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ØRESUND FOOD NETWORK AND
ØRESUND ENVIRONMENT ACADEMY

Climate change and the food industry

Climate labelling for food products: Potential and limitations

ØRESUND FOOD NETWORK

ØRESUND ENVIRONMENT ACADEMY
A PART OF THE ØRESUND SCIENCE REGION

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Climate Change and the food industry
– Climate labelling for food products: Potential and limitations

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1. Introduction

1.1 Background

Climate change has been recognised as one of the greatest environmental, social and economic threats of our time. According to the Intergovernmental Panel on Climate Change (IPCC), greenhouse gas (GHG) emissions generated as a result of human activities (for example, burning of fossil fuels, agriculture, deforestation) are the main cause of climate change, with at least 90% certainty. Therefore, in order to mitigate climate change, a significant reduction of emissions of GHG is needed. The fist steps taken to address this problem were the development and adoption of two international treaties: the United Nations Framework Convention on Climate Change (1992) and the resulting Kyoto Protocol (1997). Developed countries having ratified the Kyoto protocol are committed to reduce their GHG emissions by a given percent compared to 1990 levels, during the period 2008-2012. Under the Protocol, the EU-15 has to reduce its GHG emissions by 8% compared to 1990 levels. To achieve GHG emissions reductions in a less costly way, countries are allowed to participate in what is referred to as flexible mechanisms: emissions trading, joint implementation, and the clean development mechanism.

In January 2007, to minimize adverse affect of climate change as well as to reduce the European Union's (EU) dependence on imported fuels, the European Commission proposed to EU member states to commit 'unilaterally' to a stricter 20% reduction in GHG emissions by 2020. Andris Piebalgs, Energy Commissioner, went further by stating: "If we take the right decisions now, Europe can lead the world to a new industrial revolution: the development of a low-carbon economy" (Euractiv.com, 2007, a).

To achieve this objective, the EU has initiated a new energy and climate change policy with the following targets: to reduce GHG emissions by 20%; to improve energy efficiency by 20%; to raise the share of renewable energies to 20% and the share of bio-fuels in road transport to 10%. All these targets should be achieved by 2020 (Confederation of Food and Drink Industries (CIAA), 2007). Such stricter legislative requirements, rising energy prices, as well as concerns over supply security force energy users to improve their energy efficiency. As a result, the industries are undertaking a wide range of activities and investments to cut energy use and GHG emissions, in particular carbon dioxide (CO_2).

According to the CIAA report, the food and drink industries are also actively taking part in energy and carbon management, including voluntarily cutting energy use, switching fuel, investing in energy efficient and low carbon technologies, and/or participating in national or sector-specific energy efficiency schemes (CIAA, 2007). Climate labelling for food products is an example of high-profile initiative recently initiated by food producers, retailers and labelling organisations to reduce the affects of the industry on climate change and stimulate energy efficiency throughout the food supply chain. This initiative will be presented and analysed in this report.

1.2 Impact of the food industry on climate change

Food, along with housing and transportation, is one of households' consumption categories which cause the highest environmental impacts from a life-cycle perspective. According to the study The Environmental Impact of Products, undertaken for the European Commission to identify the environmental impact of European consumption, the 'food and drink' category causes 20 to 30% of the various environmental impacts of private consumption, and this share increases to more than 50% for eutrophication (Tukker et al, 2006). The analysis included the full food production and distribution chain 'from farm to fork'. It also identified product categories that are the most GHG intensive, based on their global warming potential (GWP). Out of 25 top GHG intensive product categories, 52% are related to food production. It was shown that meat, dairy, fats and oils are the most GHG intensive products within the food category. The authors estimated that meat's and meat products' contribution to GWP ranges from about 4 to 12% of all products studied across the EU. Milk and dairy products are responsible for 2-4%, fruits and vegetables (including frozen ones) for approximately 2%.

The food chain is a complex system and consists of many different stages and players: farmers, suppliers, transport companies, producers, retailers, consumers and waste management companies, all of whom generate different environmental impacts, including eutrophication, acidification, ozone layer depletion, as well as global warming. An example of a typical food supply chain is presented below in Figure 1.

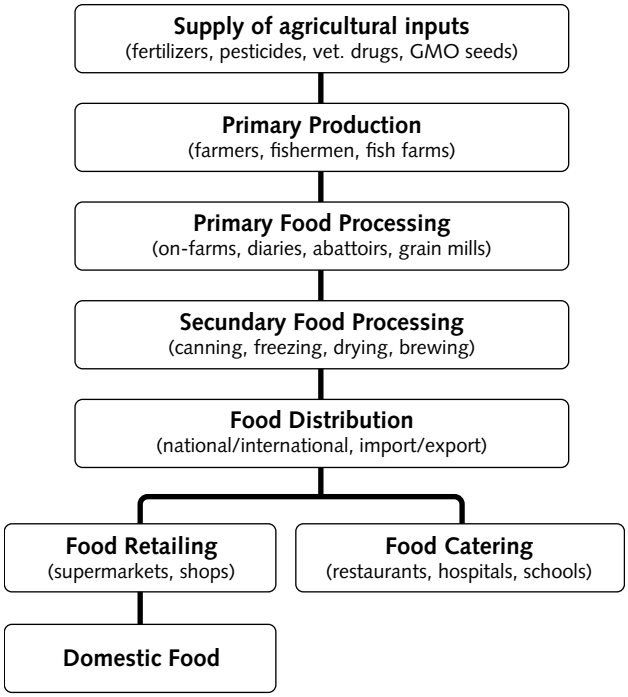

Figure 1. The supply chain in the food system
Source: Fuentes and Carlsson-Kanyama et al., 2006

The impact of food products on climate change originates at all stages of a food product's life cycle: farming (crop production, livestock production), manufacturing, processing, packaging, storage, transportation, consumption (food shopping by car, storage and cooking) and disposal. According to the CIAA report mentioned above, the food and drink industry accounts for about 1.5% of total GHG emissions in the EU-15. Within the food chain, agriculture accounts for 49% of GHG emissions (mainly due to emissions of methane (CH_4) and nitrous oxide (N_2O)), followed by the final consumption stage with 18% and manufacturing with 11% (CIAA, 2007). Refrigeration of food products also has an impact on climate change due to the release of Hydro Fluoro Carbons (HFCs), used as refrigerants. The emissions of HFCs are responsible for around 0.2% of the food sector's emissions (CIAA, 2007). Another important contributor to emissions of GHG is transportation, due to fuel and energy consumption. In total, transport is responsible for 21 % of total GHG emissions in the EU 15 (EEA, 2007). However, no data was found about how much of these emissions generated should be allocated specifically to food transportation. Nevertheless, to provide an order of magnitude, in the United Kingdom (UK), it was assessed that food transport was responsible for 8.7% of the total emissions of the road sector in 2002 (Smith et al., 2005).

Based on the above paragraph, it can be stated that the impact of food products on climate change depends on several factors, including where and how food is produced, processed, packaged, preserved, stored, distributed, prepared and disposed of. Moreover, there are many other factors that may significantly influence the impact of food products on climate change: the type of agricultural soil and its fertility, the climate of a country, the more or less intensive use of fertilisers and chemicals, the type and amount of energy used at different stages, the type and amount of fuel used for distribution and delivery, the efficiency of the equipment, etc.

Therefore, when estimating the impact of food products on climate change, it is essential to take this multitude of factors into account. However, as practice shows, to do so is not always possible and feasible due to, in particular, sophisticated supply chains, lack of available data, and/or lack of time and financing allocated to the evaluation. This can lead to over- or under-estimations, which in turn might question the relevance of such assessments to lead decision-makers in the right direction from an environmental perspective.

Partly as a response to this issue, labelling of food products with information related to their climate change impact (what will be referred to as "climate labelling" in this report) has received a lot of attention recently. Various initiatives, especially in the UK, have been and are being brought forward by retailers, producers or labelling organisations. Climate labelling and carbon footprint management is therefore likely to become an additional aspect to be taken into account by all actors involved in the food industry.

1.3 Purpose of the research

The study was commissioned and financed by the Øresund Food Network and the Øresund Environment Academy (both located in Copenhagen, Denmark). Based on the interests they expressed,

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the following points were identified as objectives for the research and report:

- To present the concept of climate labelling for food and its various forms;
- To provide an overview of existing examples of implementation of climate labelling for food as a way of informing consumers about climate impacts of food products;
- To identify the main strengths, driving forces for, and limitations of climate labelling for food;
- To analyze what climate labelling might imply for producers and in particular for Danish and Swedish food producers.

1.4 Scope and limitations

In understanding the concept of climate labelling for food, particular attention is placed on "food miles" and "carbon footprint label", as they are the two main categories of initiatives that have been undertaken to date. Both are looked at and assessed from the perspective of their key features (including in particular the definitions of system boundaries, the GHG included/excluded, and the calculation methodology used), purposes, driving forces, as well as strengths and limitations. Other initiatives undertaken to estimate carbon footprint of products as well as supply chains without printing labels are also presented in this report.

The scope of the research however does not include an in depth analysis of the science behind the various calculations methods.

When presenting the results of the study, special attention is given to the initiatives and practices that are being undertaken by food producers, retailers and labelling organisations, as those appear to be the main three categories of actors of the food chain currently initiating climate labels.

With regard to the geographical scope, a worldwide overview of initiatives is provided. The scope was however mostly narrowed down to European countries, with a particular focus on the United Kingdom (UK), where the majority of existing or upcoming climate label schemes for food were found. Nevertheless, examples of climate labelling initiatives undertaken in the United States of America (USA), New Zealand and Australia are also included in the report, and were considered when drawing conclusions regarding the implications and potential impact of climate labelling for food. Final recommendations for food producers are provided both from a general perspective, as well as with a more specific focus on Danish and Swedish food producers.

Limitations of the research can be placed on the small amount of scientific literature available, due to the recent birth of the concept of climate labelling. To compensate this literature gap as well as to assess opinions and eventual initiatives in practice, interviews were conducted with the main stakeholder groups identified: producers, retailers, labelling organisations, and consumers' association. In relation to the interviewing process, relatively few interviews could be conducted for each given type of target group, which raises a certain degree of uncertainty regarding the representativeness of the information obtained. In practice, the range of interviews undertaken was constrained by the amount of time available, as well as the variations in the availability and level of cooperation from different interviewees.

1.5 Methodology

In order to create a theoretical basis for discussing the various existing types of climate labelling for food as well as their advantages and limitations, a review of available literature was conducted.

Due to the limited quantity of publications and information available on climate labelling initiatives in the food domain, the core of the report was however built on primary data gathered. As mentioned above, interviews were conducted with representatives of food producers, retailers, labelling organisations and other stakeholders, some having already undertaken or about to undertake climate labelling initiatives, and some not. The selection of organisations interviewed was based on different factors e.g. whether a company has implemented or is planning to implement climate labelling, whether it plays a significant role in the food value and supply chain, etc. The main focus of the interviews was placed on identifying the following aspects:

- Opinion of each stakeholder regarding climate labelling for food;
- Practical implementations of carbon accounting methodologies, their characteristics and implications;
- Main driving forces for implementing (or not) climate labelling;
- Potential benefits and implications for companies; and

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- Limitations that should be placed on climate labelling.

The complete list of companies interviewed is presented in Appendix.

1.6 Structure of the report

Chapter 2 provides an overview and analysis of climate labelling initiatives that have been undertaken to date. It is divided in two main parts, the first one focusing on "Food Miles" and the second one on "Climate Footprint", those being the main two types of labelling initiatives launched related to the climate impact of food products. For both, the following aspects are presented:

- Origin and purpose;
- Driving forces;
- Calculation methodology;
- Examples of implementation; and
- Main limitations.

In chapter 3, the analyses of food miles and carbon footprint initiatives are brought together in order to provide the reader with a comprehensive understanding of implications of climate labelling for food producers. The chapter is divided in two sections: general implications for food producers, and more specific ones for Danish and Swedish producers.

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This first chapter is dedicated to presenting the concept of climate labelling for food, by focusing on the two main types of labelling initiatives that have been developed recently: Food miles, which accounts for the distance products have been travelling to reach the end consumer, and actual climate or carbon labelling as such, which aims at assessing the GHG emissions (often specifically CO_2) along the whole life cycle of products. Both concepts are described in depth, including examples of practical implementations, and their respective potential benefits, strengths and limitations are analysed.

2.1 Food miles

2.1.1 Origin and purpose of the "food miles" concept

Recently, awareness has increased about the fact that more and more food products travel long distances before their final consumption and disposal of the waste generated. In the USA, for example, it was assessed that the food for a typical meal has travelled nearly 2 100 kilometres, but if that meal contains off-season fruits or vegetables the total distance is many times higher (Clay, 2004). It is not uncommon practice for food products to be transported many kilometres to be packaged or processed and then sent back to be sold near where they were produced in the first place. In the UK, for example, it is estimated that food transport accounts for 25% of all heavy goods vehicles (HGV) vehicle kilometres[1]. In France food transport represents around 28.8% of total industry transport (in tonne-kilometres[2]) (CIAA, 2007).

According to a study published in 2005, there are several factors that have lead to the increase in the distances food travels, in particular:

- Trade liberalization in which most countries have engaged worldwide;
- Increased sourcing of food from around the world, due in particular to an increase in consumption of food that cannot be grown in a country, import of out of season products, and increase in the range of exotic products;
- Geographical centralization of food production and processing to achieve economies of scale, along with the increase in the total amount of food processing (consumption of processed food is rising and processed food travels further than unprocessed);
- Increase in the market share of retailers located out of town, meaning that people use cars more and more to do food shopping, and that the distances driven have increased;
- Low transportation costs: transport is still relatively cheap compared to some of the other supply chain costs (Smith et al, 2005).

As a result of these travels, CO_2 and other emissions are increasingly released, contributing to climate change, but also other
environmental and social problems. To address these problems, the concept of "food miles" was created. The term 'food miles' was firstly mentioned by the British non-governmental organisation (NGO) SAFE Alliance (now called Sustain: The Alliance for Better Food and Farming, the UK) in 1994 in The Food Miles Report: The dangers of long distance food transport, and defines the distances (in kilometres or miles) food travels between production and final consumption. According to this report, the food miles concept attempts to internalise the energy costs and negative environmental externalities related to the transport of food products (Paxton, 1994). In essence, the concept aims at encouraging consumers to buy food locally produced, implying that the lower the food miles the less impact a product creates for climate change and for the environment in general.

To try to address the problem of the long distances that food travels as well as to engage the population in taking actions on environmental issues, some retailers in Europe and North America and even governmental authorities started undertaking and promoting food miles initiatives. Many of these initiatives actually focus mostly on promoting localism or regionalism in food-sourcing. Examples of such initiatives will be presented further,

[1] Vehicle kilometres measure the distance travelled by vehicles carrying food and drink regardless of the amount being transported.
[2] 'Tonne kilometres' are vehicle kilometres multiplied by load. For example, a load of 12 tonnes transported 100 kilometres represents 1200 tonne kilometres.

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after having given an overview of the main driving forces for a potential implementation and use of the food miles concept.

2.1.2 Main driving forces for "food miles" initiatives

2.1.2.1 NGOs lobbying

In the middle of 1990s, to highlight the social and the environmental impacts, in particular global warming, caused by the increasing distances travelled by food, some British environmental NGOs initiated a debate on the issue of food miles, lobbying citizens, organizations and politicians to address the problem. One of the main arguments used to support the food miles concept was the concern for climate change, implying that the longer the distance food travels, the more energy is consumed, the more fossil fuels are burned, and consequently the more GHG are released to the air.

As Headcorn Sustainability Group, a British NGO stated: "Over 100 years ago, nearly all the food we ate came from less than a 20 mile radius of our homes. What a different story today. Wine from Chile, strawberries from California, beans from Kenya, apples from New Zealand, beef from Argentina, the list is endless. The average contents of a supermarket trolley with only 20 items of produce could have travelled over 50,000 miles to get to your dinner plate, which is equivalent to twice round the world and in the process releasing 37 kilograms of carbon dioxide into the atmosphere. Assisted by free trade, no tax on aviation fuel, supermarkets transport food from every corner of the globe… this is not only damaging British Farmers but is bad news for the environment, for our roads and for our bodies" (Headcorn Sustainability Group, 2006).

Other arguments used by pro-food miles campaigners included the concern that food that could be produced in the UK is imported instead, causing a loss of income to British farmers, and the concern that workers overseas are unfairly treated, which makes it possible for the UK to import cheap food products (Saunders et al., 2006).

NGOs also argued more specifically against air freighting of food products because this mode of transport is very energy intensive and causes significant negative externalities. The Soil Association, the UK's leading campaigning and organic certification organization, even plans to take away its organic labels from products transported by air (Farmers Weekly, 2007). A further argument was brought forward against multilateral international trade, as NGOs have been asking why a product was imported in the UK while the national production of that same product was exported from the country. As the solution to all these problems, NGOs are lobbying to source and consume food produced locally (Saunders et al, 2006).

2.1.2.2 Government support

Initiated by environmentally orientated NGOs, the food miles debate was also supported by British governmental departments and agencies such as the Department for Environment, Food and Rural Affairs (DEFRA), the Advisory Committee on Consumer Products and the Environment, as well as the Sustainable Development Commission. According to DEFRA comments, food miles can be used as a "possible indicator of environmental sustainability" because "the distance and mode by which food is transported is a significant element of energy use within the food chain as well as being associated with pollution from vehicle emissions" (Saunders et al, 2006). Nowadays, the food miles concept is used as one of the principles of the reviewed Sustainable Farming and Food Strategy of the UK. Moreover, the UK's Organic Action Plan requires that 70% of in-season organic food should be sourced from the UK by 2010 (Soil Association, 2002).

It is important to note that even if it is leading the implementation of food miles concept, the UK is not the only EU country having supported the concept of local production and consumption of food products. In Italy, for example, the government has passed a legislation forcing local authorities to include organic and local food in school catering. As a matter of fact, the EU itself, although not directly supporting food miles, provides funding to support local food initiatives to develop farmers' markets and local food brands (Stancu and Amith, Undated).

2.1.2.3 Consumer demand

Major food scares of the past decade (foot and mouth disease, mad cow disease, potential consequences of producing consuming genetically modified food) and concerns about the impact of transport on climate have increased consumer awareness and

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interest in the origin and traceability of food, including in particular a preference for local food. As Katrine Milman, Head of Environmental Affairs at COOP Denmark (retailer), expressed during a telephone interview, consumers have a higher trust in locally produced food because they know and understand where it comes from.

Therefore, the idea of food miles has become familiar to the broad public, leading consumers to believe that food travelling a shorter distance is better for the environment. They often also recognize that local food is fresher and tastes better than when shipped long distances, and sometimes equate locally produced food with less processing. Moreover, consumers are being made aware that buying local food supports local farmers, develops farmers' markets and local food brands, which in turn supports local economy, creating employment opportunities (Farmers Weekly, 2007, b). The use of such socio-economic arguments is another explanation for the growing consumer demand for locally produced food. For example, according to the Local and Regional Food Opportunity survey (Institute of Grocery Distribution, UK, 2005), 70% of British consumers want to buy local food. Another survey, carried out by NOP, a British market research organization, in 2006, showed that 59% of consumers would consider shopping elsewhere in their area if their usual supermarket was not committed to sourcing local products, while 85% of the 1000 respondents said that they wanted their usual supermarkets to do more about sourcing from local suppliers (Farmers Weekly, 2007, c).

2.1.2.4 Marketing use of the "food miles" concept

The concept of food miles can be used in marketing efforts to strengthen consumers' positive perception of locally produced products and therefore could help to differentiate products from the competition. Consumers might be interested in having the opportunity to purchase products that were grown and processed within a short distance from their homes. Moreover, they might be specifically interested in buying low food miles products due to their perceived freshness and quality (Pirog and Benjamin, 2003).

Based on consumers' demands and due to climate change aspects being increasingly included in business strategies, the concept of food miles is being used by some big producers as well as national industry associations in their marketing strategy to differentiate products from the international competition. Such communication strategies are however being criticised by those food producers whose products will have a relatively negative environmental profile according to the only food miles criteria. As Andrew Ferrier, Chief Executive of Fonterra (New Zealand's largest company and the world's biggest exporter of dairy products), stated in an interview to the country's leading daily newspaper: "[The concept of food miles] was invented by some competitors of ours who decided they had a clever way of making their butter look better than our butter" (Burgess, 2007).

Hence, one can say that food miles initiatives undertaken by producers or retailers are used as one of the tools to prove their commitment to sustainable development and advertise a superior sustainability performance. Such examples will be presented in the later in this section.

2.1.2.5 Potential cost reduction

Due mainly to the low cost of shipping containers around the world, but also to the fact that aviation fuel (kerosene) is not taxed and air freight and shipment is not currently included in the EU Emissions Trading Scheme (ETS), food transportation is still relatively cheap compared to some of the other supply chain costs. However, from 2011, due to its growing contribution to climate change, aviation will be included in the ETS. Airlines will therefore have to reduce their GHG emissions or buy "pollution credits" on the EU "carbon market" (Euractiv.com, 2007, b). This in turn will increase costs of goods transportation, including food products, generating additional transportation costs for food producers and retailers. Therefore, integrating the food miles concept in a company's procurement policy might bring potential cost savings on airline freighting of raw materials or ingredients. More generally speaking, it is simple to understand that a reduction of the distance travelled by food ingredients and products (whether by truck, boat, train or airplane) for sourcing and distribution purposes will result in a mechanical reduction of logistics costs for the company paying for that transportation.

2.1.3 Calculating a product's food miles

To calculate how far a food product travelled, a Weighted Average Source Distance (WASD) is commonly used. WASD is used to

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calculate a single distance figure that combines information on the distances from production to point of sale and the amount of food product transported (Carlsson-Kanyama, 1997).
The formula for the WASD is:

$$WASD = \frac{\sum (m(k) \times d(k))}{\sum m(k)}$$

Where:
k - different location points of the production
m - weight (amount) from each point of production, and
d - distance from each point of production to each point of use (or sale).

Despite the fact that the formula looks quite simple, the actual calculation might become a complicated process in practice. This is particularly true for multiple ingredient food products (for example, frozen ready-meals, yogurt, and cakes). Often, due to a lack of precise data about how far different ingredients have travelled, the calculation is based on many assumptions and approximations. In other words, it is difficult to generate a precise figure. Another limitation of this calculating method is that it does not distinguish different modes of transport (marine, road, air, and rail) even though these modes have very different levels of associated GHG emissions per product unit transported. This limitation will, among others, be presented more in detail in the section "Strengths and limitations", after having presented an overview of existing examples of implementation of food miles in practice.

2.1.4 Examples of existing initiatives

According to a DEFRA report, the food miles concept can be used in two ways to reduce the environmental impact of food transport, using the so called "fewer miles" and "friendlier miles" notions. "Fewer miles" means that companies and retailers are trying to reduce the overall distances food travels. Such initiatives include local sourcing and greater capacity vehicles (more products are carried on the same trip). "Friendlier miles" initiatives can be achieved when the environmental impact of a given mile or distance travelled is reduced by, for example, using less damaging forms of transport (such as rail or water compared to road or air) or by technological improvements in vehicle and fuel technologies to reduce the impact of any given mile (DEFRA, 2007). Air-freighted labels (for consumers to identify those products having been transported by plane) can be an example of "friendlier miles" initiatives as its final goal is to promote more sustainable modes of transport.

Both examples of "local sourcing" and "air – freighted" initiatives will be presented in the coming two sub-sections before presenting later on their strengths and limitations. Such initiatives are undertaken either by retailers, producers or certifying organizations. The analysis of these initiatives will be presented in the following section "Strengths and limitations."

2.1.4.1 Local sourcing initiatives: "fewer miles"

As it was mentioned above, food quality, support of local community, food freshness and concern about the impact of transport on climate change have increased consumers' interest in the origin and traceability of food, including a strong preference for locally produced food. Therefore, driven by consumer demand and with the objective to reduce food mileages of the products they distribute, big retailers such as ASDA, Whole Food Market, Marks & Spencer, Tesco, Morrisons, J Sainsbury, Carrefour, and Waitrose, made local sourcing initiatives a core aspect of their sustainable policies. Examples of such initiatives are presented below.

ASDA (UK): 90% of products distributed that can be sourced nationally actually come from the UK. By the end of 2007, ASDA was going to have around 3500 local products on sale in its stores, supplied by over 300 local suppliers (ASDA, 2007, a). To cut food miles, ASDA has also launched a food delivery scheme that aims to cut 3 million "food miles" a year. The first two-month pilot project was launched in Cornwall, allowing farmers to deliver their products directly to stores in the county, rather than sending them via a distribution centre. Initially, three farms took part in the scheme, which will supply the local stores with fresh goods labelled "Produce of Cornwall". According to ASDA's Head of Ethical and Sustainable Sourcing, Chris Brown, this will minimise the impact on the environment and ensure ASDA's fruit and vegetables are as fresh as possible. Recently, to cut its carbon emissions, the company also initiated a series of measures, including a switch to bio-diesel and a shift to moving more freight by train (which is an example of friendlier miles initiative) (ASDA, 2007, b).

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J Sainsbury (UK) sources 100% of organic meat, fish, poultry, milk and eggs from British farms (except when New Zealand lamb is in season). All tomatoes and apples, when in season in Britain, are also sourced from British farmers. Moreover, J Sainsbury launched the initiative 'Farm Promise' milk. Its aim is to help British dairy farmers convert to organic standards (J Sainsbury, 2007, a).

Morrisons (UK) sources 100% of its carrots, broccoli, and cauliflower, when in season, and 90% of its onions, potatoes and mushrooms, when in season, from the UK. Moreover, from October 2007, it made a commitment only to sell fresh pork sourced in Britain in all its stores (Morrisons, 2007).

Waitrose (UK): 100 % of beef, pork, fresh chicken, venison, ducks and geese distributed are British and 85% of the bacon. Steven Esom, Managing Director, stated: 'Our business is also about localization, not globalization, and our pivotal position in the supply chain gives us the opportunity and the responsibility to help customers understand the importance of British agriculture and appreciate the quality of its output.' For customers to easily spot the provenance of the food, Waitrose labels relevant products as either local or regional food, as per the figure below (Waitrose, 2007, a).

Figure 2. *Logos used by Waitrose to label local and regional products*
Source: Waitrose, 2007, b

Tesco (UK): 90% of its fresh chicken, 95% of its fresh beef, 92% of its fresh pork, 80% of its fresh lamb, and 100% of its fresh eggs and milk come from the UK. Tesco launched labels on fresh meet and farmhouse cheeses. This label provides information about the provenance of the products (Tesco, 2007, a). Moreover, Tesco supports the Red Tractor symbol (see Figure 3 below) on over 700 fresh produce, dairy and meat products. The Red Tractor scheme ensures that food safety and hygiene standards are maintained as well as standards for animal welfare and the environment. Only British farmers are eligible to apply for this label (Assured Food Standards, 2007).

Figure 3. *Red tractor logo*
Source: Assured Food Standards, 2007

In addition, Tesco has also been working with organic farmers to increase their output and aims to source 100% organic meat, milk and in-season products distributed from the UK (Tesco, 2007, a).

Coles[3] **(Australia):** In 2006, 97% of Coles' fresh food and 85 % of its grocery products were sourced from Australia (The Australian made, 2007). To support local organic farmers, Coles developed its own brand of certified organic foods in 2006 - "You'll love Coles Organic™". "You'll love Coles Organic™" meat, milk and eggs are sourced from Australian farms. The products with such label are grown and processed without the use of synthetic chemicals, artificial fertilizers, pesticides or herbicides. These certified organic products should be independently validated by Australian Certified Organic Limited (ACO) as meeting the Australian National Standard for Organic and Biodynamic Produce or comparable international standard for imported products. "You'll love Coles Organic™" products are labelled with the Australian Certified Organic Logo (bud logo), this logo looks differently depending whether products were imported or not (Coles, 2007), as per Figure 4 next page.

[3] *Coles (Australia) is a full service supermarket operating over 730 stores throughout Australia, employing more than 87,000 people.*

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Figure 4. *Australian Certified Organic Logo (bud logo) for Australian and imported products*
Source: Coles, 2007

Unico-op, Firenze[4]**, (Tuscany, Italy):** During the 1990s Unico-op Firenze noticed a shift in consumers' demand towards a preference for quality and local origin. To fulfil this demand, Unico-op Firenze attempts to make local sourcing as a key component of its business plan. In 1999, it signed an agreement with ARSIA (the agency for research and innovation in agriculture and forestry) that provides financial support to enhance the sales of locally typical products. 18.2% of Unico-op Firenze's products come from the Italian region of Tuscany (Whitelegg, 2005, p. 20-22).

Coop, (Sweden): In 2007, Coop Sweden together with the Association of Swedish pork producers (Grisproducenter) carried out a joint campaign to market Swedish pork meat. The aim of the campaign was to point out the quality of Swedish pork meat as well as the quality of Swedish pork production. Ultimately, the campaign aimed to provide more information to consumers about the benefits of Swedish pork meat, influencing consumers' purchasing decision. The campaign was financed by Swedish farmers and was carried out during the whole year 2007. Different messages, some of which are presented in Figure 5 and translated below were used in marketing Swedish pork meat:

- "Swedish pork meat is world quality;
- "You can rely on Swedish pork meat";

- "Swedish pigs are good for Sweden" (Sveriges Grisproducenter, 2007).

Figure 5. *Messages used to market Swedish pork meat*
Source: Sveriges Grisproducenter, 2007

To conclude this list of examples, one can add that, to help consumers identify local products, many retailers use various other labels, more or less official and verified, as well as temporary communication campaigns that provide information about food provenance, for example: "Product of Australia", "Made in Australia", "Australian grown", "Buy New Zealand Made", "British food", etc.

2.1.4.2 "Air freighted" initiatives: "friendlier miles"

Consumers' demand for all year round fresh products leads to increase of air freighted products. Air freight is considered to be the fastest growing mode of food transport and the growth is predicted to continue. Even though this mode of transportation is currently far from having the biggest share of food transportation, it has the biggest global warming potential per unit of food transported over a given distance. For example, in the UK air freight only accounts for 1% of food tonne kilometres and 0.1% of vehicle kilometres. However, it produces 11% of the food transport's CO_2 equivalent emissions (Smith et al, 2005).

[4] *Unico-op Firenze is a regional (Tuscan) division of the supermarket chain Co-op Italia. Unico-op Firenze was set up in 1891 in Florence. After a long merging process among Tuscan cooperatives it has become the biggest retail company, with 1 million members and more than 100 stores. Two out of every three families have a member. Unico-op Firenze has a 25% market share for food in the region and is the largest member partner of Co-op Italia.*

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Therefore, to promote more sustainable modes of transport, different "air-freighted" initiatives were undertaken, under the concept of friendlier food miles. For example, the UK Soil Association is planning to take away organic labels from already certified products and not award new products with labels if they are air-freighted.

Another example of incorporating the principle of local sourcing and environmental impact of transportation in already existing eco-labels was explored by the organic certifier Bio-Suisse (Switzerland). Bio Suisse incorporated the food miles principle in its Bud organic labels by requiring the provenance of raw materials (whether they are imported or produced nationally) to be specified on the label. Moreover, Bio Suisse awards products only if they were imported to Switzerland by land or sea (air transportation is prohibited). The label looks differently, depending on whether the raw materials were imported or produced within Switzerland. The Bio Suisse Bud label means that a product is fully organic and produced in Switzerland, i.e. more than 90 % of the raw materials come from Switzerland. This label is presented in on the Figure 6, a. The Bio Bud label (without the mention "Suisse") means that a product is fully organic, but that more than 10% of raw materials were imported (see Figure 6, b) (Bio-Suisse, 2007, a).

a) The Bio Suisse Bud

b) The Bio-Bud

Figure 6. *The Bio Suisse Bud logos*
Source: Bio-Suisse, 2007, a

Moreover, according to Bio Suisse's import policy, the certification body gives priority to organic products from nearby countries. It also restricts Bud label awards for foreign products to cases when the domestic supply is insufficient. Fresh products, including fruit, vegetables, herbs from overseas (except from Mediterranean countries), and fruit juices and frozen products cannot be Bud labelled. However, such products may obtain the label if they cannot be cultivated in Switzerland or in Europe for climatic reasons (Bio-Suisse, 2007, b).

In Sweden, certification bodies, KRAV and Svenskt Sigill, are also currently developing a label for climate-friendly products. According to Johan Cejie, Head of Standards Development (regelutvecklingschef) at KRAV, products transported by air will not be eligible to be awarded with this label (Local Tidningen, 2007). More detailed information about this label scheme will be presented further in section 2.2 dedicated to carbon footprint labelling initiatives.

To address the problem of climate change caused by air traffic and to meet the customers' interest in knowing how food is transported into the UK, in 2007 two UK retailers, Marks & Spencer and Tesco, started an initiative to label food that has been imported to the UK by air. Marks & Spencer prints a small aeroplane symbol and the words 'air freighted' (see Figure 7) on over 20 different food products, including beans and strawberries, raising this number to 150 by the end of 2007 (Marks & Spencer, 2007). Tesco has put an aeroplane symbol on all air-freighted products. It also plans to restrict air freight to no more than 1% of its imports with a voluntary bias in favour of sourcing from developing countries (Tesco, 2007, b).

Figure 7. *'Air freighted' labels*
Source: Newconsumer.com., 2007 and Lindvall, 2007

2.1.5 Strengths and limitations

In this sub-section, the main strengths and limitations of food miles initiatives will be presented. As most advantages and potential benefits of the concept have already been covered above, limitations will be described here in more details than strengths.

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2.1.5.1 Summary of strengths

Based on the previous sections, it can be said that one of the main advantages of food miles concepts and approaches promoting local food, is that they can lead to a reduction of the amount of GHG emissions because food does not travel as far as if imported from further regions or abroad. Buying local food also has the advantage of promoting local farming, which, in turn, supports the local economy and the creation of new employment opportunities. It is also believed that local food is fresher and tastes better than food shipped long distances. This is motivated by the fact that the longer distances food products have to travel, the more food products are usually processed. This in turn might lower the nutritional content, such as vitamins and minerals.

To summarise, the food miles concept is expected to lead to a reduction of transport-related GHG emissions, might guarantee that local food is fresher, and supports local communities. However, the questions can be raised whether accounting for food miles really guarantees that a product sourced locally generates lower GHG emissions over the whole product's life cycle, and therefore whether implementing the food miles concept actually results in a lower climate change impact. This point, along with other limitations of food miles, will be discussed in the next paragraphs.

2.1.5.2 Main limitations

A potential justification for political and economical protectionism

Recently, the food miles concept has been criticized for being used as a justification for protectionism (Wilson, 2007). Since the main principle of food miles is to promote fewer miles and the consumption of local products, this might create unofficial import barriers for some countries to export their products because they travel long distances. Among developed countries, such countries include in particular Australia and New Zealand, due to their geographical location. Both are big agricultural exporters (in particularly, of such products as apples, dairy products, and meat) to European markets. Being transported for long distances, food miles of agricultural products from these countries will be high. Therefore, this represents a business risk to Australian and New Zealand exporters.

However, such trade arguments against the food miles concept can be questioned as well. All countries are supporting their local communities in a way or another, and Australia and New Zealand are no exemption. As it was mentioned in the section "Existing initiatives", there are different labels and programmes undertaken in both counties promoting consumption of locally produced food, such as Australian Grown, Australian made, Product of Australia, the Buy New Zealand Made, Buy Kiwi Made campaigns.

The concept of food miles excludes the climate impact of other aspects than transportation

Another limitation that can be used against the food miles concept is the fact that a single indicator based on the total distance food is transported over cannot be an adequate indicator of sustainability (Smith et al, 2005). A study carried out in 2005 by Smith et al for DEFRA came to this conclusion, although DEFRA initially though that food miles could be used as a possible indicator of environmental sustainability of products. As the UK Food and Farming Minister, Lord Bach, said: "This study is an interesting contribution to the 'food miles' debate. It shows that the issue is complex and that a range of factors have an effect on the overall impacts of food transport, not purely the distance travelled by individual products" (DEFRA, 2005).

One of the problems of food miles is that food transportation represents just one of many components of the total environmental impact of food production and consumption. When assessing the environmental impact of food, in particular global warming, it is essential to take into account all those different factors, including how food was produced, packed, stored, as well as but not only, how and how far it was transported. As an example, Smith et al. found out that importing tomatoes from Spain during the winter generates less CO_2 emissions than growing tomatoes in greenhouses in the UK.

Pirog et al. also showed that food miles might only represent a small percentage of the total energy inputs in a product's life cycle. According to this study, transportation accounted for "11 percent of the energy use within the food system [in the United States], considerably less than agricultural production (17.5 percent) and processing (28.1 percent)" (See Figure 8) (Pirog et al, 2001).

The main argument against the food miles is that, in order to

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quantify the climate impact of a product, it is essential to consider all GHG emissions through the whole life cycle of the product, rather than just those related to transportation, or, as done when implementing food miles, rather than just looking at the distance in miles or kilometres.

ENERGY USE IN THE U.S. FOOD SYSTEM*	
Sector	**Average (percent)**
Production	17.5
Processing	28.1
Transportation	11
Restaurants	15.8
Home preparation	25
Food system **	**15.6**

*(Excerpted from Tabel 2, "Energy Use in the Food System: A Summary of Existing Research and Analysis." Center for Integrated Agricultrural Systems, University of Wisconsin-Madison.)

** Percentage of total U.S. enerbgy consumption used in the food system

Figure 8. *Energy use in the U.S. food system**
Source; Pirog et al, 2001

In 2006, to prove that food miles can not be used as an adequate indicator of the climate impact of a product, a study carried out in New Zealand provided an assessment of GHG emissions throughout the life cycle of some agricultural products (apples, onions, dairy products and lamb) exported from New Zealand to the EU, and assessed them against comparable products produced in the UK (Saunders et al., 2006). The findings are presented in the Figure 9 below.

According to it, energy input per tonne of output of each product is substantially less during production in New Zealand. Although the energy input of New Zealand based products increases as a result of post-harvest transportation to EU countries, in total it still remains significantly less than if produced in the UK. The same results are found for CO_2 emissions. According to the study, the total amount of CO_2 emissions for apples and lamb is less if produced in New Zealand and exported than if produced in the UK. Only onions have a comparable total amount of CO_2 emissions, but that is still after including export transportation.

This report also identified the main factors that led to the differences in CO_2 emissions between the UK's and New Zealand's agricultures: the amount of fertilizers used, the amount of animal feed and fodder used, and the percentage of the total electricity generation coming from renewable sources. Saunders et al.

TABEL 1: ENERGY INPUT BY MEGAJOULE PER TONNE OF PRODUCTION						
	Apples		**Onions**		**Lamb**	
Country	NZ	UK	NZ	UK	NZ	UK
Production	950	2,961	821	678	8,588	45,859
Post Harvest	2,030	2,069	2,069	3,082	2,030	NA
Total	**2,980**	**5,030**	**2,890**	**3,760**	**10,618**	**49,859**

TABEL 2 CO_2 EMISSIONS PER TONNE OF PRODUCTION						
	Apples		**Onions**		**Lamb**	
Country	NZ	UK	NZ	UK	NZ	UK
Production	60.1	186.0	58.9	42.3	563.2	2.849.1
Post Harvest	124.9	85.8	125.6	127.8	124.9	NA
Total	**185**	**271.8**	**184.5**	**170.1**	**688.1**	**2,849.1**

Figure 9. *Comparison of products from New Zealand and the UK regarding energy consumption and CO_2 emissions per tonne of production. Source: Wilson, 2007*

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	KENYAN	DUTCH
Climate impact	2,400 $kgCO_2e$ (no altitude impact) 6,200 $kgCO_2e$ (with altitude impact)	37, 000 $kgCO_2e$
Most carbon intensive stages	Air freight (73-89% of climate impact)	Heating and lighting of greenhouses (99% of climate impact)
Other key differences	Geothermal source for energy use & almost double the yield per unit area	Fossil intensive heating and lighting, and just over half the Kenyan yield rate

Table 1. *Comparison of impacts for the production of 12,000 cut stem Kenyan and Dutch roses*
Source: UKERS, 2007, a.

showed that New Zealand's agriculture tends to apply less fertilizers (which require large amounts of energy to produce and cause significant CO_2 emissions) and animals are able to graze outside all year around, eating grass instead of large quantities of bought and brought-in feed such as concentrates. Moreover, New Zealand uses more renewable energy, such as electricity generated from hydroelectric sources or wind, than the UK, still more dependent on fossil fuels: "The carbon dioxide released during electricity generation comes from the mix of fuels used. In the UK 72 per cent of the energy required for generating electricity comes from coal and gas reserves. By contrast in NZ coal and gas contribute just 36 per cent, while renewable hydro energy is 32 per cent. Also note that due to large losses when converting fossil fuel to electricity, of the electricity generated in NZ 64 per cent comes from hydro." (Saunders et al. 2006: 33)

Another study was carried out to compare the carbon impact of growing 12,000 marketable quality cut stem roses in Kenya and air-freighting them, with growing them in the Netherlands and driving them to the UK (Williams, 2007). The results of the LCA study are presented in the table below.

It shows that the production and following export and delivery of Kenyan roses generates less GHG than the production and delivery of Dutch roses. This is mainly due to the fact that Kenyan production uses substantially less primary and fossil energy than the Dutch production. The results are presented in Table 1 below. However, these results should be viewed with caution as they represent the comparison of a specific example. It is not clear how representative they are of the more general situation. In addition, due to averages being used (e.g. for the geothermal embodied energy and air-freight figures), the error margin estimated by the authors of the study is +/- 30% of the values reported here.

The importance of the transport mode

Another problem with the food miles concept is that it does not take into account the mode of transport. Woodin and Lucas in 2004, outlined that the percentage of total energy inputs used for

AVERAGE ENERGY USE OF DIFFERENT FORMS OF TRANSPORT					
	Energy consumed (kijlojules per T-km)	**Emissions of carbon dioxide (g/T-km)**	**Emissions of hydrocabons g/T-km)**	**Emissions of nitrogen oxides (g/T-km)**	**Emissions of carbon monoxide (g/T-km)**
Rail	677	41	0.06	0.2	0.05
Sea	423	30	0.04	0.4	0.12
Road	2.890	207	0.30	3.6	2.40
Air	15.839	1.206	2.00	5.5	1.40

T-km = tonne-kilometers of goods transported. **g/T-km** = grams per tonne-kilometre.

Table 2. *Average energy use of different forms of transport. Source: Woodin et al., 2004*

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transporting agricultural goods does not solely depend on how far it has travelled, but also on which form of transport is used (Woodin, and Lucas, 2004). The difference in emissions of some greenhouse gases (CO_2, and NOx) caused by different transport modes is presented in Table 2. From this table it can be clearly seen that air freight has by far the highest global warming potential of all modes of transport. It is also important to note that there is also a significant difference between road on the one side, and rail and sea on other, which both appear as more climate-friendly transport modes than road.

To confirm that food miles are not adequate, neither as a measure nor as an approximation for GHG emissions from transport, one can refer to Garnet's report, "Wiles Moves", in which she used the example of apples shipped from New Zealand. According to her findings, the mode of transport makes a big difference: "The environmental impact of transport from New Zealand by sea is not dissimilar to that of transport from southern Europe by road, even though the distance is far greater" (Garnett, 2003).

Transport efficiency also makes a difference

According to Smith et al, there is also a concern that moving to lower food miles (i.e. local and regional sourcing) can have a negative impact on overall transport and energy efficiency. They explain it by the fact that "If there is a growth in business for smaller producers and retailers, there could be an increase in energy consumption or congestion as smaller vehicles are used and economies of scale in production are lost." (Smith et al., 2005). Hence, it should be outlined that the promotion of local products could, in some cases, result in a less efficient shipment and distribution of food, which would outweigh potential gains in terms of reducing food miles and GHG emissions.

Impact on developing countries

There is also a concern that a reduction of food miles, in particular prohibiting air freighted products, could have an adverse impact on imports from developing countries. This concern is motivated by the fact that farmers in developing country are heavily dependent on exports to developed country markets. For example, the International Institute for Environment and Development (IIED)[5] showed that exports of fruit and vegetable from sub-Saharan Africa to the UK are worth £200 million. IIED estimated that over one million African rural livelihoods are supported in part through UK consumption of imported fresh products. Estimated 50,000-60,000 small-scale producers and 50,000-60,000 employees on larger farms grow products consumed in the UK. According to Vorley, Head of IIED's Sustainable Markets Group, "Export horticulture is one of the few genuine opportunities to bring direct and indirect benefits to the rural poor in developing countries" (MacGregor and Vorley, 2006). One should therefore bear in mind that prohibiting or restricting air freighted products on a large scale, knowing that air freight is currently the only possible mode of transport from most of Africa for highly perishable produce, could have an immediate negative impact on the development of many African countries.

Moreover, according to Vorley, "airfreight of fresh fruits and vegetables from sub-Saharan Africa accounts for less than 0.1% of total UK carbon emissions, far greater emissions result from the domestic transport of food goods within the country. The UK must first look to the huge impacts of our food system at home, before pulling up the ladder on Africa." As a matter of fact, critics of the food miles principle say that banning air freighted food from Africa will do little to mitigate the climate change but would significantly affect the development of African farmers. As Vorley said, "Climate change is going to affect the poor in Africa harder than anyone else. These are the people who have done least to cause the problem. They shouldn't be made to pay the cost of fixing it too" (Vorley, 2007).

The International Trade Centre (ITC)[6], the United Nations Conference on Trade and Development (UNCTAD) and the United

[5] The International Institute for Environment and Development (IIED) is an independent, non-profit research institute. Set up in 1971 and based in London, IIED provides expertise and leadership in researching and achieving sustainable development (see: http://www.iied.org).

[6] The International Trade Center is the technical cooperation agency of UNCTAD and WTO for operational, enterprise-oriented aspects of trade. ITC enables small business export success in developing countries by providing, with partners, trade development solutions to the private sector, trade support institutions and policy-makers.

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Nations Environment Programme (UNEP) also criticized the intention of the Soil Association to ban air freighted products on environmental ground. The main reasons for such criticism are the following:

- The total carbon footprint of the products should be considered, rather than just transportation;
- The Soil Association, whilst proposing a ban on access for air freighted products, also certifies UK products that are highly energy intensive;
- UK farmers (including organic) receive £2.8bn every year in farm subsidies, which supports the use of carbon inputs (agrochemicals, fuel, electricity, gas). In addition, farmers receive a further 50% subsidy on their use of farm diesel fuel. African farmers receive little, if anything, in energy subsidies.
- Banning air freighted products will not mitigate climate change and risk the impoverishment of very vulnerable populations particularly in sub-Saharan Africa (ITC, UNCTAD, UNEP, 2007).

Paul Monaghan, Co-op[7] UK's's Head of Ethics, also criticised the initiative of "airplane symbol" used by Marks & Spencer and Tesco: "We will never do aeroplane logos. It is lazy thinking and it is dangerous." He further explained that Co-op does not want to support this logo because it might have a detrimental effect on growers and farmers in less developed countries: "The drive to reduce food miles and reduce carbon dioxide could have real social impacts on third world growers as supply chains are redirected more locally." He added: "We will try to reduce carbon but never at the expense of the world's poorest" (Finch, 2007). A similar position was expressed by the UK retailer ASDA.

Impact on food prices

There is also discussion whether policies based on food miles could lead to an increase of food prices. On the one hand, reducing food miles might lead to reduced transportation costs, which, in turn, could reduce food prices. On the other hand, locally sourced food can be more expensive than globally sourced food, because economies of scale are lost (in cases where local sourcing involves smaller scale production, distribution or retailing), or due to differences in climatic conditions and/or labour costs.

According to Smith et al., the internalization of the social and environmental costs of food transport in the cost of sourcing and distributing food is one example that could directly increase transport costs and therefore the cost of products with high miles. Taken into account that distribution costs represent a small share of the food prices (in the UK, for example, they currently account for 3.5% of food prices), it however seems unlikely that policies to reduce food miles through internalising the social costs of transport would have a significant effect on food prices in general. However, there might be an impact for certain goods and certain modes of transport. For example, there might be noticeable price increases for some very low-priced "value" brands where transport is a higher proportion of the overall cost and price. In particular, the price of air-freighted goods would increase significantly if the full environmental impact of air transport is reflected in the fuel price (Smith et al, 2005).

In the above section dedicated to food miles, it has been shown that although initially believed to be a potential good indicator of climate sustainability, approaches focusing only on accounting for the distance travelled by food products before their final consumption generate limited benefits in terms of mitigating climate change, can be used for protectionist purposes, and have significant negative side effects. Therefore, more comprehensive methodologies have been initiated by various stakeholders in the food industry, in order to try to generate labels that would provide a more reliable and objective information regarding the overall climate impact of food products. Such initiatives, referred to as "carbon footprint labelling" or "climate labelling" will be presented in the next section. Similarly to what has been done above for food miles, the concept will first be presented in general

[7] The Co-op has a history of leading the debates on how retailers should address ethical trading and their environmental impact. It was the first major retailer to champion the Fair-trade label, when it put Cafédirect coffee on its shelves in 1992, and introduced the UK's first Fairtrade bananas in 2000. It still claims to sell a wider range of Fairtrade goods than any other retailer. It also sources almost all of its electricity from wind and water power, and only sells electrical goods rated "A" and above in its stores.

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terms, before outlining driving forces, existing examples of implementation, as well as limitations that should be placed.

2.2 Carbon footprint label

2.2.1 Origin and purpose of carbon footprint labels

After the publication of a report by Smith et al., which was produced for DEFRA, it was realized by many stakeholders in the UK that food miles can not be used as an adequate indicator of sustainability. Therefore, a more complex approach in estimating products' impacts on climate change was needed that would include different stages of products' life cycle rather than only transportation. As a result, in 2007, Carbon Trust[8], driven by the governmental target to reduce carbon emissions in the UK by 60% from 1990 levels by 2050 (as set out in the 2003 Energy White Paper) has launched a "carbon reduction label" that demonstrates the commitment of companies to reduce the carbon footprint of their products (Carbon Trust, 2006, a).

The term carbon footprint of a product is commonly used to describe the total amount of GHG emitted across the supply chain for a single unit of that product (Carbon Trust, 2007, a).

Figure 10. *Carbon Footprint logo developed by Carbon Trust*
Source: Carbon Trust, 2007, e

The aim of this label is to provide consumers with information about the climate impact of products. It is believed that this information will help them make more climate friendly purchasing decisions (Carbon Trust, 2007, b).

This label (also often referred to as "carbon label" or "climate label") is based on an experimental methodology developed by Carbon Trust. It measures the carbon embodied in a given product's life cycle (the main principles of this methodology will be presented later on).

Up to now, this initiative has been supported by different (mainly British) companies, retailers, and stakeholders. This includes Cadbury Schweppes, Coca-Cola, Pepsico, The Co-operative Group, Halofax, Muller Dairy UK limited, Innocent, Walkers, Boots, Tesco, Marks & Spencer, Sainsbury's, Duchy Originals, The Climate Group, the British Retail Consortium, WWF, Food and Drink Federation, Forum for the future, and some others (Carbon Trust, 2007, c).

Similar initiatives to print climate label on the products are now also being pushed forward in some other countries. In October 2007, the Swedish Minister for the Environment, Andreas Carlgren, stated that he would like for the climate effects of food production to be displaced on products' packaging (The local, 2007). As a result, KRAV[9] and Svenskt Sigill[10] are currently working together to develop such label. In France, the retailer Casino also initiated climate labelling for its own brand products. These and other examples of climate labelling initiatives undertaken by companies, retailers and certifying organizations will be presented later in this section. Before that, the main driving forces to implement carbon labelling will be analysed.

[8] *Carbon Trust is a private company set up by the UK government in response to the threat of climate change. It works with UK businesses and the public sector to develop practical solutions in the area of climate change.*
[9] *KRAV is a key player in the organic market in Sweden. It develops organic standards and promotes the KRAV label. [Online]. Available: http://www.krav.se/sv/System/Spraklankar/In-English/*
[10] *Svenskt Sigill (the Swedish Seal of Quality) is the quality label for assured food. The label guarantees the food has been produced on farms, which follow strict criteria for safe food, animal welfare, responsibility for the environment and a vivid landscape. [Online]. Available: http://www.svensktsigill.com/website2/sd_page/441/1/index.php?*

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2.2.2 Driving forces for carbon footprint labelling initiatives

2.2.2.1 Retailers' push

Due to potential negative consequences associated with climate change as well as increased costs of energy resources, climate change mitigation became one of the top priorities of sustainability strategies of food retailers. Retailers being major players in the food market (e.g. the USA supermarket Wal-Mart has 2% of the global food market, five supermarket groups now control 28.3% of the European food market and 85% of the UK food market is shared among the five top retailers (Woodhouse, 2007)), they have a significant power to influence the food supply chain and mitigate the impact on climate change.

To prove their commitment to combat climate change, retailers started different initiatives, including reducing energy consumption, switching to renewable fuels, optimizing distribution logistics, improving energy efficiency of vehicles, reducing amounts of packaging used, switching to low carbon products, etc. For example, Wal-Mart announced that it will run its stores entirely powered by renewable/green electricity (Carbon Disclosure Project, 2007), Tesco has been targeting to cut its energy use by 50% between 2000 and 2010 (Tesco, 2007, c), and Marks & Spencer plans to become carbon neutral within five years (Environmentalleader.com, 2007).

Another initiative recently announced by large retailers is to calculate their own as well as their supply chain's carbon footprint. At the beginning of 2007, Tesco announced that it would put carbon labels on 70 000 food products distributed in its stores, to provide information to consumers about the climate impact of products. Mainly due both to cost reasons and the complexity associated with calculating carbon footprint of products, this ambition has however more recently been lowered down to a few tens of products. In September 2007, Wal-Mart announced a partnership with the Carbon Disclosure Project to assess and measure the energy footprint of its suppliers (Wal-Mart, 2007). Jim Stanway, head of Wal-Mart's global supply chain initiatives, said, "Our objective here is to find efficiencies in the supply chain. If we remove carbon, which equates to energy, which equates to cost, we fulfil our objective of getting low prices to the customer and having a positive environmental impact" (Harvey, 2007). Carrefour, the largest French retailer and second largest in the world behind Wal-Mart, is also working in collaboration with different companies, including Nestle, Coca-Cola, Kraft, Danone, as well as public institutions to identify and test solutions to reduce emissions in the food supply chain (Carbon Disclosure Project, 2005).

In having the aim to combat climate change and to shift to low carbon products, retailers put pressure on their suppliers (including food producers) to reduce the carbon and energy footprint of their products. As Jan Dalsgaard, Head of Environmental Affairs of diary giant Arla Foods (Denmark) stated in the telephone interview, pressure from retailers, in particularly from the UK, is one of the main drivers for the company to initiate activities aimed at climate impact reduction of Arla's products. Customers' and retailers' demands to know the carbon footprint of packaging was also the major driving force for Tetra Pak to develop a CO_2 calculator tool in 2007. This tool provides interested customers, brand-owners and retailers with carbon footprint information of beverage cartons in a transparent way, which, in turn, helps Tetra Pak to meet customer needs and remain competitive (Besch, 2007). Coca-Cola's involvement in climate labelling initiatives is also mainly motivated by retailers' requirements, as indicated by their Environmental Coordinator West Europe Group, Cees Van Dongen. Danish Crown, a major world producer and exporter in the meat industry, although being actively involved in climate impact reduction activities, is however not willing to participate in climate labelling initiative at the moment. According to the representative interviewed, Charlotte Thy, Environment Manager, the company will nevertheless participate if required to do so by retailers.

It should however be underlined that environmental issues, in particular climate change, are not of primary concern for all retailers. According to a study carried out in 2008 by Master students at the International Institute for Industrial Environmental Economics (IIIEE) in Lund, Sweden, price and timely delivery are the most important factors for low-cost retailer stores. This study showed that some low-cost retailers in Sweden (Willy:s and Netto) were not aware of climate labelling initiatives and viewed it as something that would not concern their stores, at least in the near future (Barsoumian et al, 2007). This should however not

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overshadow the fact that the climate impact of food products (carbon footprint) is in the process of becoming a key aspect taken into account by the majority of big retailers in their purchasing decisions. Although those products with relatively higher carbon footprints are not expected to be automatically excluded, those companies not providing any carbon information at all for their products might be disregarded by some retailers.

2.2.2.2 Legislative requirements

As it was mentioned in the introduction, a majority of countries have signed the Kyoto Protocol, in order to tackle climate change. Under Kyoto, developed counties are committed to cut their GHG emissions by a specific percent compared to 1990 levels, by 2012. The EU-15 has to reduce GHG emissions by 8 % (each Member State has its own reduction target). Because the agreement expires in 2012, governmental representatives recently agreed in Bali (at the UN climate conference in December 2007) on negotiating a framework to develop a new global climate policy by 2009. It will require "deep cuts" in emissions by developed countries and "appropriate mitigation actions" by developing countries. Moreover, during negotiations, it was underlined that in order to enhance the reduction of GHG emissions "cooperative sectoral approaches and sector-specific actions" are needed (ENDS, 2007, a).

In 2005, EU countries introduced the ETS in order to reach the EU targets under the Kyoto Protocol in a cost-efficient way. Its main principle is that companies are allocated[11] CO_2 pollution permits, which they are able to buy and sell depending on the level of their actual CO_2 emissions. The ETS enables companies exceeding individual CO_2 emissions targets to buy allowances from 'greener' ones. This principle is supposed to give incentives to companies to cut their emissions. Under the current scheme the ETS is mandatory for many heavy industries, including individual "combustion installations" with a rated thermal input exceeding 20MW (ElAmin, 2006). Currently, 12 000 energy-intensive plants across the EU are participating in the ETS, covering about 40% of the EU's total CO_2 emissions (Euractiv.com, 2004). Among these plants are food and drinks industry sites. For instance, in France 13.6 % of all ETS installations are food and drink production sites (159 food and drink installations are covered by ETS out of 1 100 total plants). In the UK the food and drink industry accounts for 3.1 % of the estimated allocations (ElAmin, 2007, a).

The first trading period ended on the 31st of December 2007. The second trading period started in January 2008 and will last until 2012. For the second period the current ETS was going to be reviewed. The following changes were planned to be added: higher reduction targets for each Member State, expansion of the scope of the scheme (the possibility of including GHG others than CO_2 is being examined), adding new industry sectors into the scheme (for example aviation should be included around 2011), other economic sectors and smaller industrial installations could also be brought in, and auctioning of emissions permits instead of free distribution (Euractiv.com, 2004). These changes might lead to the inclusion of agricultural and small food processing companies into the trading scheme, thereby causing extra costs to companies that emit more GHG than allocated to them. In addition, the planned inclusion of aviation in the scheme will make food transportation by air more costly. Therefore, the ETS creates incentives in many ways for companies, including in the food and drink sector, to cut their GHG emissions. Companies have to identify the areas within their own operations as well as within the whole supply chain for potential energy and emissions reduction. As a result, methods and tools to estimate the carbon footprint of products are very likely to be a useful tool for companies to identify energy and GHG reduction opportunities. This in turn would lead to improved energy efficiency, cost reduction and reduced regulatory risk.

2.2.2.3 National voluntary target setting

Another driving force that makes companies to reduce their emissions and energy consumption is countries' national voluntary targets in their energy and climate change policy. For example, the

[11] *By now the allocation of permits to businesses is done free of charge, however, it is planned to carry out auctioning of emissions permits, because free allocation of permits allowed companies to accumulate unexpected profits from selling their extra credits. Moreover, overallocations of pollution credits by several member states is forcing carbon prices down that lessen companies intentions to cut their emissions.*

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EU announced that it will reduce GHG emissions by 20%, improve energy efficiency by 20%, raise the share of renewable energy sources by 20%, and the share of bio-fuels in road transport by 10%. All targets are to be achieved by the year 2020 (CIAA, 2007). In the UK, the Energy White Paper 2003 sets a target to reduce carbon emissions by 60% from 1990 levels by 2050 (Carbon Trust, 2006, a). In February 2007, The New Zealand Prime Minister, Helen Clark, has pledged that New Zealand will become a carbon neutral country; however, she did not mention a deadline (Marks, 2007). Another country that aims at becoming carbon neutral is Norway. In September 2007, Jens Stoltenberg, Prime Minister, announced that Norway will become carbon neutral by 2050. It plans to achieve this goal by significantly reducing its own GHG emissions and offsetting the remaining through the purchase of emission reductions world-wide (Ministry of Finance, 2007). Costa Rica is also planning to become a carbon neutral country by 2021 (Reuters, 2007). One of the key instruments that will be used to achieve this goal, according to the Environment and Energy Minister Roberto Dobles, is a "C-Neutral" label to certify that tourism and certain industrial practices mitigate all of the carbon dioxide they emit (Herro, 2007).

Agreements between governments and the food and drink sector on energy efficiency and emissions reduction might be another driving force companies to look at carbon footprint of their product. Such agreements exist, for instance, in the Netherlands, Belgium and the UK. As an example, in 2004, 132 Belgian food and drink companies, representing more than 80% of energy use in the sector, signed an Energy Efficiency Agreement with the authorities, under which each company commits to a specific energy use reduction target that should be achieved by 2012 (CIAA, 2007). In October 2007, the Food and Drink Federation of the UK announced that its members are committed to reduce CO_2 emissions by 20% by 2010 compared to 1990. Food industry will also attempt to reach a further 10 percentage point reduction by 2020 (ElAmin, 2007, b).

The EU's Integrated Product Policy directive, which aims at minimizing products' environmental impacts by looking at all phases of a product's life-cycle, could also facilitate the adoption of carbon labelling schemes indicating the impact of products on climate change. As a matter of fact, Stavros Dimas, the EU's Environment Commissioner, supported the idea of climate labelling scheme: "If there is a big demand for carbon labelling then it will be one of the issues that I will be looking to follow up on." However, he thinks this scheme should be implemented EU wide: "I know that a number of companies and retailers are developing their own carbon labelling and given that we have a single market it would appear to make sense to have one set of labels for the single market" (ENDS, 2007, b). The idea of climate labelling is also supported on a national level in Sweden. In October 2007, the Environment Minister, Andreas Carlgren, expressed that information about climate impact of food production should be displaced on product packaging (The local, 2007). The Norwegian government is also considering a system of carbon labelling for consumer goods, as it appeared in the Norwegian newspaper, Dagsavisen, in January 2008 (ENDS, 2008).

To summarize the above described points, governmental policies to combat climate change, including especially emissions trading schemes and voluntary agreements and programmes, force companies to understand and manage their GHG emissions better.

2.2.2.4 Managing risks and identifying opportunities

Climate change presents both business risks and opportunities for a company (WBCSD and WRI, undated). The increased costs of production due to high prices of energy resources can be an example of the risks associated with climate change. Moreover, companies should consider the potential negative effects of a changing climate, for example floods and drought, on their operations. Extreme weather events might also increase significantly the prices of food products. For example, in 2007, a combination of drought and floods in grain-growing regions, coupled with rising demand, lead to a significant increase of the price of wheat. This in turn resulted in higher costs for the numerous food companies using wheat as a raw material or ingredient, which impacted the price of many final food products (Harvey, 2007).

Another relevant business and financial risk for a company worth mentioning is the potential liabilities due to current and future stricter GHG regulations. More stringent standards will force those companies that did not anticipate the regulations by progressively reducing their carbon footprint, to take costly short term measures

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in order to comply. On the contrary, a proactive accounting of the corporate carbon footprint and the footprint of products will enable companies to improve their understanding of their emissions profile and identify potential GHG related risks and liabilities. This will help them to anticipate and respond more efficiently to future stricter GHG regulations and compulsory reduction targets.

It should also be underlined that the risks associated with climate change promoted corporate disclosure on carbon performance as one of the key aspects demanded by insurance companies, shareholders, and investors. As Joachim Faber, Allianz SE Board Member and CEO of Allianz Global Investors, said, "Climate change creates significant costs for the financial industry. In the interest of our clients and shareholders we are obligated to take these risks into account when making decisions on insurance underwriting, investments or lending credit" (Innovest Strategic Value Advisors, 2007). Hence, companies with relatively bad carbon profiles, especially if they are unable to display proactive measure taken to improve their climate performance and to reduce their exposure to climate change related risks, will have to pay higher insurance premiums and might loose part of their attractiveness to potential investors.

On the other hand, climate change also provides opportunities for companies. For example, by improving its resource efficiency and being more climate-innovative, a company can reduce its production costs and improve its competitiveness. Moreover, as underlined above, investors are more and more interested in companies actively tackling climate change. As Paul Dickinson, chief executive of the Carbon Disclosure Project[12], said, "Increasingly, investors view good carbon management as a sign of good corporate management" (Carbon Disclosure Project, 2007, b). Thus, calculating carbon footprint of products might be a useful tool for a company to assess and manage its GHG emissions and to identify potential GHG risks and most effective reduction opportunities. Also supporting this idea, Mr. Campbell, Chief Executive of Walkers (Walkers already prints carbon footprint label on its cheese and onions crisps) stated that carbon footprint label helped the company "to spot areas for continual improvements in all elements of the supply chain" and to understand "where to focus resources to reduce carbon" (ENDS, 2007, c).

Finally, for a company to achieve its GHG reduction targets, it is important that its staff understand well the current climate performance of the company. In that sense, conducting an inventory of company and products' related GHG emissions would certainly help to raise internal awareness about risks and opportunities presented by climate change and ensure the issue is on the business agenda (WBCSD and WRI, undated).

2.2.2.5 Consumer demand

Recently, the topic of climate change and its consequences was intensively covered by media, which increased consumers' concern about the issue. However, there are still ongoing discussions whether consumers are and will be interested in information about climate impact of products, and whether climate related information about products will have a strong influence on their purchasing decisions. Different positions and opinions are presented below.

According to a recent survey commissioned by the Swedish Environmental Protection Agency, the proportion of Swedish people who are prepared to reduce their own climate impact has increased sharply in 2007, as 81% think they can do something themselves to curb climate change (in 2006, the proportion was 73%) (Swedish Environmental Protection Agency, 2007).

Another consumer survey amongst 2,734 consumers in the USA and the UK, carried out by Consumer International in July 2007, showed that 66% of respondents agreed that everyone should take responsibility for their personal contribution to global warming. However, the survey also revealed that their actions in practice do not match with the concern they express. According to

[12] *Carbon Disclosure Project is a New York based independent organisation. In 2007 Carbon Disclosure Project on behalf of 315 institutional investors carried out an analysis of how the world's largest companies are responding to climate change. The questionnaire about the corporate risks and opportunities associated with climate change as well as about corporate GHG performance was sent to 2,400 large companies, including to Wal – Mart, Tesco, Unilever, Cadbury Schweppes, Coca Cola, Danone, and Nestle. Participation in this project made companies disclose the information about their GHG emissions.*

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the survey, one of the main reasons why consumers are reluctant in taking actions is a lack of product information: 66% of respondents want companies to provide more product based information at the point of sale, while half of them would rather buy from a company that takes actions to combat climate change than from other companies (Consumers International, 2007). Another survey among 1,000 people interviewed in the UK by Populus for the account of Walkers, showed that half of respondents were more likely to buy a product with a carbon label, and 69% said that the label demonstrated a company's commitment to reducing its carbon emissions (Climatechangecorp.com, 2007).

Terry Leahy, Chief Executive at Tesco, said the following regarding consumer perception of climate labelling: "The market is ready. Consumers tell us that they want our help to do more in the fight against climate change if only we can make it easier and more affordable" (ENDS, 2007, c). Similar opinion regarding climate labelling was expressed by Inger C Larsson, R&D and Quality Director at the frozen food company Findus (Sweden), during a telephone interview. She believes that the topic of climate change is well known by consumers and that they are now willing to know more about the specific climate impact of products. To her opinion, consumers should be given the right to make such choice. To mention a contradicting opinion, the representative of Danish Crown interviewed, Charlotte Thy, Environment Manager, stated that the percentage of consumers really interested in the topic of climate change and environment in general is small, and that, therefore, she does not believe that consumers might have a strong interest in climate labelling.

Another aspect that requires particular consideration is whether consumers' willingness to have more climate related product information will guarantee that they actually will act based on this information. For instance, the same survey done by Consumer International than mentioned in the previous paragraph, showed that levels of consumer awareness of other existing labels, such as health and social label, are generally high (90% for nutrition labels and 67% for fair-trade). However, levels of consistent purchasing decisions are much lower (32% for nutritional labels and 15.5% for fair-trade) despite the fact that 50% of respondents in the survey said that they are concerned about global poverty (Consumers International, 2007). A survey carried out by Kesko, a Finnish retailer, in 2004, showed that 40 to 60% of consumers claim to look at sustainability aspects when choosing a product, but that only 10% do actually buy such products. The French retailer Casino investigated that 80% of its customers say they are concerned about responsible consumption, but that only 5% of purchases are decided based on this criterion. This is mainly due to the fact that purchasing price still remains the dominant decisive factor (Almaani et al, 2004). It can be feared that climate labelling schemes will face a similar problem: a general interest expressed by consumers, who might however only rarely base their purchasing decisions on the information provided by eventual climate performance labels.

To find out the public's opinion about climate labelling in Sweden, a small survey was carried out among 250 consumers during the summer of 2007. It showed that 73% of consumers would always or often buy climate-labelled food products. Around 40% said they would be willing to pay 10% more for labelled products (Toivonen, 2007). However, Johan Cejie, Head of Standards Development (regelutvecklingschef) at KRAV, commented that those numbers are most likely too good to be true. He added that probably only a quarter of Swedes would be actually ready to buy the climate-friendly goods, most likely those who already buy organic or biodynamic food (Treehugger.com, 2007). Louise Ungerth, Head of Consumer and Environment Affairs at the Swedish Consumer Association (Konsumentföreningen Stockholm, Sweden), also thinks that mainly those consumers who are already interested in environmental aspects (according to her it is approximately 50% of Swedish consumers) of food products would be interested in climate labelling as well.

2.2.2.6 Additional driving forces

Green marketing and product differentiation

Given that the sustainable food market is constantly growing in volume and share of total food consumption, and based on the assumption that consumers are willing to buy from companies that are tackling climate change, climate labelling schemes might provide producers and retailers with an additional competitive advantage, an enhanced image, and, as a result, an increased number of customers. For instance, after the New Zealand Wine Company started placing carbon neutral labels on its wines, the UK retailer Sainsbury's decided to purchase more of these wines

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(Smith, Undated). For Tetra Pak, the provision of carbon footprint of its packages helps the company to meet customers' needs and therefore is one aspect used to remain competitive (Besch, 2007). To mention the position of the British retailer ASDA, and despite the fact that it opposes the implementation of climate labels due to its cost and lack of meaning, the representative interviewed agreed that climate labelling, if used in practice, could bring improved reputation for the company (Brown, 2007).

Demonstrating leadership and corporate responsibility
With the emergence of international and national GHG regulations, as well as growing concerns about the effects of climate change, a company's commitment to reduce GHG emissions demonstrates its environmental leadership and a proactive corporate responsibility strategy. Carbon footprint labelling for products can be considered as a part of such commitment. Mr. Campbell, Chief Executive of Walkers, for instance, stated that the key motivation of Walkers in implementing such label was the company's commitment to reduce its emissions (ENDS, 2007, c). For Arla Foods, demonstrating proactiveness and leadership was also one of the main drivers to initiate an inventory of GHG emissions of its products (Dalsgaard, 2007). Linking back to what was mentioned above regarding the development of a new form of competitive advantage, such corporate commitment to combat climate change can in turn improve a company's position with customers, employees, investors, business partners, as well as consumers by enhancing the brand's reputation and help differentiate the company on the market (WBCSD and WRI, undated).

Personal carbon trading
Another driving force might be the potential implementation of the so called system of Personal Carbon Allowances (PCA), which, once again, has been initiated in the UK. The system is similar to existing ETS among businesses, but for households. The PCA system implies that all individuals within a country are allocated equal carbon credits per year, which would reduce annually, with reductions announced well in advance. These allowances would be tradable. When buying products, paying energy bills, travelling, people will have to withdraw carbon credits from their account. If they have used up all their credits they will be able to buy more from those who used less carbon credits, at the market price. Such and similar systems of personal carbon trading are planned to be implemented in the UK and Ireland (Fawcett, 2007).

Figure 11. *Example of personal carbon allowance*
Source: Fawcett, 2007

However, before the system is in place, each product should have detailed and reliable information about its carbon footprint, so that when buying any good or service, a certain amount of carbon credits can be deducted from the individual account of the purchaser. After having outlined the main driving forces for the implementation of climate labelling, and before presenting examples of such initiatives and analysing limitations that should be placed, the focus will now be placed on the calculation methodologies developed to assess the climate/carbon footprint of products.

2.2.3 Calculating a product's carbon footprint: The Carbon Trust methodology

Due to the lack of international standard for calculating GHG emissions embodied in products, different companies use different methodologies to calculate the carbon footprint of their products. Taking into account that in the UK, almost all companies currently involved in carbon labelling initiatives are using the Carbon Trust methodology, and due to the fact that there is currently no sufficient data available about other methodologies used, the focus here will be on describing more in details the Carbon Trust methodology. Other methodologies will be briefly presented in the following sub-section within each example of initiatives undertaken by companies in practice.

The Carbon Trust methodology is based on Life Cycle Analysis (LCA) thinking (Carbon Trust, 2007, d). An LCA is an assessment of the environmental effects a product or service has during its lifetime, from cradle to grave, which means that all the important

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processes of a product's lifecycle are included. Part of an LCA analysis can therefore be used for assessing how much GHG emissions are emitted to the environment during the production of one particular product (LCA Food Database, 2007). However, limitations are often placed by professionals having conducted an LCA: the results of the assessments can often not be applied uniformly and are usually not comparable between different studies because different assumptions are made before and during each study. As the main purpose of this report is not to discuss LCA methods, principle and limitations, the LCA concept will not be discussed further as such. More detailed information about LCA methodologies is widely available via publications as well as online . The remaining of this section will focus more specifically on the practical use of LCA principles by the Carbon Trust to achieve a comprehensive assessment of GHG emissions associated with a given product.

According to the Carbon Trust methodology, all GHG emissions should be measured and then converted in CO_2 equivalent emissions using 100 year global warming potential (GWP) coefficients[14]. To be able to calculate GHG emissions, a company has to complete five steps:

- Analyze internal product data (raw materials and packaging involved in producing the product, the resources used in the manufacturing process, storage, as well as transportation, and waste materials produced during production);
- Build a process map of the full supply chain (both for the finished product, raw materials and co-products);
- Define boundary conditions and identify data requirements (according to the methodology, data is required and should be included for all emissions that make a significant contribution to the carbon footprint of the product; by now the final level of significance for the assessment is defined by mass, with at least 90% of the mass of the final product having to be analyzed);
- Collect primary and secondary data (collect the data required for calculating the GHG emissions at every stage in the process, both within the company and/or using comparable studies if no information is available internally);
- Calculate carbon emissions for each supply chain process steps. The final step is to calculate the mass balance (i.e., the quantity of materials coming into and going out of each stage of the process) and use it to calculate the total GHG emissions.

The Carbon Trust recommends that emissions be calculated through energy and direct emissions data using energy coefficients for the conversion into carbon equivalents. In addition, the calculation of GHG is done at a 'product unit' level, where product unit is defined as the item, including packaging, in which the product is sold to/purchased by a consumer. The carbon emissions are presented in kg of CO_2 per kg of product (ratio).

Regarding system boundaries, the methodology includes all stages of supply chain up to the arrival of the product at the retailer's store, plus final disposal. The following comments can be made:

- Disposal is included because it is considered that producers have the ability to greatly influence this stage, for example though choosing packaging material;
- Emissions generated at the retail store (e.g. from heating, lighting and refrigeration) are not included, the justification used being that the producer will have no impact on this stage of the life cycle;
- Also excluded are emissions from consumers' stage (e.g. emissions from transporting food from shops to home, from the energy used to cook food, to refrigerate it, to power an electrical appliance, etc.). This choice is motivated by the fact that producers have limited influence on changing user phase behaviours. Moreover, the emissions from this stage are highly variable depending on the user of the products, which would make it difficult to obtain an accurate average.
- Emissions generated from activities that indirectly impact the supply chain, for example emissions during commuting to a factory by workers, are also excluded from the calculation.

[13] For instance at the following website: http://www.lcafood.dk/LCA/LCA.htm#general

[14] The international standard practice is to express greenhouse gases in CO_2 equivalents. Emissions of gases other than CO_2 are translated into CO_2 equivalents using global warming potentials. The IPCC recommends using 100 year potentials. GWPs are used to convert emissions of non-CO_2 gases into their CO_2 warming equivalents (CO_2e). The CO_2e of a non-CO_2 gas is calculated by multiplying the mass of the emissions of the non-CO_2 gas by its GWP.

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However, all direct processes should be included in the analysis.

- With the aim to provide information on the actual emissions associated with the product's supply chain and to identify potential emissions reductions, offsetting of emissions at the company level from any part of the supply chain is not included in the carbon footprint of the product. It would otherwise reduce the total carbon footprint of the product, which would distort the actual carbon profile of a specific product (Carbon Trust, 2007, d).

This label is to be updated every second year. Companies participating must also commit to reducing the carbon footprint of each product within the same two years cycle. Products that fail to do so will lose the label, under a so called "reduce it or lose it" clause. If after two years, a company wants to retain the label it must certify it again and commit again to further reductions (ENDS, 2007, c).

2.2.4 Examples of existing initiatives

2.2.4.1 Examples of producers' initiatives

Walkers (the UK)

Walkers is the UK's largest snack food manufacturer with brands such as Walkers, Wotsits, Quavers, Doritos and Walkers Sensations. Walkers' cheese and onion crisps is the first product having been labeled with a carbon footprint logo. The carbon footprint of a bag of 33.5g of crisps amounts to 75g of carbon[15] emissions per packet. A label including this figure is printed on the front of the bag of crisps, with background information on the back and additional information available on the company's website (Carbon Trust, 2006).

To estimate the carbon footprint of its product, Walkers worked together with the Carbon Trust and used its methodology. Walkers analyzed the full product life cycle, including emissions from fuel used in raw material production and sourcing, products' distribution, as well as disposal. However, emissions from the retailing and final consumption stages were excluded. This was motivated by the fact that snack foods do not require refrigeration and heating in consumers' homes or retailers' stores, which is assumed to bring down their associated energy consumption levels during those two stages close to zero (Carbon Trust, 2006). To calculate carbon emissions from the whole supply chain, Walkers worked together with its suppliers (primary data) as well as used existing studies (secondary data). Suppliers willingly participated in the research, as they wanted to know more about carbon emissions from their own operations as well as emissions from the whole supply chain (Carbon Trust, 2006). The overall analysis of the whole supply chain and individual processes showed that 44% of carbon emissions were generated in the production of the raw materials and 30% during manufacture of the chips themselves. Packaging accounted for 15% of total emissions, transportation 9% and disposal 2%. The total carbon footprint, as it was mentioned above, was estimated to be 75g per packet of crisps (ENDS, 2007, c).

Figure 12. *Carbon footprint logo on Walkers' cheese and onion crisps. Source: BBC, 2007*

One of the main incentives for Walkers to implement this label was the company's target to reduce energy use by 3% per year and increase profitability through energy savings. According to Mr. Campbell, chief executive of Walkers, this label helped the

[15] *Walkers' website says that it is 75 g of CO_2, however, given the fact that calculation of carbon footprint of Walkers' crisps is based on Carbon Trust Methodology that includes all GHG emissions from almost all stages of the product's supply chain (except refrigeration in a retailer store and consumer stage), therefore, here and further in this chapter CO_2 can be assumed as CO_2 equivalent.*

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company to identify hot spots of GHG emissions generation throughout its supply chain, and to understand where to focus its resources to reduce these emissions (ENDS, 2007, c). The product carbon footprint study allowed identifying opportunities to achieve savings of 18,000 tonnes of CO_2 per year, equivalent to 8% of the total emissions across the supply chain (Carbon Trust, 2006).

Moreover, when calculating the carbon footprint of crisps, it was found out that it is possible to reduce energy consumption by buying potatoes with lower water content. The study showed that potatoes farmers were growing involved higher energy consumption at Walkers' operations. Farmers were storing potatoes in artificially humidified warehousing sheds, which, in turn, was forcing Walkers to increase frying time of the potatoes to compensate for the increased water content, leading to increased carbon emissions and higher bills. Walkers realised that the overall supply chain could save up to 9,200 tonnes of carbon dioxide and £1.2 million (British Pounds) per year by changing the way potatoes are purchased. Until now, Walkers has been paying a price per ton of potatoes. The company is now thinking of varying the prices based on the water content, rewarding farmers for producing potatoes with a lower water content (Carbon Trust, 2006).

Innocent (the UK)

Innocent is a UK based smoothie manufacturer. In addition to "no air freight" (all fruits it uses are transported by land or boat) and a local sourcing policy, Innocent (together with Carbon Trust and the Edinburgh Centre for Carbon Management) has calculated the carbon footprint of some of its products: the mango and passion fruit smoothies. Ultimately, Innocent's plan is to provide carbon footprint for all smoothie recipes (ENDS, 2007, c). It is important to note that the company displays the label on its company website, rather than printing it on the packaging, which, one could argue, very much limits the awareness raising of consumers to those already pro-active ones who will actively check Innocent's webpage. As per the figure below, a 250ml bottle of mangoes and passion fruit smoothie has a carbon footprint of 294g of CO_2 equivalent. In comparison, a 250ml serving from its 1 liter carton has a relatively lower footprint of 190g.

Figure 13. *Carbon footprint logo on Innocent smoothies*
Source: Innocent drinks, 2007, a

According to Innocent's website, these figures of CO_2 include all "emissions of GHG associated with growing, transporting, crushing and blending the fruits, manufacturing the packaging, bottling and distributing the drinks, and keeping them cold in the shop" (Innocent drinks, 2007, a). The distribution of carbon footprint through supply chain is presented in the following Figure 14.

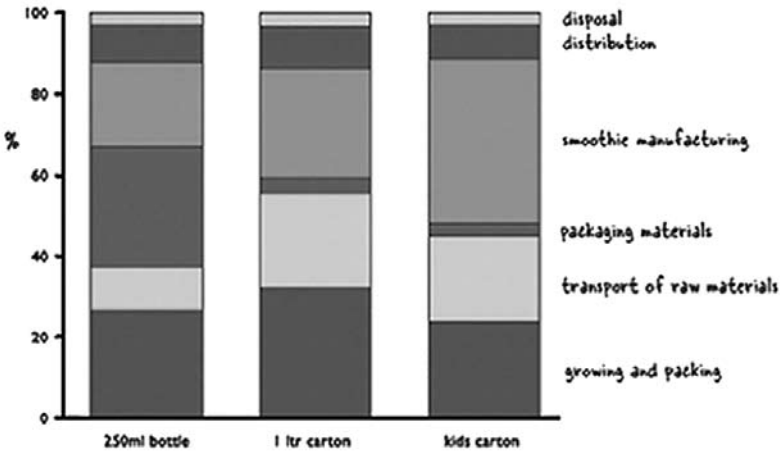

Figure 14. *Percentage of carbon footprint split up through Innocent's supply chain*
Source: Innocent drinks, 2007, a

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This tends to show that emissions from transportation of the fruits are not the main source of emissions, as they amount for less than 20% of total carbon emissions. This discredits the validity of "food miles" as an indicator of climate sustainability for this product, and outlines the fact that other areas than transportation should also be focused on where emissions can be significantly reduced.

To get the final figures, Innocent used industry averages in some case (secondary data), rather than specific farms' emissions. Therefore, the company does not claim that the figures presented are precise. The website recommends viewing carbon footprints as a good start, but the company promises to improve the methods and measurements to get them more accurate (Innocent drinks, 2007, a).

In addition, after working through its supply chain, Innocent identified three areas of work which will allow to reduce GHG emissions significantly: packaging (it plans to increase the amount of recycled plastic it uses); manufacturing (energy audits will be conducted with its manufacturing partners to cut energy usage; the amount of power from renewable resources will be increased); and its distribution in the UK (by working with its transportation supplies to improve load and fuel efficiency as well as to explore the use of alternative fuels) (Innocent drinks, 2007, b).

Unilever (the UK)

Unilever is one of the world's leading suppliers of consumer goods across food, home and personal care categories with a portfolio of around 400 brands (Unilever, 2007, a). Unilever's food's leading brands include, among others, Knorr, Hellmann's, Calvé, Amora, Bertolli, Rama, Magnum, Lipton and Brooke Bond. In response to the threats posed by climate change, Unilever has developed a climate strategy aimed at reducing GHG emissions from its production processes as well as through the whole supply chain, including sourcing, manufacture, distribution, consumption and disposal of its products. First, Unilever estimated GHG emissions from its own factories, offices, laboratories and business travels. In 2006, these emissions were in the order of 4 million tonnes of CO_2 equivalent a year. To reduce these emissions, the company has undertaken various initiatives, including installing energy efficient technologies, switching to renewable energy sources, offsetting travel-related emissions through renewable energy initiatives in India and South Africa, as well as installing leading-edge video-conferencing facilities in the offices to avoid some travelling when possible. All these initiatives have reduced CO_2 emissions within the company's own operations by more than 30% over the past decade in absolute terms. Unilever actions have been recognized externally and in 2006 Unilever was ranked first in the food and retail sector by the Carbon Disclosure Project's Climate Leadership Index, for best practice in GHG emissions and climate change strategies (Unilever, 2007, b).

By being proactive in reducing its own GHG emissions, Unilever has realized that the impact of its products on climate change can be significantly higher when looking at the whole supply chain rather than just at their own production processes. For example, it was estimated that GHG emissions in the raw material supply chain are 10 times bigger than Unilever's "own" emissions (Unilever, 2007, b). Therefore, the company has developed a 'greenhouse gas index', which it intends to incorporate into its product development process. The purpose of this index is not to label a product with the precise figure of CO_2 emissions, but to identify "hot spots" of products' climate impact through the supply chain, including own processes, and, where possible, to reduce this impact. This index is used internally for decision making purposes, for setting energy and GHG reduction targets, as well as for increasing awareness among the employees about the climate impact of the different products (King, 2007).

The estimation of the carbon footprint of the products is carried out based on data collected from suppliers and existing LCA studies. However, as Henry King, Science & Technology Leader for Sustainability at Unilever UK, pointed out during a telephone interview, the final figures are not precise because the initial aim of the estimation was more to identify stages that generate the most GHG emissions with potential reduction activities, rather than getting precise figure of GHG emissions. The estimation of Unilever's carbon footprint of products is presented on the Figure 15.

As per the Figure above, the final consumption and disposal stages are responsible for the majority of GHG emissions. Therefore, in order to reduce emissions from this stage, Unilever works on product design and reformulation, as well as carries out different

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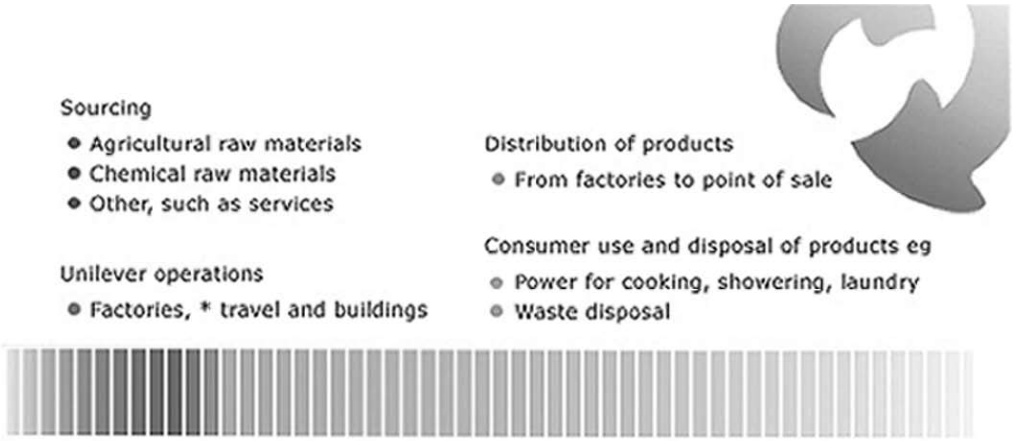

Figure 15. *'Unilever's carbon footprint*
** Includes third-party manufacturing. Source: Unilever, 2007, b*

sustainability campaigns that influence consumers' behaviour. For example, for washing powders, the "Washright" campaign encourages consumers to wash at lower temperatures and use full wash loads. Unilever has also initiated actions in other stages of its products' life cycle, by, for instance, promoting HFC-free refrigeration technologies, reducing the amount of packaging, as well as increasing the renewable and recycled content of packaging (Unilever, 2007, b).

Tetra Pak (Sweden)

Tetra Pak is providing processing and packaging solutions for food. Despite the fact that it is not a food producer, the case of the CO_2 calculator developed by the company for its packaging will be presented in this report, because packaging is one of the stages of the food product's life cycle that is considered in the calculation of a food product's total carbon footprint. The information below is based on a telephone interview with Katrin Besch, Environmental Specialist at Tetra Pak. As an initial comment, it is important to point out that Tetra Pak has been developing a calculation methodology, without the intention to use it for labelling purposes, but rather to be able to provide information to its customers requiring the quantified carbon footprint of the packages.

Tetra Pak has been working with LCA of its packaging for many years. During 2007, to respond to requirements of interested customers, brand-owners as well as retailers interested in knowing the carbon footprint of packages (which they need to include in calculation of total carbon footprint of their products), Tetra Pak developed a CO_2 calculator tool. This tool provides "cradle-to-gate" carbon footprint information measured in grams of CO_2 equivalent per package. This means that the results from the CO_2 calculator provide the carbon footprint of the beverage cartons up to the moment when the packaging material leaves Tetra Pak factories.

Exclusion of other stages (such as transportation to the customers' facilities, filling of products, distribution, as well as final consumption of the product and disposal of the packaging) is motivated by the fact that an assessment across the full life cycle requires additional data that varies locally, and with each specific product. For example, distribution distances vary depending on where each package is filled and sold; some filled packages are stored chilled while others not; some packages will be recycled, others not. Four different types of beverage cartons are covered by the CO_2 calculator, mostly for milk and juice products. The calculator covers all packaging volumes up to 1 litre.

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The calculations behind the tool were made on the basis of available corporate data, as well as industry average data for European conditions. Tetra Pak did not use specific data from each of its suppliers, because it considers that public available average industry data provide a higher level of transparency and credibility. The methodology and data employed are based on a 'Carbon Indicator Tool for Beverage Cartons' prepared by the Institute for Energy and Environment Research - IFEU[16], in Heidelberg, Germany for the account of ACE (Alliance for Beverage Cartons and the Environment).

The development of the CO_2 calculator and the underlying methodology gives Tetra Pak the ability to meet customers' requests for transparent carbon footprint data. Although Tetra Pak has been working with energy consumption and GHG reduction for several years, the increasing interest of its stakeholders in carbon footprint information has provided additional motivation for the company to set stricter internal goals for reduction of GHG emissions in order to continuously reduce the carbon footprint of Tetra Pak's packaging solutions.

The New Zealand Wine Company (NZWC)

To make its products more attractive in overseas markets where retailers put pressure on their suppliers to reduce their impact on climate change and where consumers are concerned about climate change, the New Zealand Wine Company (NZWC) has pursued and gained a CarboNZero certification[17] for its Grove Mill and Sanctuary wines. The CarboNZero logo (see Figure 16 below) implies that Grove Mill and Sanctuary wines are carbon-neutral products. GHG generated from growing grapes, winemaking and shipping were included when calculating the carbon footprint of those wines, (CarboNZero, 2007).

In order to meet the requirements of the CarboNZero programme, NZWC made energy efficiency improvements throughout the winery processes and redesigned packaging to optimise the use of maritime freight. Remaining unavoidable emissions were offset by investing in the regeneration of indigenous forest through a forest sinks project. In addition, since gaining certification, more opportunities for emissions reduction were identified, thus ensuring that further improvements can be made before their next CarboNZero assessment, in order for the labelling to be renewed. The benefits of CarboNZero label for NZWC include bottom line cost savings and value added to the two brands. The wines have, in particular, been more widely distributed by retailers in the UK since obtaining the label. This is very relevant to note in a country that, as described in the previous chapter, has recently been targeting many of New Zealand's agricultural export products, supposed to be bad for the climate based solely on "food miles" assessments (Smith, undated).

Figure 16. *CarboNZero logo used for Grove Mill and Sanctuary wines. Source: CarboNZero, 2007*

Dole Food Company (Costa Rica)

Dole Food Company is one of the world's largest producers and distributors of fruits and vegetables. In 2007, it announced that 'Standard Fruit de Costa Rica' (Dole's operating subsidiary in Costa Rica), the National Forestry Financing Fund (Fondo Nacional de Financiamento Forestal), and an entity of the Ministry of Environment and Energy of Costa Rica, signed an agreement to work together on a project aimed at establishing a carbon neutral product supply chain for bananas and pineapples, from their production in Costa Rica to the markets in North America and Europe. To become carbon neutral, Dole has committed to reduce and offset the CO_2 emitted to produce, pack, transport and distribute the fruits. Reductions are planned to be achieved by using new, more efficient transportation methods, by changing

[16] *IFEU is an independent consultant with long standing experience in the LCI/LCA business and expertise in packaging related topics.*
[17] *CarboNZero certification programme encourages and supports individuals and organisations to minimise their impacts on climate change by providing them with tools to measure, manage and mitigate their CO_2 emissions.*

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agricultural processes to reduce CO_2 emissions, while offsetting will be achieved by partnering with local farmers to implement preservation and reforestation programs.

The project in Costa Rica will in particular include the Organic Pineapple Farm producing "YourChoice" Organic Pineapples. It is planned that these pineapples will become Organic C-Neutral in the near future. Another example of initiatives to compensate CO_2 emissions generated by each vehicle was undertaken by other Dole's organic farm, Don Pedro Farm in La Guajira, Colombia. In June 2007, during the celebration of the Planet's Day, all vehicles drivers planted trees to compensate the 5.5 tonnes of CO_2 generated, on average by each vehicle each year. Thus, according to Dole's website, every vehicle used in Don Pedro Farm is now Carbon Compensated until the next Planet's Day (Dole Organic, 2007).

2.2.4.2 Examples of retailers' initiative

Tesco (the UK)

Driven by a company-internal target to reduce its carbon footprint by 50% by 2020, Tesco announced in February 2007 its intention to label 70 000 products sold on its shelves with the amount of carbon generated from manufacture, packaging, and transport of those items. This initial target has however been recently reduced to a much lower number of products due to the actual cost and complexity of doing this in practice.

Currently, Tesco is working together with Carbon Trust to measure the carbon footprint of 30 Tesco own-brand products, including the following product categories: tomatoes, potatoes, orange juice, light bulbs, and washing detergent. The products will be assessed using the draft standard being currently developed by the Carbon Trust, DEFRA and the British Standards Institute (BSI). The so called "Publicly Available Specification (PAS) 2050" measures the embodied GHG emissions from products and services (Carbon Trust, 2007, b).

The objective of Tesco's initiative is to provide consumers with information about the climate impact of different products and to encourage them to buy more sustainable products. Tesco believes that consumers will consider the climate impact of the products in their purchasing decision. Mr. Leahy, Chief Executive of Tesco, said: "The idea is that you can compare the carbon footprint of a product as you would compare nutrition or price" (Stein, 2007).

Taken into account that there are no well-established methods for collecting information about the energy required for products' manufacture, packaging and transport to the supermarket shelves, and about emissions generated during these processes, Tesco is going to invest £5 millions in academic research on these methods, working with the Environmental Change Institute at Oxford University (Tesco, 2007, d). There is no final deadline for when the first label will appear on the products. However, Tesco hopes that the initiative will be supported by other retailers, in order for the 'carbon calorie-counting' system to become an accepted part of food packaging, in a similar way to nutritional information' (Stein, 2007).

Wal - Mart (the USA)

Having environmental goals to be supplied 100% by renewable energy, to create zero waste and to sell products that sustain resources and environment (Carbon Disclosure Project, 2007, a), Wal-Mart Stores announced a partnership with the Carbon Disclosure Project to measure the amount of energy used throughout its supply chain including procurement, manufacturing and distribution processes.

The main aim of the pilot project is to find new and innovative ways to make the entire process more energy efficient. "This is an important first step toward reaching our goal of removing non-renewable energy from the products Wal-Mart sells," said John Fleming, executive vice president and chief merchandising officer, at Wal-Mart Stores Division. "This is an opportunity to spur innovation and efficiency throughout our supply chain that will not only help protect the environment but save people money at the same time" (Wal-Mart, 2007). Moreover, this project will allow Wal-Mart to reduce its total carbon footprint by reducing its indirect emissions, i.e. emissions that are not relevant to direct Wal-Mart operations.

Initially, seven products categories (DVD's, toothpaste, soap, milk, beer, vacuum cleaners and soda) will be covered by the pilot project to define energy consumption and carbon throughout the

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entire supply chain. These products were identified because they are commonly used by customers.

The carbon footprint of Wal-Mart supply chain will be assessed by the Carbon Disclosure Project using a methodology which complies with the World Resources Institute (WRI) and the WBCSD's Greenhouse Gas Protocol[18] Initiative for corporate greenhouse gas accounting and reporting. The data provided by suppliers about their GHG emissions will be used by Wal-Mart to develop supplier score cards to evaluate the carbon footprint of suppliers and products, and include this information in its sourcing choices (Wal-Mart, 2007). .

ICA[19] (Sweden)

Recently, the Swedish retailer ICA carried out a research in order to identify what its consumers know about climate impacts of food products. The research showed that most consumers think that the biggest impact on climate change within the food supply chain is caused by transportation of food products, despite the fact that in practice it is often agricultural activities that cause the biggest impact. In parallel, ICA also decided to understand what impact its own brand products cause on climate change. Together with the Swedish Institute for Food and Biotechnology (SIK)[20] Institute, ICA undertook an initiative to estimate CO_2 equivalent emissions of 100 ICA-brand products, including dairy products, oils, meat, fish, vegetables, and sugar.

The estimation of emissions includes all stages of the supply chain (among others, storage at its stores, which means ICA carries out research about GHG emissions generated as a result of own activities), as well as packaging disposal, except consumer stage. This exclusion is motivated by the fact that it is complicated to calculate emissions during consumption stage because consumer behaviour may vary significantly. It was planned to finish this estimation by the beginning of 2008. The results will be used to identify the areas through the whole supply chain where ICA's products have the biggest climate impact, in order to educate consumers afterwards about the climate impact of ICA's products. The main aim of this initiative is therefore not to label ICA brand products with carbon footprint information, but to provide and build the knowledge to the retailer itself as well as to its consumers. If this initiative is proven to be successful, ICA will carry out similar estimation for other 200-300 products (Lindvall, 2007).

Casino[21] (France)

In 2006, the French food retailer Casino, together with Bio Intelligence Service consultancy, and with the technical and financial support of ADEME (France's national public Agency for Environment and Energy Control), initiated a label that provides consumers with information about the climate impact of Casino brand products. The initial scope includes food, perfumes, hygiene products and other small products. In total, Casino plans to label 3 000 products of Casino brand by the end of 2008 (ADEME, 2007). The figure below presents a draft of the planned label.

The methodology of calculation of CO_2 emissions was developed by Bio Intelligence Service. It consists of three aspects: packaging, waste and transport. Choice of these three is motivated by the fact that it is easy to collect the data needed from suppliers, and, according to the Environmental Manager of Casino, because they represent a large part of the life cycle emissions for some products (Picard, 2007). The label consists of two combined information levels: quantified information and a colour scale describing the magnitude of the associated environmental impacts (where green means low impact, red significant).

[18] The Greenhouse Gas Protocol (GHG Protocol) is widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. [Online]. Available: http://www.ghgprotocol.org/ [2007, December 10th]

[19] The ICA Group (ICA AB) is one of the Nordic region's leading retail companies, with around 2,300 of its own and retailer-owned stores in Sweden, Norway and the Baltic countries. The ICA Group's Annual Report 2006. [Online]. Available: http://www.ica.se/file_archive/pdf/Arsred2006ENGlow070321.pdf [2007, December 10th]

[20] SIK is an industrial research institute owned by SP Technical Research Institute of Sweden. The purpose of the Institute is to strengthen the competitiveness of food industry and biotechnology companies. [Online]. Available: http://engwww.sik.se/default.asp?viewset=1&on=About+SIK&initid=206&heading=About+SIK&mainpage=templates/04.asp?sida=152 [2007, December 10th]

[21] Food retailer Casino is present in 13 countries in Europe, North America, Latin America, Asia and the Indian Ocean. At the end of 2006, the Group operated 9,537 stores: 344 hypermarkets, 2,328 supermarkets, 734 discount stores, 5,757 convenience stores and 374 restaurants and other businesses.

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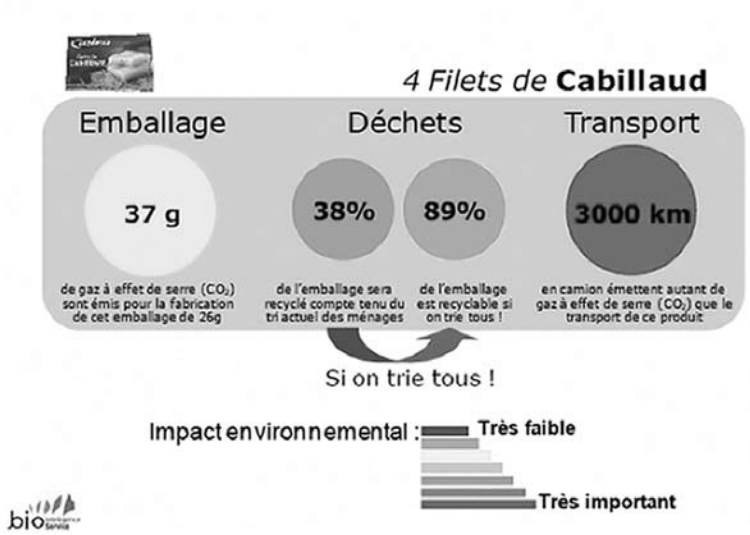

Figure 17. *Climate label for 4 filets of cod-fish, Casino retailer, France "Emballage" means packaging "Dechets" means waste*
Source: ADEME, 2007

With regard to quantified information, the first circle to the left provides information about how much CO_2 was emitted as a result of packaging manufacturing. In the case of the sample product used (4 filets of cod-fish), 37 g of CO_2 were emitted for the manufacturing of the packaging of 26g. The second stage provides information about waste. For the same sample product, the figure 38 in the second circle means that 38% of the packaging will be recycled based on the current sorting rate of household waste in France. The number 89 means that 89% of packaging can be recycled provided that 100% of the waste is actually sorted properly. The third aspect/circle provides information about kilometres done by each component of a product and each component of the packaging (from crop production to the shops). The figure 3000 means that transportation of the sample product and its packaging emitted as much CO_2 as is emitted by a truck over the distance of 3 000 km (ADEME, 2007).

This version of label is not final. Casino is now testing whether it is possible to include CO_2 emissions from the product manufacturing. Corinne Picard, Environmental Manager at Casino, expressed that it is difficult to collect such data from suppliers because it will require them to conduct sophisticated calculations in order to allocate emissions to specific product. Casino is also looking for information about agricultural emissions. According to Corinne Picard, this data can be quite easily obtained from Casino's suppliers and the company is working now to obtain more information. As it was mentioned above, Casino plans to label 3 000 products of its own brand by the end of 2008, while, by the end of 2007, already 300 products were expected to be analyzed by Bio Intelligence Service according to the three criteria. The first product with such label is planned to appear in stores in May 2008.

2.2.4.3 Examples of certifying organizations' initiatives

KRAV[22] and Svenskt Sigill[23]

Driven by Swedish consumers' willingness to know more about the climate impact of food products, and by the support of Sweden's Environment, Agriculture and Consumers' affairs ministers (Treehugger.com, 2007), KRAV and Svenskt Sigill initiated a project to develop a label aimed at those food products that are produced in a way that helps limit climate change. The main objective of this initiative is to give consumers a real opportunity to choose products that have the least negative environmental effect. This in turn is expected to create a clear driving force for many small and large

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businesses to rearrange their production in a "climate-friendly" direction (KRAV, 2007, b). Therefore, KRAV and Svenskt Sigill intent to develop standards that will allow many producers to gain access to the market of climate labelled products and to identify measures that clearly reduce greenhouse gas emissions.

KRAV and Svenskt Sigill are currently working on the development of the main principles of the standard for certification of climate impact of products. Final principles are going to be presented on the 1st of the April 2008 (KRAV, 2007, c). Initial principles are already available in the Standard for climate marking of foodstuffs, Draft #2, according to which, the main climate rating will primarily be a system for certifying production processes and conditions, not directly the product. This means that food producers who are willing to label their products with climate-friendly (klimatvänlig) label (Local Tidningen, 2007) will have to prove that they are taking measures to reduce their GHG emissions in their operations (KRAV, 2007, b). The label will be the same for all certified products, meaning that the label will be used as an indicator that will not classify products having the label against each other. It will rather differentiate products with the label from those that do not have it. The appearance of the label is still under the development. The example of how the label might look like is presented in the figure below:

Figure 18. *Potential label stands for CO_2-reducing production*
Source: Local Tidningen, 2007

When calculating the climate impact of products, the following GHG will be included: carbon dioxide, methane gases and nitrous oxide (KRAV, 2007, b). At the initial stage, primarily Swedish food producers will be able to apply for the climate-friendly (klimatvänlig) label. Moreover, to be able to obtain this label, products must already have, as a pre-requisite, either the Svenskt Sigill-label or the KRAV-label, or similar eco-labels, securing that other environmental impacts of the products are estimated and taken into account. The scope limitation to Swedish producers is due to the fact that there is currently no sufficient and reliable data available about GHG emissions throughout foreign food supply chains (Elmquist, 2007). Nevertheless, in the future, the scope is planned to be expanded (Tidåker, 2008).

According to Helena Elmquist, Responsible for Standard Development (regelutvecklingsansvarig) for the climate labelling scheme at Svenskt Sigill, the estimation of the climate impact of products for the purpose of this label is planned to include production of raw materials, processing of food, transportation, and packaging. However, there is still an ongoing discussion on label's criteria. Regarding air freight products, they will most likely not be eligible for the climate-friendly label (Tidåker, 2008). It must however be outlined that all criteria of the future "climate-friendly" label are still under discussion at the moment and will be confirmed during the spring.

Carbon Reduction Institute[24] (Australia)

The Carbon Reduction Institute (CRI) initiated the $NoCO_2$ and $LowCO_2$ certification programmes for businesses to become carbon neutral and be able to sell carbon neutral products and services (e.g. wine, coffee, dentists, weddings, ski holidays, home loans) (Carbon Reduction Institute, 2007, a).

The $NoCO_2$ certification programme implies that a business is carbon neutral and has accounted for, reduced and offset all GHG

[22] KRAV is a key player in the organic market in Sweden. It develops organic standards and promotes the KRAV label. http://www.krav.se/sv/System/Spraklankar/In-English/

[23] Svenskt Sigill (the Swedish Seal of Quality) is the quality label for assured food. The label guarantees the food has been produced on farms, which follow strict criteria for safe food, animal welfare, responsibility for the environment and a vivid landscape. http://www.svensktsigill.com/website2/sd_page/441/1/index.php?

[24] The Carbon Reduction Institute (CRI) help businesses to offset and reduce their carbon emissions. Businesses and organisations that have offset their carbon emissions with CRI are rewarded with a 'carbon neutral' certification. [Online]. Available: http://environmentalresearchweb.org/cws/company/C000004222 [2007, January 11th]

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Figure 19. *NoCO$_2$ and Pre Green logos*
Source: Carbon Reduction Institute, 2007, b

Figure 20. *LowCO$_2$ and Green Choice logos*
Source: Carbon Reduction Institute, 2007, c

emissions from its operations as well as the carbon emissions embodied in the products it sells and uses. NoCO$_2$ certified businesses can sell carbon neutral "Pre Green" products and services. According to the institute's website, a product displaying the Pre Green logo has had all its lifecycle's carbon emissions offset prior to being placed on the market and purchased (Carbon Reduction Institute, 2007, b). These logos are presented in the Figure 19.

The LowCO$_2$ certification programme is designed for businesses that want to offset a percentage of their carbon emissions immediately with a plan to become carbon neutral over a period of time. The LowCO$_2$ logo displays the percentage reduction so that consumers are aware of the carbon emission reductions initiated by the business. LowCO$_2$ certified businesses offer Green Choice products. According to the website, the additional embodied carbon emissions of Green Choice products can be offset by the customer at the point of sale. This means customers are given the choice to make products they purchase from LowCO$_2$ certified companies carbon neutral by paying a small amount extra (Carbon Reduction Institute, 2007, c).

The CRI's carbon footprint methodology is compliant with the WBCSD's GHG Protocol. The institute claims that the methodology allows to capture 100% of the emissions for which a company is responsible. With regard to system boundaries, it distinguishes two types of emissions boundaries: an organizational boundary and an operational boundary. Organizational boundaries help a company to identify activities generating GHG emissions, which are attributable to the organization itself and those which are not.

Operational boundaries allow a company to define the emissions they own or control and categorize them into different 3 scopes:

- Scope 1: Direct GHG emissions: carbon emissions occurring from sources that are owned or controlled by the company (e.g. emissions from combustion in owned or controlled boilers, furnaces and vehicles),
- Scope 2: Electricity indirect GHG emissions: carbon emissions from the generation of purchased electricity consumed by the company,
- Scope 3: Other indirect GHG emissions: carbon emissions, which are a consequence of a company's activities, but occur from sources not owned or controlled by the company (e.g. emissions from waste, the extraction and production of purchased materials; and employee travel to and from work).

Under the CRI's certification programme, all three scope levels should be included in the calculation of embodied emissions. After calculating the total emissions, a company can offset them by buying carbon credits to "neutralize" its CO_2 impact on global warming. According to the website of the institute, each carbon credit represents the abatement or sequestration of one tonne of CO_2 emissions from the atmosphere. The CRI provides carbon credits from energy efficiency, renewable energy, and tree planting projects (Carbon Reduction Institute, 2007, d).

To date, businesses among the Australian food and drink companies certified as NoCO$_2$ or LowCO$_2$ are Cullen Wines, Woodlands Margaret River Winery, Found Organic Pomegranate Juice, Café E Vero, Cold Rock Ice Creamery.

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2.2.5 Strengths and limitations

Similarly than in the section about Food Miles, most strengths and benefits of carbon footprint initiatives have been outlined in length earlier in this section. This is why more details are provided below about the potential limitations of carbon footprint assessments and labelling.

2.2.5.1 Summary of strengths

One of main advantages of 'carbon footprint' labelling initiatives is that they provide consumers with information about climate impact of the products, which might influence consumers' purchasing decision in favour of products that have a relatively lower impact on climate change. This in turn can create a driving force for businesses to modify their operations and processes in a 'climate friendlier' direction and develop low carbon products (KRAV, 2007, b).

From a company's prospective, carbon footprint can be an effective tool for energy management (Besch, 2007). Hence, calculating the carbon footprint of products might help companies to identify and prioritize significant energy and emissions reduction opportunities both within their own operations and the whole supply chain. This in turn might reduce energy consumption and increase operational efficiency, leading to costs savings to the companies (Carbon Trust, 2006). As an example, the case of Walkers has shown that just by changing the water content of potatoes, the company identified an opportunity to save up to 9,200 tonnes of carbon dioxide and £1.2 million per year. Based on this, one can say that carbon footprint analysis of products might help companies to make better informed decisions in product manufacturing, purchasing, distribution and product development, by considering costs and liabilities that exist whenever carbon emissions are generated. This in turn can help mitigate regulatory risks and improve a company's reputation and attract investors.

Moreover, according to the Carbon Trust methodology, companies also have to commit to reducing the carbon footprint of the product within two years. In case they fail to do so, the product will lose the label. If, after two years, a company wants to retain the label it must certify and commit again to further reductions. Therefore, the carbon label provides an incentive for companies to reduce GHG emissions as a continuous improvement activity along the supply chain. This, in turn, has the potential to improve efficiency within the company but also upstream and downstream (ENDS, 2007, c).

2.2.5.2 Main limitations

Exclusion of other negative environmental impacts

There is a concern that printing carbon footprint labels on products separately might divert the attention from other environmental problems by focusing only on climate change. Pascal Gréverath from the Nestlé Corporation and Chairman of the Sustainable Production and Consumption Expert Group of CIAA, opposed the idea of a carbon label because it "would risk being inaccurate and misleading, since focusing only on the CO_2 impact of a product would distract attention from other factors, particularly the amount of water required in product manufacturing or the amount of waste produced at disposal" (Euractiv.com, 2007, c). A similar idea was expressed during a telephone interview by Cees Van Dongen, Environmental Coordinator West Europe Group at Coca-Cola Company, who said that "one of main drawbacks of climate labelling is that it narrows down the focus to only one problem."

If a product has a low impact on climate change it does not necessarily mean that it does not create other significant environmental impacts. For example, the carbon intensity of products can depend to a large extent on the national fuel mix used to produce the electricity. Fuel mixes vary from country to country. France and Japan, for example, have a low electricity carbon intensity because of strong dependency on nuclear power, similarly to Norway and Sweden, which primarily rely on hydropower (UKERS, 2007, a). This might allow products manufactured using such electricity mixes to have a relatively low impact on climate change. However, these products, based on nuclear and/or hydro-energy, indirectly affect biodiversity and/or lead to generation of hazardous and radioactive waste.

According to Mikael Karlsson, President of the Swedish Society for Nature Conservation (SSNC) and European Environmental Bureau (EEB), climate change should not be labelled as such because there is a 'risk leading to suboptimal or even counter productive measures.' This means, for instance, that carbon labelling might stimulate the development of nuclear power, considered to be a less carbon intensive source of energy (Karlsson, 2007).

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Moreover, low carbon intensive products might contain different harmful chemicals that affect human health as well as environment. The question should therefore be asked whether all chemicals should also be labelled separately. According to Mikael Karlsson, integrated tools are needed, that will take into account the different environmental impacts of products, which implies that climate impact considerations should be integrated in already existing eco-labels. For example, climate-related criteria such as the level of energy efficiency, transportation, and the use of fertilizers could be added to existing eco-labels, which would altogether help mitigate the impact of products on climate change. Louise Ungerth, Head of Consumer and Environment Affairs at Konsumentföreningen (the Swedish Consumer Association), also believes that climate considerations should be incorporated in already existing eco-labels: by doing so, when producers apply for existing eco-labels, they would also have to satisfy climate requirements to be able to get the label. She thinks that such approach will provide more benefits to mitigate climate change and other environmental impacts of products, rather than just putting figure of CO_2 on the packaging.

A similar approach is taken by KRAV and Svenskt Sigill. Despite the fact that their future climate- friendly label will be printed separately on the products, it has been decided that only producers that already have eco-labels will be allowed to apply for the climate-friendly (klimatvänlig) label. This secures that other environmental impacts of the products are also taken into account, and that the climate label does not distract the attention from other significant environmental impacts.
Another concern expressed by Mikael Karlsson is that separate climate labels can confuse consumers a lot. For example, it will be difficult to make a purchasing choice between a conventional product having a climate label and an organic product without climate label. For consumers, it can be quite problematic to weigh different aspects when making decisions, especially as some of them have little understanding of the complexity of the underlying environmental aspects and issues.

Challenging calculation of carbon footprint
Calculating the carbon footprint of products through their entire life cycle is most often a complicated process. As a simple example, a cow rose to produce meat and milk generates a large amount of methane. The challenge is to accurately allocate the GHG emissions to the quantity of meat or milk produced. The increasing complexity of supply chains, due in particular to outsourcing and the internationalisation of sourcing strategies, make it even more difficult to accurately assess a product's total carbon footprint and to include all emissions generated during its entire life cycle. As a matter of fact, the complexity of calculation of carbon footprints in practice was one of the main reasons given by many interviewees to oppose climate labelling e.g. Unilever, ASDA, and Carrefour.

Which GHG emissions should be included?
Agriculture and food production is a sector with a diversity of sources and types of GHG emissions, including methane (CH_4), nitrous oxide (N_2O), HFCs, sulphur hexafluoride (SF_6), in addition to CO_2. Methane and nitrous oxide mostly come from agriculture, in particular for the production and use of fertilizers, as well as livestock and animal waste management. Methane can also be released during disposal stage of food (organic waste) and its packaging. The main sources of HFCs in the food industry are refrigerant leakages, while CO_2 mainly comes from burning of fossil fuel for energy production and transportation (Carlsson-Kanyama and González, 2007).

According to an IPCC - WG1 (2007) report, the leading economic sector in GHG emissions is energy production, while CO_2 is the particular GHG with the largest relevance. The second largest sector after energy is agriculture, which is responsible for around 10% of total GHG emissions in the EU-25 due to its methane and nitrous oxide originating from use of fertilizers, livestock, and animal waste management (Euractiv.com, 2007, d). It should also be mentioned that despite the fact that the total amount of methane and nitrous oxide (N_2O) emitted is smaller than CO_2 emissions, they also have significant impact on climate change because they have a much bigger GWP than CO_2. For example, the GWP of CH_4 is 25 times bigger in a 100-year perspective and the GWP of N_2O is 298 times bigger than GWP of CO_2 (IPCC-WGI, 2007).

Moreover, there is a global tendency to increase animal production, either for local consumption or for exports (Smil, 2002), which is why the amounts of NO_2 and CH_4 originating from these activities are expected to rise further. In Sweden, for example, 20% of the

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total greenhouse gas emissions come from CH_4 and N_2O, mainly originating from agriculture (Carlsson-Kanyama and González, 2007).

When calculating the carbon footprint of products, all GHG should therefore be included. It is however not always the case. The exclusion of other GHG than CO_2 in calculations is mainly due to high uncertainties and complexities associated with measuring emissions of those other GHG gases. For example, the quantity and rate of methane and nitrous oxide emissions depends on complex interactions between different variables, for which data is often unavailable (Eggleston et al, 1998).

In the case of the Carbon Trust methodology, it is stated that all GHG emissions that make a significant contribution to the carbon footprint of the product are included. By now the level of significance is defined by mass, with at least 90% of the mass of the final product being analyzed (Carbon Trust, 2007, d). However, Carbon trust admits that it would be more preferable in the future to define significance based on likely percentage contribution to the total carbon footprint of the final products, because even a component of a food product representing a small portion of a product's mass might contribute to its carbon footprint significantly. Moreover, the analysis of the carbon footprint does not take into account the emissions generated at the retail store and emissions in the final consumption phase. This is motivated by the fact that these emissions can not be influenced by producers (Carbon Trust, 2007, d).

However, excluding HFCs emissions generated at retail stores and in homes storage might create more advantageous conditions for chilled and frozen food than for fresh food that does not require being stored in a chilled environment (Foster et al, 2006). Moreover, in studies reviewed by Foster et al (2006), the contribution of the consumer stage to overall carbon footprints was between 3-64% depending on many factors, such as the type of products (whether it is fresh product or frozen products), how food is transported to home from the point of purchase, and then stored, cooked, and the remaining product and packaging waste disposed of. The studies conducted by Unilever also showed that the biggest impact of many products often occur during consumer stage. Therefore, by excluding these stages, the carbon footprint label will not capture difference in practices between retail stores, or differences in consumers' behaviours, meaning the label will ultimately not drive emissions reduction in these areas. In addition, it might in some specific cases, favour products with high climate impacts during retail and consumption stages that are not being accounted for, to the detriment of products that might have an overall better GHG profile, but not according to the label.

Therefore, to prevent situations when some products are placed in disadvantageous positions and to stimulate emissions reductions at different stages of a product's life cycle, more research is needed to define which GHG emissions and stages should be included in calculation of carbon footprint of different product categories.

Lack of data and problems of data accuracy

To calculate the total carbon footprint of a product, a lot of data should be collected, both primary and secondary. The preference is obviously given to primary data because it is more accurate and presents company/product specific information about energy consumption, efficiency and GHG emissions of each process within a supply chain. However, collection of primary data at all stages of the supply chain is likely to be complicated and difficult to achieve in practice, mainly because there are too many external actors to the company involved. This makes it is difficult, time-consuming and costly to track all data, especially as these actors might be located abroad. In some cases, primary data is simply not available.

Moreover, suppliers might consider the information about energy consumption, efficiency and GHG emissions as confidential, and will therefore not be willing to share it. According to the Casino representative interviewed, one of the main reason why the French retailer has chosen only three stages (packaging, waste and transport) to be displayed on the label, was because the process of data collection from suppliers was already quite complicated and involved some confidentiality issues.

Therefore, due to time constraints and complexity of primary data collection, companies often use secondary data, including existing LCA studies, industry average data, etc. Using secondary data might lead to uncertainties and inaccuracies in final figure of carbon footprint because it does not consider specific local conditions that vary over time and from one place to another. This

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is why limitations are to be clearly placed on results obtained using secondary data. Another drawback when, using secondary data is that it does not illustrate the difference between products produced in season and out of season; the information presented will be an average. This provides an inaccurate picture, as energy requirements for refrigeration/heating as well as animal raising practices vary strongly depending on different seasons and weather conditions. Whether food is produced in or out of season might influence the carbon footprint of the products significantly (production of food products during winter is much more energy intensive than during summer). Therefore, omitting this difference will put seasonal products in disadvantageous conditions by not highlighting their actual lower energy intensity.

An additional limitation if using average data for a climate labelling is that more energy and/or GHG efficient farmers and food producers will not benefit from their efforts. This means less efficient producers and those not having invested time and money in energy and GHG reduction projects will "free-ride" on producers making more efforts (UKERS, 2007, a).

Lack of data (whether primary or secondary) was considered by many interviewees as one of the main obstacles preventing companies to implement carbon footprint label. Kerstin Lindvall, the Head of Environment Department at the Swedish retailer ICA, for instance, stated that based on a lack of data, the company considers that it is too early to create such type of label. To mention a contradicting opinion, Helena Elmquist, Responsible for Standard Development (regelutvecklingsansvarig) at Svenskt Sigill, expressed that despite the fact that some data is missing, there is enough information available to label at least some food products. She believes that lack of data should not be used as an excuse preventing implementation of climate labelling. According to her, in order to collect accurate data, it will take as additional 5-10 years when actions are urgently needed now. Therefore, "by building and gathering knowledge constantly, climate labelling will be improving all the time, the figures will be presented more in details to the consumers. Until then we will rely on experiences and earlier studies" (Elmquist, 2007).

To summarise the arguments presented above, it can be said that when calculating the carbon footprint of a product, the process of data collection, in particular accurate one, is an issue. However, over time, this process might cause fewer difficulties as better and more transparent communication with suppliers will be developed and data and knowledge will be accumulated.

Lack of standard for calculation of carbon footprint of products
For 'carbon-footprint' labels to be a trustful tool and to provide equal conditions for all companies which would like to get this label, the methodology used to calculate carbon footprint of products should be standardized. Otherwise consumers' confidence in carbon labelling will fail and businesses will not participate in this scheme.

Until now there is however no internationally accepted standard for the calculation of GHG emissions embodied within products along the whole supply chain. Therefore, different companies use different methodologies for which system boundaries are defined differently. For example, the retailer Casino, when calculating the climate impact of its brand products, includes packaging, waste and transportation stages. The food producer Walkers includes all stages except storage at retail store and consumer use.

According to Jan Dalsgaard, Head of Environmental Affairs at Arla Foods, the lack of standard makes climate label meaningless because different companies use different methodologies to calculate the carbon footprint of their products. It makes it impossible for consumers to compare carbon footprints of products from companies and brands using different methodologies. As stated by Mr. Dalsgaard, Arla Foods considers that climate labelling is a useful instrument that might provide consumers with relevant information about the climate impact of products. However, for Arla Foods to participate in this initiative, international standard should first be developed that will guarantee that all producers follow the same rules, which would secure that the carbon footprint information disclosed by the industry is transparent and credible to consumers. Similar opinions were expressed by Charlotte Thy, Environment Manager at Danish Crown, and by Katrin Besch, Environmental Specialist at Tetra Pak.

Currently, Carbon Trust, DEFRA and BSI British Standards are working together to develop a single standard in the UK that will ensure a consistent and comparable approach to supply chain

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measurements of GHG embodied in products and services (BSI British Standards, 2007). The draft standard is called the Publicly Available Specification (PAS) 2050. It is planned to finalize it by summer 2008 (Climate Action Programme, 2007). Until then, intensive participation of producers and retailers in climate labelling scheme is therefore not expected.

Temporal validity of the information presented on the label
Another issue that should be considered is the period over which the carbon footprint is considered to be valid. According to the Carbon Trust methodology, recalculation of GHG emissions for a particular supply chain is required every two years, in order to be able to renew the certification. Yet, changes within supply chain can occur more often than every two years e.g. suppliers might be changed, equipment might be replaced, the use of fertilizers might be reduced or increased, or ingredients of a product might be replaced by others that might be more or less GHG intensive (UKERS, 2007, a). The issue is obviously for those certified products that might have increased embodied GHG emissions during the two years certification period, without the label being updated.

However, due to the complexity and high costs of the calculations, it is unlikely that all changes within supply chain can be taken into account at all times and reflected on a continuously updated carbon footprint label. This makes the information presented on the climate label inaccurate and questions its temporal reliability after the certification date. It was one of the main motivations for retailers such as Carrefour (France) and ASDA (the UK) to be against climate labelling. According to Chris Brown, Sustainable and Ethical Sourcing Manager at ASDA, for a label to be reliable, the retailer has to compare different supply chains of lamb producers, then take into account the season when the lamb was produced, as well as the weather conditions that vary each day, all of which affects the carbon footprint of the product. As Chris Brown expressed, "Does it mean that ASDA has to calculate the carbon footprint each day?" If not, according to Chris Brown, there is no sense to put such labels on the products, because they do not provide reliable information to consumers and do not help them to make environmentally sound choices (Brown, 2007).

Consumer confusion
The main aim of a carbon footprint label is to influence consumers' purchasing decision and make them buy more climate friendly products. However, one of the key factors that make a label successful is that consumers must perceive the label to be credible. As Stavros Dimas, EU Environment Commissioner, commented about carbon labelling, it is necessary to make sure that "consumers can trust that labels are telling the whole truth and are not just being used to 'greenwash' products" (Euractiv.com, 2007, c).
Taken into account that there is no international standard for calculating the embodied carbon footprint of the products and that companies use different methodologies, making different assumptions when calculating carbon footprint, the credibility of carbon labels might be questioned. Moreover, the lack of standard complicates possibilities of comparison between different products.

Another significant factor that makes, in theory, labels effective in changing consumer behaviour is consumers' awareness of the issues that the labels address. Recently, the topic of climate change and its consequences has been covered intensively by media; therefore, public awareness of the topic has increased. According to Inger C Larson, R&D - Quality Director at Findus Sverige AB, the topic of climate change is well known to consumers, who are willing to know the impact of products on climate change in order to make a choice. Therefore, she added that consumers' knowledge about climate change should not be underestimated and that consumers should be given the right to make a choice. However, a research recently conducted by ICA among its own consumers about their knowledge of climate impact of products showed that a majority of consumers associate climate impact of the products only with transportation and do not consider other stages of products' life cycles (Lindvall, 2007). Kerstin Lindvall, Head of Environment Department at ICA AB, is convinced that knowledge among consumers about climate impact of different products should be built first, and only afterwards can the implementation of carbon label be considered. This idea was also supported by Louise Ungerth, Head of Consumer and Environment Affairs at the Swedish Consumer Association (Konsumentföreningen, Stockholm).

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Another concern, expressed by Katrine Milman, Head of Environmental Affairs at COOP Denmark, is that some consumers might not know so well what CO_2 means on the product packaging, and might consider for instance as a hazardous chemical. Some consumers might therefore react negatively to the label, if no background or additional information is provided with the label. Moreover, just putting figure of CO_2 (for example, 75 CO2 g for Walkers' crisps) might be meaningless to consumers. They might not understand whether it is good or bad as such, especially if they have no alternative or scale to assess it against. As Jess Sansson, Sustainability Manager at Innocent, expressed, the label itself is meaningless to consumers: "We felt we had to put some meaning around the information for our drinkers, just putting a gram figure does not have a great deal of meaning. It's a great as a symbol of a company's commitment, but it does not really empower drinkers to understand where it fits into their life." Therefore, to communicate this information in a more effective way, Innocent has developed a "guideline daily allowance"[25] of CO_2, where, according to the company's calculations, one smoothie equals 9% of a person's daily CO_2 allowance from food and drink. Innocent considers that such approach, similar to existing nutritional diets advises, will provide a better idea to consumers about a smoothie's impact on climate change (ENDS, 2007, c).

Katrine Milman also expressed that it is difficult to see how consumers can use the carbon footprint figure on the products on its own. The representative of COOP Denmark thinks that it will bring more value to consumers and climate change mitigation if consumers are provided with the information about how and what they should eat to reduce their impact on climate change. Thus, as a part of the campaign "1 ton mindre" (the campaign aims that each person will produce 1 tonne of GHG emissions less), COOP Denmark is currently working together with Informationscentret for Miljø & Sundhed[26] (the Information Centre for Environment & Health in Denmark) to develop a brochure about different types of food products and their average impact on climate change (all products are divided into groups depending on their impact on climate change). These brochures are going to be distributed among customers of COOP Denmark. According to Katrin Milman, such brochures will provide more knowledge about climate change to consumers and. In addition, will help them to understand what they can eat in order to reduce their climate footprint.

Finally, another concern associated with carbon labelling can be raised by asking the question whether consumers will react or not to it, based on the fact that there is already a profusion of labels of all types. As underlined by the Coca-Cola representative, Cees Van Dongen, Environmental Coordinator West Europe Group, "consumers are overburden with information". This potential issue tends to support those thinking that product-related climate information should be integrated in existing eco-labels, as an additional aspect.

Cost and time

To encourage retailers and producers to participate in the eco-labelling initiatives, costs involved in applying and obtaining the label should be low. Consumers want low prices and eco-labelled products need to stay price-competitive (Environment DG, 2006). The issue here is that, in order for climate labelling to provide accurate information, the costs of obtaining data and conducting calculations might be significant due to the technical complexity of the LCA methodology, on which calculations of carbon footprint are based.

[25] Based on the UK CO_2 reduction target of 60% by 2050 and using a sliding scale per annum to achieve that reduction, the company calculated that in 2007 this allowance is equal to 8.3 tonnes of CO_2 per person, per day, 22 kg. Then considering the research by Carbon Trust that showed that 13% of each person's annual emissions are attributable to the manufacturing, transporting and consuming of food and drink (which is equal 2.9 kg), one smoothie equals 9% of a person's daily CO_2 allowance from food and drink. [Online]. Available: http://www.innocentdrinks.co.uk/us/?Page=working_out_footprint [2007, December 15th]

[26] The Information Centre for Environment & Health is an independent information centre on the environment, health and consumption. The purpose of the center is to provide the consumers with tools to make their everyday life more environmentally friendly and healthy. The information centre is funded by the Danish Ministry of the Environment.

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Among the costs associated with the calculation, one can mention understanding and mapping of production processes, purchasing equipments to weigh inputs and outputs as well as meters, monitoring changes within the supply chain over time, buying access to LCA databases, filling out documentation and databases, and conducting the processes of actual verification and certification (UKERS, 2007, b). For example, Pascal Gréverath of the Nestlé Corporation and Chairman of the Sustainable Production and Consumption Expert Group of the European Food and Drink Industry Association, expressed that cost can reach up to '75,000 Euro for the carbon footprint of one single product, carbon only, no other environmental impacts considered' (Gréverath, 2007). For Boots, a UK based company that prints carbon footprint labels on its Botanics and Ingredients shampoo, revealed that it costs £40,000 to work out the carbon footprint of a single product (Stategic Risk, 2007).

The Coca-Cola representative interviewed, Cees Van Dongen, Environmental Coordinator West Europe Group, expressed that in the long term carbon labelling might certainly bring financial savings to producers due to improved energy efficiency through the whole supply chain. However, he added that the cost side of carbon labelling can be an issue because making the estimation accurate for one product might cost 10 000-40 000 Euro. Moreover, Cees Van Dongen stated that the label will require continuous expenses due to continuous changes within the supply chain, which will have to be taken into account. This in turn is likely to lead to products' price increase, which, given consumer's preferences for low cost products, would make climate labelled products uncompetitive compared to those not involved in carbon labelling or in a less costly climate labelling scheme.

Chris Brown at ASDA also expressed that the estimation of the carbon footprint of thousands of products sold in its stores will be costly and time-consuming. According to the representative of the company, such label might provide better reputation to the company but will not provide any financial return due to high associated costs. As it was said before, ICA is currently carrying out estimations for 100 ICA-brand products. If the initiative is successful, the retailer will carry out research for additional 200-300 products. However, it will only conduct such research if cooperation with other stakeholders is established because the estimations are too costly for the company alone (Lindvall, 2007).

Regarding costs required to measure the carbon footprint of products, Nick Monger-Godfrey, Head of Corporate Responsibility at the British retailer John Lewis, and member of the BSI British Standards steering group, which is currently developing the draft product carbon foot printing standard, stated that 'The current carbon measurement methodology is extremely resource expensive…' (Stategic Risk, 2007). The representative of BSI Management Systems, interviewed, Hewitt Roberts, Director Global Sustainability Strategy, believes that climate labelling will be very successful in the future and there is big potential market for it, but expressed that depending on the product's type, estimation of carbon footprint can be a very costly process. Moreover, he expressed that it is essential for companies to make comparisons between the actual products' impact on climate change on the one side, and costs and complexity of estimation of such impacts on the other. For example, for the products with low climate impact, it might be not financially reasonable and not worth it for a company to make this estimation.

There is also a concern that SMEs, small retailers and overseas producers in some countries would be significantly affected by cost associated with climate labelling (Gréverath, 2007). It is however assumed that all costs associated with climate labelling will fall over time, as databases are developed, people get familiar with the system, and as knowledge is built. However, the period of time over which costs will be reduced is not clear (UKERS, 2007, b).

Regarding time needed to conduct carbon footprint estimation for one product, it might vary a lot depending on the level of detail required, the type of product, data availability, and amount of people involved. Precise data about time required for estimation was not found. However, as an indication, it took Cadbury 6 months to estimate the carbon foot print of 2 products, with the work being carried out on a part time basis and not as a top priority. For Boots, 3 months were needed to estimate the carbon footprint of 2 shampoos, with 8 people involved in the research (UKERS, 2007, b). Hence, despite the fact that there is no clear answer regarding time required, all interviewees expressed the idea that in order to get more or less accurate figure of carbon footprint based on the analysis of the whole supply chain, a lot of time is

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needed without guarantying the credibility of the figure as it is impossible to take all factors into consideration when calculating a carbon footprint.

Presentation of labels

The specific way how to present the carbon footprint of a product should also be considered. By now, companies are presenting it in the following different ways:

- kg of CO_2 equivalent per kg of a product and kg of CO_2 equivalent per unit of a product (Carbon Trust, Walkers and Innocent);
- Both numbers and a colour coded system (Casino-brand products);
- "climate-friendly" label without quantified information (KRAV and Svenskt Sigill) and "carbon neutral" label (Carbon Reduction Institute, NZWC).

Obviously, each of them has its own benefits and limitations. For example, presenting carbon footprint in kg of CO_2 equivalent per kg of a product could be more understandable for consumers than in kg of CO_2 equivalent per unit of a product because it might be complicated for consumers to compare similar products with different volumes or weight. On the other hand, to support the label designed by Casino, the EU's energy label with A-G categories (UKERS, 2007, a) has proved that comparative (colour based) labels are easy for consumers to understand and effective.

The "climate-friendly" and "carbon neutral" labels can also be easy for consumers to understand, moreover it will eliminate the difficulties related to calculation of precise figure. As Hewitt Roberts, Director Global Sustainability Strategy at BSI Management Systems, expressed, these types of labelling are more meaningful to consumers than just figure of CO_2. However, it is important to outline that these labels do not allow consumers to compare products among the ones having the label.

Another question to be considered is where to present the label. Most companies present it on the packaging of the product, but some do so on their website instead. Presenting a carbon footprint figure on the packaging might have little meaning to consumers, or even worse, might have a negative effect on the product's image (Milman, 2007), because there is not enough space on the packaging to explain what the figure actually means and implies. Placing carbon footprint on the website can be better from this point of view, as it allows more background information to be provided. However, consumers might not systematically check this information. This in turn leads to the label not being noticed, which reduces the probability that such carbon label influences consumers' purchasing decisions.

Criticism of climate neutrality

Over the past years, driven by climate change agenda, many companies started claiming that their businesses and products were climate neutral. In theory, it means that a business or a product does not have impact on climate change. However, according to Nilsson (2007), "running a business in Western Europe 2007 without affecting the climate is not possible." Therefore, to become climate neutral, companies are, in practice, most of the time simply offsetting their emissions by buying emissions reductions from tree planting or energy saving projects run in other countries, usually in developing countries. This allows companies to "neutralize" their emissions and market their products on the basis of "climate - friendly" credentials (Carbon Trade Watch, 2007).

However, this approach used by companies to mitigate their impact on climate was recently criticized. One of the main reasons for criticisms is that, by offsetting emissions, companies avoid taking responsibility for their own emissions and use emissions offsetting as a justification to continue business as usual without taking actions to make their operations more energy efficient and less GHG intensive. "Offsetting is a dangerous delaying technique because it helps us avoid tackling the task [of dealing with climate change]," reported Kevin Anderson, a scientist with the Tyndall Centre for Climate Change Research (Carbon Trade Watch, 2007).

Another ground for criticisms is that the tree planting or energy saving projects are often either not effective in their emissions reductions or have negative impact and side effects on local communities. Indigenous populations were, for instance, forced to move away from their traditional living places because of tree planting project implemented in this area as part of a carbon offset project (Carbon Trade Watch, 2007).

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In addition, there is no industry standard of what carbon neutrality actually means. Different companies providing offsetting services use different methodologies and make different assumptions in their calculations. For example, it can be seen from the table below that different companies provided different emission levels and corresponding offset costs for the same return flight (Boston-Washington) (Nilsson, 2007).

Therefore, many producers are opposing the adoption of any carbon neutral logos until the industry has agreed on a common standard. For example, Richard Hanns, Environment Manager at Tetra Pak, said: "Declaring we are 100% carbon neutral was always the last stage of our plan in the absence of industry standards. It is too early in the consumer's understanding of the term to start putting logos on packs. If we do that it has to mean something to our customers" (Lyons, 2007). In the absence of standards and control authorities, climate neutral initiatives are difficult to verify, which makes it hard to distinguish environmentally sound initiatives from pure greenwashing.

DOMESTIC FLIGHT			
Company	**Distance (miles)**	**Emissions (tons)**	**Cost of offset**
Atmosfair	889	.48	$11.85
Climate friendly	797	.44	$6.44
Myclimate (Swiss site)	824	.43	$12.25
NativeEnergy[2]	822	.37	$12.00
Myclimate (US site)	NA[3]	.27	$4.86
The CarbonNeutral Company[2]	824	.27	$18.40
Terrapass	824	.26	$9.95[4]
Carbonfund[1]	822	.24	$1.31
CarbonCounter[1]	822	.23	$2.28
Climate Care[1]	822	.19	$2.35
Offsetters	824	.19	$2.44

Table 3. *Domestic Flight: Boston – Washington, D.C. – Boston, Sorted by emissions*
Source: Nilsson, 2007

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3. Implication of climate labels for food producers

Based on the previous chapters, this section will summarise what the food miles and carbon footprint labelling initiatives might imply for food producers, with a focus on Danish food producers in the later sub-sections.

3.1 Key considerations for food producers

Strong driving forces to act now

Over the past years, climate change has become one of the top issues discussed and dealt with both on international and national levels. Governmental policies (in particular the EU's ETS and national GHG reduction targets), retailers' push for low carbon products, increased consumers' demand for more sustainable products, and rising cost of energy resources, all force companies to understand, manage better and reduce further their GHG emissions. Therefore, for a company to account for its GHG emissions, both at the company and products levels, is becoming a common thing to do in the industry. While some years ago, companies engaging in climate and carbon accounting were considered as front runners, nowadays those not pursuing a climate friendlier business strategy risk to be exposed to severe criticisms from various stakeholders, including an increasing share of their customers. The question is therefore not whether to act on the issue now, but how to do so.

Improve operational performance, company reputation, and product differentiation

Climate labelling scheme can be a potential tool to help companies to account for their carbon footprint and the footprint of their products. This scheme can also enable a company to identify potential GHG related risks (e.g. increased production costs due to high prices of energy resources, regulatory and financial liabilities due to upcoming stricter regulations and standards) and opportunities (e.g. reduced costs due to improved energy efficiency). Other benefits of climate labelling schemes include the ability to demonstrate the company's responsibility through a commitment to carbon emissions reduction, as well as the achievement of product differentiation and improved reputation. Incorporating food miles in marketing strategies can also bring benefits for companies. For instance, it can help to differentiate products from the competition, as studies and opinion polls show that consumers have more trust in locally produced products. In particular, consumers appear to be interested in buying low food miles products due to their perceived higher freshness and quality.

Unclear impact on product-related costs and food prices

The implementation of food miles and carbon labelling initiatives can also force companies to put particular attention to the efficiency of the food distribution system beyond their own operations. This leads in particular to a reduction of companies' transport-related GHG emissions. From a cost perspective, the implementation of the food miles concept can potentially both reduce and increase companies' costs, leading to subsequent increase or decrease of food prices. On the one hand, reducing food miles might lead to reduced transportation costs, which, in turn, could reduce food prices. On another hand, locally sourced food can be more expensive than globally sourced food, because economies of scale are lost (in cases where the local source involves smaller scale production, distribution and/or retailing), or due to differences in climatic conditions as well as labour costs. Therefore, more research should be carried out to investigate the potential impact of "food miles" concept on food prices. Looking at climate labelling initiatives, one should also be aware of the potential additional costs linked to the complexity of assessing and evaluating GHG emissions along a product's supply chain. Although carbon foot-printing is expected to lead to process efficiency gains by allowing to cut energy consumption and emissions, those potential savings should be weighed against the costs involved in achieving a reliable GHG assessment for products.

Use of food miles for economic protectionism purposes

A potential downturn of the food miles concept is that it can create trade barriers for producers located far away from their export markets, based on the fact that their products will systematically have higher miles in comparison with locally or regionally produced food products. Therefore, it should be underlined that producers and retailers incorporating food miles in their procurement strategies can be criticized as being protectionists, and in particular for affecting farmers in developing countries (especially if air-freighted products are prohibited), who are heavily dependent on markets in developed countries.

3. Implication of climate labels for food producers

Problematic choices of methodologies and calculation methods

Another argument that can be used against the food miles concept and producers incorporating it, is the fact that food miles do not take into account the transport mode which was used for food transportation. It also excludes the climate impact of other aspects and stages of the food supply chain than transportation. For example, products produced by applying environmentally responsible farming as well as energy efficient production practices and then shipped by sea often have a lower total climate impact than those travelling shorter distances but produced using less climate friendly processes. From this point of view, carbon footprint labelling schemes are much better because they intent to incorporate the products' impact on climate change throughout the entire supply chain. However, the calculation of the carbon footprint of a product through its entire life cycle can be a very challenging process, mainly due to the complexity of supply chains, difficulties associated with allocation of emission to one specific product, confidentiality issues with suppliers, and lack of data, in particular accurate one. As underlined above, calculations of carbon footprints might require companies to devote a lot of time and resources, which would imply high additional costs. This in turn can have an impact on the final retail price of a food product.

Absence of standards and 'green-washing'

One of the main problems associated with carbon footprint labelling is the lack of existing standard for the calculation of GHG emissions embodied within products along the whole supply chain. So far, different companies have started using different methodologies to calculate their products' carbon footprints, defining system boundaries differently. This makes it impossible for consumers to compare carbon footprints of different products as well as has the potential to destroy consumers' confidence and trust in carbon labelling as a reliable approach. Knowing that it is much easier to destroy than to gain consumers' trust, this risk should be seriously considered. Moreover, some companies using less demanding and comprehensive carbon foot printing methodologies are likely to be accused of "greenwash" by their competitors as well as other stakeholders. The lack of standard also creates unequal conditions for companies. Companies that carry out more detailed and broader estimation of the carbon footprint of their products will spend more time and cost than companies not taking similar efforts. All in all, it is therefore difficult to expect and recommend intensive participation of businesses in this scheme until a standard and the verification procedures that go with are developed.

Risk of loosing track of other environmental impacts

Another limitation that can be used against both food miles and carbon labelling schemes is that they divert the attention from other environmental problems and focus only on climate change. Some products, for instance, can have a low climate impact while directly or indirectly causing other significant environmental impacts. For example, the carbon intensity of products manufactured in Norway, Sweden might be low due to the fact these countries primarily rely on hydropower. However, via the type of energy used, these products indirectly affect biodiversity. Similar example can be given for products produced in France and Japan, which are relying on nuclear power. In this case, products indirectly lead to the generation of hazardous and radioactive waste). Therefore, when using climate labelling in marketing purposes, producers should also take into account other environmental impacts of products, e.g. water usage and use of toxic substances. One way of doing this, at least in the initial stages, would be to award with a climate label, only those food products that already have an eco- or organic label.

Consumers' awareness and understanding is key

Another issue that companies should consider when using carbon labelling for marketing purposes is consumers' awareness of the topic. Consumers' knowledge about climate change has increased recently, mainly because it was intensively covered by media, which has participated in increasing consumers' willingness to be provided with more climate related product information. However, there is a concern that some people might not understand what the CO_2 or climate information on the packaging actually means. Some consumers might systematically associate it with, for instance, harmful chemicals and not buy products with such labels at all. Moreover, more investigation should be done to understand whether consumers' willingness to know more about products' climate impact implies that they will actually act based on this information. If yes, carbon footprint labelling scheme can bring potential benefits for producers implementing it. Otherwise, from

3. Implication of climate labels for food producers

a company's perspective, carbon footprint labelling might only result in high costs and time spent on carbon footprint calculation.

3.2 More specific implications for the Danish and Swedish food industries

Denmark's and Sweden's commitments under the Kyoto Protocol

According to the EU Burden-Sharing Agreement designed to meet the EU's reduction obligations under the Kyoto Protocol, Denmark is committed to reducing its national GHG emissions by 21% in 2008-2012, compared to levels of the reference year 1990 (Denmark's National Allocation Plan 2008-12, 2007). Sweden is allowed to increase its emissions by 4% during the same period. However, the Swedish Parliament has established the goal of reducing national GHG emissions by at least four per cent on average below 1990 levels by 2008 - 2010. There is also a longer term environmental quality objective of reduced climate impact that implies that Swedish GHG emissions should decline by up to 50% from present levels by 2050 (Ministry of the Environment, 2008). To achieve these reduction targets, Sweden and Denmark participate, among other mechanisms, in the ETS.

Under the trading scheme, Danish energy-producing installations with a thermal capacity of more than 20 mega watts (as well as a number of installations in specific industries) are allocated 24.5 million emissions allowances annually for the period 2008-2012 (Denmark's National Allocation Plan 2008-12, 2007). According to Denmark's National Allocation Plan for 2008-12, in total, 372 existing Danish installations are included under the allowance system in the period 2008-12. In 2006, out of all Danish installations covered by ETS, 32 installations with a thermal capacity of more than 20 MW belonged to the food and drink industry.

In Sweden, the planned annual allocation of emission allowances to installations amount to an average of 25.2 million tonnes of CO_2 in the period 2008-2012 (Ministry of Sustainable Development, 2006). The total number of Swedish installations in the EU trading scheme amounted to over 700 in the initial period 2005-2007 (in the new period new entrants are expected). Although it was not possible to identify the specific number of food and drink companies participating, Sweden has a number of large actors in the food industry that are included in ETS.

This means that both the Swedish and the Danish food and drink industries will have to take proactive steps to reduce its GHG emissions in order to avoid regulatory and financial liabilities. Taken this into account, and as previously underlined, climate labelling can be a potential tool to help food and drink companies identify potential GHG related risks and reduction opportunities, by making it possible to account for their carbon footprint and the footprint of their products.

Food Miles as a potential threat to Swedish and Danish food exports

If the food miles concept is implemented on the international scale, Swedish and Danish exporters of food products, including dairy and meat products, in particular to the USA, Canada, Asian countries, New Zealand and other countries located far away from Denmark and Sweden, could be negatively affected. This is because Swedish and Danish products will have relatively higher associated food miles, in comparison with locally or regionally produced food. However, the food miles concept could have indirect benefits for the Danish and Swedish industries, by forcing producers to improve the efficiency of the food distribution and export systems, within and beyond their own operations. Moreover, it might indirectly encourage them to use less energy and carbon intensive transport modes.

Side effects of protectionist uses of Food Miles on the domestic market

For the domestic market, food miles can be used by Swedish and Danish producers to differentiate their products compared to imported ones, as consumers usually have more trust in locally produced products and consider local products as being fresher and tastier, moreover local products support local community. For example, this concept can be used to differentiate Danish meat products from meat products from South America. However, negative side effects and limitations of food miles should be seriously considered as they might outweigh the benefits e.g. accusation of being protectionists, negatively affecting developing countries, absence of consideration of the whole life cycle of products.

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Carbon foot-printing as a potential business opportunity

On the contrary to food miles, the assessment of products' climate impact throughout their entire life cycle can bring potential benefits for Danish and Swedish exporters. This can be explained by the fact that Danish and Swedish products might have a better carbon profile, because producers in these countries are usually known for being energy efficient, which reduces strongly the carbon footprint of products. Moreover, given the fact that the carbon intensity of products depends to a large extent on the national fuel mix used to produce electricity, food produced and processed in Denmark and Sweden might have a relatively low impact on climate change from electricity consumption. This can be explained by the fact that the share of renewable energy in the Danish electricity mix is relatively high (for example, in 2003, it was approximately 25 %, mainly from biomass and wind (The Danish Energy Authority, 2007).

In Sweden, approximately half of the electricity production comes from hydropower and most of the remainder is provided by nuclear power and renewable sources. These types of energy respurces are known to have low impact on climate change. Therefore, implementing carbon footprint labelling might potentially make Swedish and Danish products more attractive in overseas markets as being relatively climate friendlier than other carbon labelled products, despite the fact that Swedish and Danish food products exported often travel far.

However, and this is especially relevant for Sweden due to its relative reliance on nuclear power, it is essential to take into account other environmental impacts of products when printing climate labels, in order not to be accused of focusing only on climate change and diverting attention from other environmental aspects. Therefore, the current Swedish approach to award with a climate label, only those food products that already have an eco- or organic label can be a solution to avoid such criticisms.

Demands placed by foreign retailers in export markets as a strong driving force

Another reason for Danish and Swedish food exporters to implement carbon labelling is the existing and increasing pressure from retailers, especially from the UK. The UK represents a significant market both for Danish and Swedish food exporters. Given the fact that more and more of the British retailers (likely to be followed by their European counterparts in the nearby future) place demands on their suppliers to provide information about and improve the GHG profile of their products, it is likely that food producers will have to provide those retailers with such information to be able to retain and potentially increase their market share.

Danish and Swedish consumers are likely to welcome carbon labelling

Knowing that the market shares of organic products in Denmark and Sweden are among the highest in Europe, and that, in general, the Swedish and Danish population has a relatively high interest in eco-products (for example, the organic market share on fresh milk in Denmark is close to 30 percent, around 30 percent oat flakes, and constantly growing for organic vegetable and fruits (Organic.dk., 2007)), carbon labelling initiatives are likely to be welcomed, if not demanded, by many Swedish and Danish consumers. As it was expressed by the representative from the Swedish Consumer Association, consumers who are interested in organic and other eco-labels will be interested in climate labelling as well. However, as pointed out previously, more research in this area should be done in order to understand better the expectations of consumers as well as their level of understanding of climate related issued.

Weigh labelling-related costs against potential savings

From a cost perspective, as for any company wanting to implement accurate carbon labelling, carbon footprint labels could be quite expensive both for Danish and Swedish companies. However, these costs can be paid back over time as a well, based on the fact that GHG evaluation and analysis can lead to optimisation of production processes, especially energy and electricity consumption. On the benefit side, it should be noted that climate labels can lead to additional business advantages for those companies that chose to be front runners in the area of climate foot-printing of products, by enabling them to attract interest from environmentally conscious consumers.

Building upon existing knowledge in the Swedish and Danish industries

It is important to underline here that Swedish and Danish producers have been working for a long period on the quantification and reduction of their energy consumption and

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GHG emissions. Therefore, it is likely that many already understand and possess well-documented information about the energy consumption and GHG emissions associated with operations and products. Therefore, one can expect that it would be relatively less time consuming for Danish and Swedish food producers to assess the carbon footprint of their products. In particular, there are already existing Swedish and Danish LCA database providing information and secondary data about environmental impacts of food products, including climate change. However, the estimation will be more difficult if a high share of the information needs to be collected from overseas suppliers.

The current lack of accurate data and accepted standards is an issue

Nevertheless, before climate labelling can be widely implemented, more solid scientific and methodological knowledge should be built in order to ensure that this type of label is really informative for consumers. If it becomes well-known to consumers that carbon labels are not reliable, it will then be hard to regain their confidence on such initiatives. In addition, and not the least important of issues faced by companies wanting to implement climate labelling: International or at least European standards for calculation of carbon footprint of a product should be developed in order to create equal conditions for all companies, avoid confusion among consumers, and guarantee as much as possible the reliability and comparability of information provided on labels. This is an issue that front running organisations and countries, especially Denmark and Sweden, should tackle now.

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Appendix

List of the companies interviewed

1. Findus AB (Sweden): Inger C Larsson, R&D - Quality Director, 20 November 2007, telephone interview, 20 minutes

2. Arla Foods (Denmark): Jan Dalsgaard, Head of Environmental Affairs, 20 November 2007, telephone interview, 15 minutes

3. Casino retailer (France): Corinne Picard, Environmental Manager, 21 November 2007, both telephone and e-mail responses

4. The Coca-Cola Company, European Union: Cees Van Dongen, Environmental Coordinator West Europe Group, 21 November 2007, telephone interview, 30 minutes

5. Unilever (UK): Henry King, Science & Technology Leader: Sustainability, 26 November 2007, telephone interview, 25 minutes

6. ASDA retailer (UK): Chris Brown, Sustainable and Ethical Sourcing Manager, 26 November 2007, telephone interview, 20 minutes

7. Carrefour retailer (France): Paul Rowsome, Environmental Manager, 26 November 2007, telephone interview, 20 minutes

8. ICA AB retailer (Sweden): Kerstin Lindvall, Head of Environment Department, 28 November 2007, telephone interview, 30 minutes

9. Tetra Pak International (Sweden): Katrin Besch, Environmental Specialist, 29 November 2007, both telephone and e-mail responses

10. Svenskt Sigill (Sweden): Helena Elmquist, Responsible for Standard Development (regelutvecklingsansvarig) for climate labeling scheme, 30 November 2007, both telephone and e-mail responses. Pernilla Tidåker, 18 January 2008, 20 minutes

11. COOP retailer (Denmark): Katrine Milman, Head of Environmental Affairs, 4 December 2007, telephone interview, 20 minutes

12. Danish Crown (Denmark): Charlotte Thy, Environment Manager, 5 December 2007, telephone interview, 20 minutes

13. The Swedish Consumer Association (Konsumentföreningen Stockholm, Sweden): Louise Ungerth, Head of Consumer and Environment Affairs, 7 December 2007, telephone interview, 20 minutes

14. The Danish Food and Drink Federation (Part of the Confederation of Danish Industries): Christina Jacobsen, Consultant, documents were provided regarding the Federation's position on the topic, in Danish. The documents were translated by Finn Maigaard, native Danish speaker.

15. British Standard Institute (BSI) Management Systems: Hewitt Roberts, Director Global Sustainability Strategy, 14 December 2007, telephone interview, 20 minutes

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