective of the methodology is to be further extended to include other environmental impacts to fulfil the requirements in BP X30-323, a general methodology and principles for communication of environmental information on mass market products. At the E Leclerc homepage, there is no information on sourcing of data or on verification of calculations.

7.14 L'indice carbone (Casino)/ The Casino Carbon Index

The Casino Carbon Index is the result of an initiative launched in 2006 to assess the climate impact of the products of the Casinobrand products. The Casino Carbon Index is a Carbon Footprint, expressed in grams of CO₂-equivalents per 100 grams of end product and on a relative scale (from low to high climate impact), and calculated using a methodology developed by Bio Intelligence Service and data from a database validated by ADEME, the French Environment and Energy Management Agency. The carbon footprint is also detailed in life cycle steps (primary production, processing, packaging, distribution and transports). There is also information about recycling of packaging material. Presently, there are about 150 carbon indexed products on the Casino homepage

Casino provides suppliers with free software for these calculations. At the Casino homepage, there is currently no information on sourcing of data or verification of calculations.

7.15 Max climate declaration

In 2008, the Swedish fast food chain Max Hamburgerrestauranger started marking all meals with the amount of carbon dioxide they cause in making, empowering guests to consider the environment in their choice of meal. Parallel to this, the company's total emissions of CO₂-equivalents were compensated through a tree planting project in Africa.

The climate impact of each meal and product have been analyzed by the environmental organisation The Natural Step, an NGO that assists companies striving to actively take on more environmental responsibilities. No information is available on how data were retrieved and analysed.

7.16 PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services

The development of PAS 2050 began in June 2007, when the Carbon Trust (a public not-for-profit company) and Defra (Department for Environment, Food and Rural Affairs) approached BSI Standards Solutions to oversee the development of for a method for measuring the embodied greenhouse gas (GHG) emissions from goods and services.

PAS 2050 builds on existing methods established through BS EN ISO 14040 and BS EN ISO 14044 by specifying requirements for the assessment of the life cycle GHG emissions of products. An updated version is due in the beginning of 2011.

The Carbon Reduction Label is a carbon footprint labelling system run by Carbon Trust that stipulate the use of the PAS 2050 standard.

7.17 Approved by Climatop

The carbon label «approved by Climatop» labels climate friendly products. A product or a service approved with this carbon label has to cause clearly lower CO₂ emissions during its life cycle compared to relevant products or services of the same category. Furthermore, Climatop applies exclusion criteria to prevent ecologically, socially and ethically doubtful products to get labelled.

An LCA is performed, for the label candidate as well as for relevant products of the same product group (named), by an independent consultant using the acknowledged Ecoinvent database. The study is then verified by third party verification according to ISO 14040. The Life Cycle Assessment includes both greenhouse gases (CO₂-eq) as well as overall environmental impact. Both the results from the comparison and the third party verification statement can be found on the web.

Currently, there are seven food products approved according to Climatop.

7.18 Environmental reports according to the Environmental Code (SE)

If a permit is required for an environmentally hazardous activity according to the Environmental Code, the operator shall present an annual report to the supervisory authority. The environmental report shall contain a statement of the measures taken to comply with the conditions laid down in a decision granting a permit and of the results of these measures. The Government or the authority appointed by the Government may stipulate that an environmental report shall contain a description of the environmental impact of the activity, including aspects other than those set out in the conditions attached to the decision granting the permit.

The report shall also include a declaration of yearly emissions, which shall include values of certain emissions (65 substances listed in a regulation linked to the Environmental code) to air and water above certain limit values (listed in the same regulation). Waste (hazardous and non-hazardous) above specified amounts shall also be reported, divided into waste for recycling and waste to landfill, as well as exported hazardous waste (amounts, destination facility). The reported values shall be followed by a description of how it was established (measured, calculated or estimated). In addition, combustion plants with an installed power of more than 50 MW input shall report amounts of nitrogen oxides, sulphur dioxide and particles for each production unit as well as values for fuel consumption divided into production units and type of fuel (biomass, other solid fuels, specified liquid fuels, natural gas and other gases).

7.19 Environmental Product Declaration (EPD) according to the International EPD System

The EPD system was initiated by the Swedish government and Swedish industry in the late 90s. Since March 2007, the system is international, managed by the International EPD Consortium (IEC).

The overall goal of an Environmental Product Declaration, EPD, is to provide relevant, verified and comparable information to meet various customer and market needs. The international EPD® system has the ambition to help and support organisations to communicate

the environmental performance of their products (goods and services) in a credible and understandable way.

An EPD is defined as quantified environmental data for a product with pre-set categories of parameters based on the ISO 14040 series of standards, but not excluding additional environmental information.

Creating an EPD in international EPD[®] system includes the following steps:

- Considering available PCRs and prepare PCR document (see below)
- Collecting LCA-data to be included in the EPD according to the PCR document
- Compiling environmental information into the EPD reporting format
- Verification by an independent verifier and registration
- Follow-up of the accuracy of the information in the EPD and reporting significant changes to the verifier
- Rules for using the EPD[®] logotype
- Registration and publication of the EPD on the EPD website

In order to prepare an EPD, common and harmonised calculation rules for a specific product group have to be established, so called Product Category Rules (PCR). The PCR documents shall be regarded as complementary to general requirements of EPD programmes.

The EPD system is a Type III environmental label. EPDs are mainly for business-to-business communication, considering the content of detailed information in an EPD. At present, there are six EPDs on food products available on the EPD website, all of them representing products on the Italian market.

The international EPD[®] system has launched so-called "Climate Declarations" as the first example of single-issue EPDs, where only quantitative data on GWP is reported. At present, there are twelve climate declarations on food products available on the website of the International EPD[®] system. In addition to these, there are eight food products bearing a climate declaration (GHG) available on the Swedish part of this website, only available in Swedish.

International EPD consortium (IEC) is a non-profit global organisation acting as a network for the parties interested in joining the activities. The IEC acts as the Programme Operator and has the overall responsibility of the international EPD[®] system. The international EPD[®] system is a member of the Global Type III Environmental Product Declarations Network (GEDnet) and cooperates to achieve the GEDnet objectives.

8 OTHER ACTIVITIES LIKELY TO PROMOTE ENVIRONMENTAL TRANSPARANCY

Wal-Mart sustainability index. Wal-Mart, one of the largest food retailers globally, runs more than 8650 units in 15 countries. Within EU, Wal-Mart is only present in the UK through ASDA, which is the number two retailer in the UK. In 2009 Wal-Mart launched its sustainability index, as a response to the increasing concern about climate change. A life cycle approach is applied throughout the process and the ambition is to give consumers information about the products sustainability profile, enabling informed decisions. This will be achieved in a three-step model; First all Wal-Mart suppliers globally will deliver information on their production practices, second Wal-Mart will support a consortium that in turn will develop an LCA database. The consortium will facilitate cooperation with suppliers, authorities, NGOs and other retailers will be invited to join. The consortium is at present managed by Arizona State University and the University of Arkansas. It is not clear how accessible this database will be. The third step is to develop a simple tool for consumer communication. The ambition is to create “a new retail standard for the 21st century” (<http://walmartstores.com/Sustainability/9292.aspx> (accessed October 2010)).

Considering Wal-Mart’s importance, especially on the US market, this initiative might have a strong influence on the development of transparency also elsewhere.

European Food Sustainable Consumption and Production Round the table was officially launched in May 2009. The vision is to promote science based, coherent approach to a sustainable consumption and production in the food sector considering the interactions across the entire food chain. The initiative engages 24 European food chain organisations (March 2010) and is co-chaired by the European Commission through DGs ENV, SANCO, JRC and ENTER) and is supported by UNEP and European Environment Agency. The key objectives are to

- Establish scientifically reliable and uniform environmental assessment methodologies for food and drinks;
- Identify suitable tools and guidance for voluntary environmental communication to consumers and other stakeholders;
- Promote continuous environmental improvement measures along the entire food supply chain;

In July 2010 the document “Voluntary environmental assessment and communication of environmental information along the food chain including to consumers-Guiding Principles was published (www.food-scp.eu). An interim report on a framework assessment methodology for food and drink products is due in the end of 2010.

Carbon Trust Code of Good Practice for product greenhouse gas (GHG) emissions and reduction was launched 2008. It was developed by the Carbon Trust and Energy savings trust in UK to promote the reduction of product life cycle GHG emissions. As stated on its webpage, “the Code builds on the requirements specified in PAS 2050, and supports further comparability and conformity when assessing the life cycle GHG emissions of products. To achieve this, claims made under this Code must be accurate, verifiable and relevant and must not be misleading. The Code provides a robust structure for reporting the life cycle GHG emissions of products, or a reduction in these emissions, to internal or external stakeholders.

This is achieved by helping organisations to communicate their products' life cycle GHG emissions and/or emission reductions, assessed in conformity with PAS 2050, in a robust and clear manner, and on a consistent basis. Product GHG emissions and reduction information may be used by companies, consumers and other stakeholders to make business and purchasing decisions.”

(www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=CTC745.)

The Carbon Disclosure Project (CDP) is an independent not-for-profit organization holding the largest database of primary corporate climate change information in the world. CDP was officially launched 2003. The database contains greenhouse gas emissions and climate change strategies from some 3,000 organizations in some 60 countries around the world (www.cdproject.net, accessed October 2010) The database is not intended for providing transparency as defined in this work, but is rather a tool for creating environmental engagement and awareness for companies which is an important aspect in all those cases the environmental engagement goes beyond the legal requirements.

The French *Grenelle 2 Act* is the very first attempted to, by legal means, enforce environmental labelling of products (<http://affichage-environnemental.afnor.org/> accessed November 2010). The forms and means are however not readily set yet (http://www.lcainfo.ch/df/DF41/DF41-05-Gaillard-EPD_France.pdf accessed October 2010) but the implementation of the law will be based on the results from a trial phase starting on the 1 July 2011 (Chevassus, S., pers. comm. 2010). In October 2010, the European Commission had not yet been notified (Galatola, M., pers. comm... 2010).

ISO 26000 was launched November 2010. The standard provides guidance to both business and public sector organizations on social responsibility. The standard states seven principles for social responsibility being Accountability **Transparency**, Ethical behaviour, Respect for stakeholder interests, Respect for rule of law, Respect for international norms of behaviour and Respect for human rights. The core subjects are Organisational governance, Human rights, Labour practices, The environment, Fair operating practices, Consumer issues and Community involvement and development. Within the core subject “The environment” issues being covered are prevention of pollution, sustainable resource use, climate change mitigation and adaptation, protection of the environment and biodiversity and restoration of natural habitats.

(http://www.iso.org/iso/iso_catalogue/management_and_leadership_standards/social_responsibility/sr_iso26000_overview.htm, accessed December 2010)

9 DATA BASES

It is usually very time-consuming and expensive to calculate the environmental impact of a product using life cycle assessment, which often is the basis for product-oriented transparency approaches, thus reliable and accessible databases are cornerstones for achieving a general environmental transparency on food products within a reasonable time frame.

The EU Joint Research Centre for Environment and Sustainability is developing a Life Cycle Inventory (LCI) database, including methods for how to perform the inventories. It is called

the *International Life Cycle Database (ILCD)* with the methods described in its *Handbook*. The aim is to establish a common methodology and an open-access database. At present the data available is limited in scope and amount but the European Commission is requiring all new research projects financed through the Framework Programme working with LCA case studies to use the ILCD handbook and deliver ILCD compatible datasets. Hence this database can be an important source for future environmental assessments of foods (<http://lct.jrc.ec.europa.eu/>, accessed October 2010).

The most well-established LCA database is *EcoInvent* (www.ecoinvent.ch, accessed October 2010) owned and managed by a consortium of Swiss research organisations. The database has a rather good coverage of products and processes and it is continuously developed. The database is made available to users on a commercial basis. Several LCA software programs cooperate with EcoInvent and offer the database together with their own software.

In the US, the National Renewable Energy Laboratory (NREL) develops the *U.S. Life Cycle Inventory (LCI) Database*, which “aims to help life cycle assessment (LCA) practitioners answer questions about environmental impact”. This database provides individual gate-to-gate, cradle-to-gate and cradle-to-grave accounting of the energy and material flows that are associated with producing a material, component, or assembly in the U.S (www.nrel.gov/lci/).

There are obviously more databases available, but the ones described above are probably the most important ones. One initiative worth mentioning due to its quite different approach is the *Earthster initiative*, aiming at creating a tool for tracking environmental and social data in supply chains, for turning them into life cycle assessments or environmental footprints, and for sharing this information across supply chains. Earthster is meant to be an open source, to maximize accessibility and innovation. (<http://www.earthster.org> (accessed October 2010))

10 STRUCTURES FOR INTERNAL INFORMATION MANAGEMENT IN FOOD PROCESSING

A cornerstone and a prerequisite for transparency is a reliable communication of information along the food chain. Information and data need to be collected and stored in such a way that they are accessible either by open access or on demand in a useful format/level of detail, within a reasonable time frame.

Transparency may serve different actors in the food chain in different ways, while the consumers look for certain information the food processors may look for other types of information *as well*. Information, such as quality data for setting optimal process conditions, stock levels for improved logistics etc that can be *used to improve* the efficiency and sustainability along the food chain.

Integrating process data to Business Systems by MOS for creating environmental KPIs

In a food processing unit numerous technical data are collected relating e.g. equipment, time and temperature in order to control the process. Data relating to the origin of ingredients and product are collected according to the EU Regulation (EC) No. 178/2002 which states that an actor in the food chain is required to know from whom they have received a given product

and to whom they have delivered a product. (The level of detail is however decided by the food producer; the smallest traceable unit can vary from one package to an annual production volume). Looking at the evolution of data management in industry the focus was first put on the control systems. During the 80s-90s the focus was then switched into business systems. In order to make these systems work together there are the Manufacturing Operation Systems (MOS). The MOS transforms detailed process data to understandable strategic information. (Johansson, C., 2010). A MOS is designed for communicating quantitative information. The CSR may be included in the Business system.

Important ongoing initiatives in relation to the MOS systems are e.g. IEC62264, ISO22400, and ISO20140. IEC62264, "Enterprise control system integration", describes a standardised infrastructure to communicate (<http://www.iec.ch>, accessed October 2010). ISO22400, "Manufacturing operations management - Key performance indicators" is focusing on the development of KPIs. The focus has so far been on discrete production (e.g. car manufacturing) but there are discussions on how to define KPIs relevant for the process industry (Johansson C, 2010). ISO20140 Automation systems and integration- Environmental and energy efficiency evaluation method of manufacturing systems, aims towards developing indicators and models and methods for evaluating the environmental impact. Both ISO22400 and ISO20140 are under development (www.iso.org)

Integrating the business system to the food chain exemplified by the SCORE-model

Other initiatives being of importance for the manufacturing step are initiatives like the SCORE model (Supply Chain Operations Reference model), developed by the Supply Chain Council Providing a model linking business processes and supply chain by aggregating series of hierarchical process models (Supply-Chain Operations Reference model –SCORE an overview, www.supply-chain.org (accessed October 2010)).

The version 9.0 includes capabilities and features to aid environmental sustainability through

- Industry best practices such as collaboration on environmental issues, reducing fuel and energy consumption, and minimizing and reusing packaging materials.
- Metrics to measure the effects of greening, including carbon and environmental footprint, emissions, energy costs and waste.
- Waste management

11. CONCLUSIONS

- Today, environmental performance is commonly assessed/accomplished by different *process-oriented approaches*. The information available on procedures and processes is scattered between the different schemes.
- The development of major standards as Global G.A.P. and the harmonization of national standards with major standards as EU organic are important as they lead to conformity in the information flow which facilitates transparency.
- *Environmental information from many systems is not openly accessible, but kept by either producing companies or by certification organizations.* Criteria may be open,

but the result from an audit or certification process is seldom open. A particular complication with respect to transparency is when standards e.g. Global G.A.P uses different levels of compliance criteria (e.g. “Major Musts” “Minor Musts” and Recommendations).

- *Environmental impact data, when quantified, are generally based on a very large number of data that are merged to describe a given environmental category (e.g. Resource utilization, GHG, acidification etc) according to given rules (LCA ISO14040, 14044). Background data are provided in some cases but only to a certain level of detail.*
- System boundaries have a great impact on the analysis. Thus a reported value e.g. the amount of GHG associated with a product, needs to be supported by a large amount of data and meta-data to be fully transparent. The development of common and harmonised calculation rules for a specific product group, so called Product Category Rules (PCR), would probably facilitate transparency.
- Environmental data are often calculated as an average, from a number of farms, a country or region and sometimes also for an average of several years. *Hence the information as used in product-oriented approaches today is generally aggregated and can rarely be used to distinguish between similar products.*
- Manufacturing Operation Systems (MOS), linking the processing with the business systems and initiatives like the SCORE- model linking business processes and supply chain, may be key factors for developing systems for more segregated environmental information, thus creating options for increased transparency.
- An important factor for achieving transparency is *consensus on how to communicate environmental information*. As consensus is reached indicators can be defined and a standardised way of collecting information can be set up. Good examples for creating consensus are the European Food Sustainable Consumption and Production Round the table initiative and the development of *data bases for and open access* (e.g. International Life Cycle Database (ILCD)).
- There are numerous of ongoing activities that may greatly influence the future transparency of environmental information along the food chain.

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APPENDIX 1: OVERVIEW OF IMPORTANT STANDARDS, METHODS AND INITIATIVES

Overview of important standards, methods and other initiatives related to food and the European market. Those being written in italics are further assessed in more detail.

Name	TYPE	Origin	Year	Aim	Ref*
<i>Svenskt Sigill climate certification</i>	<i>Standard</i>	<i>Sweden</i>	<i>2010</i>	<i>Launched but more work in progress. The purpose is to create a certification system, which will reduce the negative climate effects in food production and give consumers a chance to make a conscious climate choices as well as strengthening the competitiveness of the food producers.</i>	<i>www.klimatmarkning.se</i>
<i>ISO 14000 series</i>	<i>Standard</i>	<i>International Organization for Standardization</i>	<i>1996</i>	<i>To enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects.</i>	<i>www.iso.org</i>
<i>WBCSD/WRI GHG Product Protocol</i>	<i>Standard</i>	<i>World Resources Institute & World Business Council for Sustainable Development</i>	<i>2010</i>	<i>Standardised methods for reporting GHG emissions for products and for companies, including up- and downstream activities. Not yet operative</i>	<i>www.ghgprotocol.org</i>
<i>Bio Suisse</i>	<i>Standard</i>	<i>The Association of the Swiss Organic Agriculture Organisations (Bio Suisse).</i>	<i>1981</i>	<i>Standards of organic farming methods</i>	<i>http://www.bio-suisse.ch</i>

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D 4.1 State of the art on information use in food chains with relevance for environmental concerns

MSC Fishery (Marine Stewardship Council environmental standard)	Standard	The MSC was developed following an international consultation with stakeholders between 1997 and 1999.	2002	Standard Principles and Criteria for Sustainable Fishing	http://www.msc.org
Global G.A.P. (environmental issues)	Standard	Euro-Retailer Produce Working Group	2007	To regulate product safety, environmental and labour conditions PRE FARMGATE. Was developed through EUREPG.A.P (1997). Several international standards are harmonised and approved by Global G.A.P.	http://www2.globalgap.org
PAS2050	Standard type	UK, British Standards Institute, Defra, developed by the Carbon Trust	2008	Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	www.bsigroup.com/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050
ISO14067	Standard	ISO	work in progress	Carbon footprint of products (expected launch 2012)	Open documents not yet available
ISO14025	Standard	ISO		Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures	www.iso.org
Voluntary Carbon Standard	Standard	The Climate Group, the International Emissions Trading Association (IETA) and the World Business Council for Sustainable Development.	2006	A global standard and program for approval of credible voluntary offsets	www.v-c-s.org

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D 4.1 State of the art on information use in food chains with relevance for environmental concerns

The Carbon Neutral Protocol	Standard	UK The Carbon Neutral Company	1997	global standard for ensuring the integrity and quality of carbon neutral certification programmes and enabling businesses to be certified CarbonNeutral®	http://www.carbonneutral.com
Climate, Community & Biodiversity Standards	Standard	CCBA	2005	Help design and identify land management activities that simultaneously minimize climate change, support sustainable development and conserve biodiversity.	http://www.climate-standards.org/
IP Swiss	Standard	Switzerland	1989	The aim is to guarantee high quality of foods products from Swiss farms that at the same time contribute to maintaining the nature values	http://www.ipsuisse.ch
Svenskt Sigill	Standard	Sweden. Sigill Kvalitetssystem AB, owned by the Federation of Swedish Farmers (LRF).	2003	<i>The purpose of the label is to simplify for consumers to make informed choices and thus to contribute to develop the consideration for human beings, animals and nature of Swedish agriculture (in order to make it cleanest in the world).</i>	http://www.svensktsigill.se (in Swedish)
Union Eco Flower	Regulation	EU	1992	<i>Regulation (EC) No 1980/2000. To encourage businesses to market products and services that are better to the environment. Serves as an umbrella scheme for several and other national schemes</i>	http://ec.europa.eu/environment/colabel/
Environmental reports (SE)	Regulation	Sweden	1999	<i>Show your compliance with given permit. Strengthen the business self-monitoring program. Basis for control. Basis for international reporting e.g. to E-PRTR according to regulation (EC) No 166/2006.</i>	www.naturvardsverket.se; http://ec.europa.eu/environment/air/pollutants/stationary/eper/index.htm

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Grenelle 2 Act	Regulation	France,	work in progress	Basis for BP X30-323, support s EPD on a European Level. If the one year experiment phase succeeds , generalization of the chosen approach of the EPD by the State Council, based on the experiences of the experimentation phase (http://www.lcainfo.ch/df/DF41/DF41-05-Gaillard-EPD_France.pdf (accessed October 2010))	http://affichage-environnemental.afnor.org/
EU regulation on organic production	Regulation	EU	1991	<i>The aim is to harmonise the legislation of the member states and define what organic production is and protect labelling of organic product from fraud</i>	http://ec.europa.eu/agriculture/organic/splash_en
EMAS	Regulation	EU (the European Commission)	1995	<i>Evaluation, management and continual improvements in the environmental performance of companies and other organisations</i>	http://ec.europa.eu/environment/emas
Coop Änglamark	Methodology	Sweden, KF (Kooperativa förbundet), owner of Coop	1991	<i>Änglamark is Coop's private label brand for organic products and environmentally labelled products.</i>	http://www.coop.se/
GWP information from E Leclerc	Methodology	E Leclerc, France (retail company)	2008		-
L'indice carbone (Casino)/ The Casino Carbon Index	Methodology	Casino in cooperation with ADEME and Bio Intelligence Service	2008	<i>GHG emissions assessed by Bilan Carbone tool</i>	www.produits-casino.fr/developpement-durable
Max climate declaration	Methodology	Sweden	2008		www.max.se/en/environment.aspx
Approved by Climatop	Methodology	Switzerland	2008	<i>Best in class for GHG</i>	www.climatop.ch
Environmental Product Declaration (EPD)	Methodology	Sweden	Late 1990	<i>Environmental Product Declaration (EPD) according to the International EPD System</i>	www.climatedec.com

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Carbon Reduction Label	Methodology	UK-	2008	Supported by PAS2050, also B2B communication	www.carbon-label.com
BP X30-323	Methodology	France	2009	Life Cycle Analysis Approach, multicriteria approach: identification of GHG and other pertinent indicators which are however limited in number	http://affichage-environnemental.afnor.org/actualites/resume-bpx30-323/resume-bpx30-323
Wal-Mart sustainability index	Methodology	US	work in progress	To develop the sustainability index aiming at a more transparent supply chain, driving product innovation and ultimately providing customers with information they need to assess products' sustainability.	http://walmartstores.com
European Food Sustainable Consumption and Production Round the table	Initiative	23 European food chain organisations (July 2010). The initiative is further co-chaired by European Commission (DGs ENV, SANCO, JRC, ENTR)	work in progress	1.Establish scientifically reliable and uniform environmental assessment methodologies for food and drinks;2.Identify suitable tools and guidance for voluntary environmental communication to consumers and other stakeholders; 3.Promote continuous environmental improvement measures along the entire food supply chain;	www.food-scp.eu
Carbon Trust Code of Good Practice	Initiative	UK	2008	The Code of Good Practice for product greenhouse gas (GHG) emissions and reduction claims has been developed by the Carbon Trust and Energy Saving Trust to promote the reduction of product life cycle GHG emissions.	www.carbontrust.co.uk
Nature & more	Initiative	leading organic product enterprises		Nature & More was created in response to consumer demand for healthy, organic and fairly traded food. The aim is to communicate the commitment and effort that individual growers make towards the planet and its people in order to empower consumers to make informed purchasing decisions.	www.natureandmore.com

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Carbon Disclosure project	Database	Carbon disclosure project	2003	Database "Some 3,000 organizations in some 60 countries around the world now measure and disclose their greenhouse gas emissions and climate change strategies through CDP"	www.cdproject.net
European Life cycle database and International Reference Life Cycle Data system	Database	EU	not relevant	Open database on European level. Research providing LCA data from EU funded project are to report their results to this database.	http://lct.jrc.ec.europa.eu/assessment
Earthster	Database	US	Work in progress	Tool for tracking environmental and social data in supply chains, for turning them into life cycle assessments or footprints, and for sharing this information across supply chains. Earthster is open source, to maximize accessibility and innovation. It enables users to engage supply chains on a path towards sustainable innovation.	http://www.earthster.org/content/About

** The information given are all based on information available on the websites October 2010 if nothing else is stated.

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**APPENDIX 2. OVERVIEW OF WHAT TYPE OF ENVIRONMENTAL INFORMATION THAT IS REGULATED BY THE SCHEME
ASSESSMENT OF THE SELECTED SCHEMES**

	Quantitative data		Criteria/ Production process information		Product specific data/information
	<i>Quantitative environmental data, specified¹</i>	<i>Quantitative data relating to environmental impact and/or not compulsory data²</i>	<i>Environmental and/or ecosystems impact, procedures³</i>	<i>Production Processes and sustainability procedures⁴</i>	
ISO 14000 series		The organization shall establish, implement and maintain a procedure(s) -to identify the environmental aspects of its activities , -to document this information - to, implement and maintaining environmental a management system."		The organization shall establish, implement and maintain a procedure(s) -to identify the environmental aspects of its activities , -to document this information - to implement and maintain environmental a management system."	
EMAS		See ISO 14000		See ISO 14000	
WBCS GHG Product Protocol	GHG				Yes
EU Regulation on organic production		Application of N/ha	Energy Pesticides, Fertilizers, Additives to feed Antibiotics Recycling		Yes
Environmental Product Declaration (EPD) according to the International EPD System	Emission contributing to : ground-level ozone, GHG, eutrophication, acidification,	An EPD can contain additional environmental information			Yes

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	Quantitative data		Criteria/ Production process information		Product specific data/information
	Quantitative environmental data, specified ¹	Quantitative data relating to environmental impact and/or not compulsory data ²	Environmental and/or ecosystems impact, procedures ³	Production Processes and sustainability procedures ⁴	
	energy (MJ), water usage				
Bio Suisse		Maximum level of total nutrients per hectare in lowland areas.	Use of pesticides Use of synthetic fertilisers Additives in processing Manure management Nutrition (feed) management Crop rotation GMO Soil Erosion Ecosystem Conservation Water conservation Land conservation No air freight No import of products that can be produced by Swiss organic farms.		Yes
MSC Fishery Standard			Ecosystem Conservation Wildlife protection		Yes
Global G.A.P. (environmental issues)		Recording of amount of fertilizers used(Major)	A conservation plan that imply compatibility with sustainable agriculture and demonstrate a reduced environmental impact (R),Manure management (R),Feed and nutritional management (Minor) IPM (minor),Ecosystem Conservation,(Minor sand	Green Energy (R) Waste management (R) Energy management (R)	

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	Quantitative data		Criteria/ Production process information		Product specific data/information
	Quantitative environmental data, specified ¹	Quantitative data relating to environmental impact and/or not compulsory data ²	Environmental and/or ecosystems impact, procedures ³	Production Processes and sustainability procedures ⁴	
			R), Wildlife Protection (Minor), Water pollution (Minor), Land conservation (Minor)		
Svenskt Sigill			Rules on maximum amount of heavy metal in fertilisers Restrictions on using soy (C, NC) Rules on use of pesticides Use of synthetic ,fertiliser are regulated, Level of locally produced fodder is set Rules on Manure, Feed management Rules on GMO and IPM Ecosystem Conservation (NC) Crop rotation(NC)	Waste management Rules on level of CO2-neutral energy (NC) Energy management	Yes
Svenskt Sigill climate certification		In addition to the base rules in given Swedish Sigill. Maximum amount of CO2e per kg N stated Nitrogen balance on farm	In addition to the base rules given in Swedish Sigill. Cultivation on organic soils only exceptionally... Increased level of locally produced fodder Only dry manure to be used.	In addition to the base rules given in Swedish Sigill. Establish plan to phase out synthetic refrigerating agents,	Yes

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	Quantitative data		Criteria/ Production process information		Product specific data/information
	Quantitative environmental data, specified ¹	Quantitative data relating to environmental impact and/or not compulsory data ²	Environmental and/or ecosystems impact, procedures ³	Production Processes and sustainability procedures ⁴	
		level, Nitrogen analysis of Manure Mapping of energy use on farm level(NC)	More detailed rules on crop rotation	Investigate possibilities to replace fossil fuel, 100 % renewable electricity	
IP Swiss		Amounts of fertilizer Minimum space for biotopes at farms	Rotation Only use of pesticides after damage criteria's and mechanical weed control for use of herbicides		
GWP information from E Leclerc	GHG				Yes
L'indice carbone (Casino)	GHG				Yes
Max climate declaration	GHG				Yes
PAS2050	GHG				
Approved by Climatop	GHG		Product should not be ecological, social or ethical doubtful .List of exclusion criteria provided.	Environmental legislation (Minimum EU-level) should be followed) Exclusion criteria are provided	Yes
Environmental reports (SE)	Yearly emission of 65 substances		Statement of measures taken to comply with given conditions in the permit	Statement of measures taken to comply with given conditions in the permit	Yes
Coop Änglamark	Not relevant the scheme is based on other certification scheme				

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	Quantitative data		Criteria/ Production process information		Product specific data/information
	<i>Quantitative environmental data, specified¹</i>	<i>Quantitative data relating to environmental impact and/or not compulsory data²</i>	<i>Environmental and/or ecosystems impact, procedures³</i>	<i>Production Processes and sustainability procedures⁴</i>	
Union Eco	No criteria for food products				

APPENDIX 3 LABELS ASSOCIATED WITH THE SCHEMES BEING ASSESSED

ISO 14000 series		Svenskt Sigill climate certification	
EMAS		GWP information from E Leclerc	
WBCSD GHG Product Protocol		L'indice carbone (Casino)/ The Casino Carbon Index	
Coop Änglamark		Max climate declaration	
Union Eco Flower		PAS2050 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services	
Bio Suisse		Approved by Climatop	
MSC Fishery Standard Principles and Criteria for Sustainable Fishing		IP SUISS	
Global Gap (environmental issues)		Environmental Product Declaration (EPD) according to the International EPD System	
Svenskt Sigill		EU Regulation on organic production	

CONSORTIUM

 <p>universitätbonn</p>	<p>Department for Food and Resource Economics, University of Bonn (UBO)</p>	<p>Germany</p>
	<p>Laboratorium für Technik im Bauwesen in der Landwirtschaft e. V. (KTBL)</p>	<p>Germany</p>
 <p>Technische Universität Berlin</p>	<p>Department of Food Biotechnology and Food Process Engineering, Technische Universität Berlin (TUB)</p>	<p>Germany</p>
 <p>the SAFE consortium</p>	<p>The European Association for Food Safety (SAFE)</p>	<p>Belgium</p>
 <p>Sik</p>	<p>The Swedish Institute for Food and Biotechnology AB (SIK)</p>	<p>Sweden</p>
 <p>ARHUS UNIVERSITY</p>	<p>Faculty of Agricultural Sciences, University of Aarhus (AU)</p>	<p>Denmark</p>
 <p>CITY UNIVERSITY LONDON</p>	<p>Centre for Food Policy, City University London (City)</p>	<p>United Kingdom</p>
 <p>Rlabs</p>	<p>RLabs Market Research Ltd. (RLabs)</p>	<p>Greece</p>
 <p>UNIVERSITEIT GENT</p>	<p>Faculty of Bio-engineering, Department of Agricultural Economics, Ghent University (Ugent)</p>	<p>Belgium</p>
 <p>Campden BRI</p>	<p>Campden BRI Magyarország Nonprofit Kft (CCH)</p>	<p>Hungary</p>

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