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Prospects of carbon labelling – a life cycle point of view

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ABSTRACT

The total carbon footprint (CF) of the following life cycle food imports was compared for the prospects of carbon labelling; one study on beef from Canada, three from the U.S.A., and one each from Japan and Brazil; three studies on pork from Australia and Canada; three case studies on chicken from Brazil and Finland; rice from Thailand; and finally, two investigations of potatoes from the UK and Australia. The CF results on average were: beef (32.0 kg CO_2-eq/kg or 100 kg CO_2-eq/kg protein), pork (4.5 kg CO_2/kg or about 18 kg CO_2-eq/kg protein), chicken (2.9 kg CO_2-eq/kg or about 10 kg CO_2-eq/kg protein); and for rice and potatoes, 3.0 and 0.43 kg CO_2-eq/kg respectively. Per 1000 kcal they are 2.31 and 0.56 kg CO_2-eq respectively. While land use is widely acknowledged as a source/sink for carbon emissions, the allocation of CO_2 amounts associated with deforestation was complex and difficult to quantify; and hence omitted from the life cycle CF analysis. It was highlighted that the results are not strictly comparable in absolute terms, but serve the purpose of shedding light on the environmental issues in a food production chain. A standardized approach would definitely be a useful GHG accounting tool to provide an indicator for carbon labelling schemes. Factors influencing carbon labelling schemes in Singapore were raised and discussed. From a survey conducted, 76% responded positively on having carbon labels.

1. Introduction

There is growing scientific evidence and consensus about climate change and its link to human activities (IPCC, 2007). This concern is compounded by a global rapid growing population, with increased demand for energy, materials, minerals, and food products. In order to feed growing populations, the world's agricultural sector faces great pressures to increase its output. In the World Population Prospectus published by the United Nations in 2005, it was projected that the world's population is set to grow by 76 million people annually, with 95% of this growth taking place in developing countries (United Nations, 2005). At the same time, developing countries are growing in affluence, resulting in a greater demand for high-value foodstuffs such as meats. The livestock sector has a significant impact on the environment in various ways. It has recently come to light that animal agriculture plays a greater and more significant role in its contribution to global warming (e.g., Kramer et al., 1999; Fiala, 2008). Policies aimed at sustainable living and consumption patterns are increasingly focussing on this challenge, drawing largely from the insights gained through the carbon footprint of various food products (McAlpine et al., 2009). Livestock are a major source of land pollution as they emit organic matter, nutrients, pathogens and drugs into the soil, which then seep into lakes and rivers (De Vries and De Boer, 2011). Greenhouse gases are emitted either directly from the animals or indirectly through waste. Furthermore, in order to create farmland for the production of livestock, large expanses of forest land has had to be cleared, resulting in the destruction of natural habitats and a loss of carbon dioxide consuming forests (Cederberg et al., 2011).

According to the Food and Agricultural Organization of the United Nations (FAO, 2006) the three most common greenhouse gases – carbon dioxide (CO_2), methane (CH_4) and nitrous oxides (N_2O) – are generated by livestock; that is, 9% of all anthropogenic CO_2 emissions, 37% of anthropogenic CH_4 emissions, and 65% of anthropogenic N_2O emissions. The majority of N_2O produced is a result of manure, while CH_4 is produced mainly from enteric fermentation, which is the process by which carbohydrates are digested in ruminant animals (Ogino et al., 2007). Additionally, the environmental impact of growing grain for animal feed is extremely intense; three quarters of all water-quality problems in rivers and streams in the U.S.A. are due to the agricultural industry (Bittman, 2008).

The world has seen large increases in the demand for meat, shown by changes in the annual per capita consumption of meat,

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which doubled between 1980 and 2002 from 14 kg to 28 kg. While the demand for meat is expected to stay relatively stable in developed countries, that for developing countries is expected to grow exponentially, reaching 37 kg per capita per year in 2030 (FAO, 2006).

1.1. Food consumption in Singapore

According to the Agri-Food and Veterinary Authority of Singapore (AVA, 2012), the aggregate annual meat consumption for Singaporeans in 2010 was 61.3 kg per capita. The figures, displayed in Table 1, are far higher than the global average, but lower than that in other developed countries such as the U.S.A., which had an annual meat consumption of 90.9 kg in 2007 (American Meat Institute, 2009). Being a developed country, Singapore's per capita consumption of meat has stabilized over the years. The trend is illustrated in Fig. 1. Of the three major meat types, chicken is consumed most abundantly, followed by pork and then beef.

Even though the consumption of beef has not declined significantly in Singapore, as it has in the United States where per capita beef consumption is down 25% from 1980, Singaporeans still consume much less beef than their counterparts in other developed countries. For example, despite the decline in red meat consumption, the average American is estimated to have consumed 26 kg of beef in 2011 (Reuters, 2011), compared to 4.2 kg in Singapore in 2010.

2. Carbon labels

Carbon labelling schemes, though voluntary, have been introduced in countries such as the United Kingdom, The Netherlands, and Japan (Gössling et al., 2011; Saunders et al., 2011), with significant participation from companies that don't want to be seen as lagging behind their rivals in cornering the green market. For example, Gadema and Oglethorpe (2011) explored the correlation between the accessibility of information and the degree of carbon footprint score on consumers' choices in selecting food products. They concluded that there exists a connection between the two to guide customer choices and therefore a targeted and well-documented carbon labelling strategy is essential. Carbon labels are expected to provide consumers with the opportunity to make informed choices, especially where the need to reduce carbon emissions has become a global concern. In another example, Upham et al. (2010) conducted a study of stakeholder and public perceptions of grocery carbon labelling in the UK. Similar to other parts of the world, it was highlighted that the prospects of carbon labels – based on carbon footprint or CF information – are still in the early stage of development. Despite the challenges faced by its implementation, the study concluded that such methods paved the way forward in helping to reduce the carbon intensity of high volume grocery products and could have a substantial role to play in meeting carbon reduction targets. Such examples initiated by many countries have become the driving force for other nations to emulate. Strategies and plans to develop methods to measure greenhouse gas (GHG) emission data – also known as carbon 'footprinting' – are becoming widespread. The purpose of this information is to be used on product labels so that consumers' awareness relating to the environmental impacts involved in the production of products can be enhanced.

This paper aims to explore the prospects of carbon labelling of raw food products in Singapore. Before carbon labels can be adopted, the carbon footprint of the top three most commonly consumed meats in Singapore – chicken, pork, and beef – and two commonly consumed raw staple foods – rice and potatoes – will first be investigated using a life cycle approach.

Table 1
Annual per capita consumption of meat in Singapore in 2010 (AVA, 2012).

Meat	Chicken	Pork	Beef	Duck	Mutton
Consumption (kg)	32.3	20.2	4.2	2.8	1.8

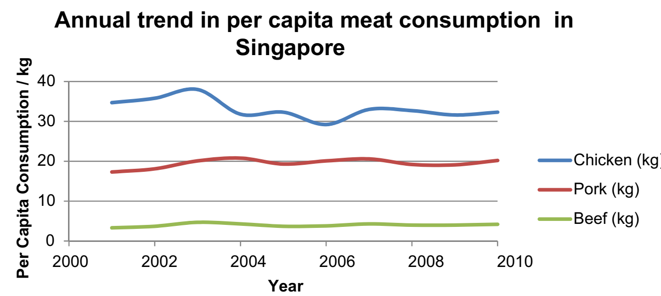

Fig. 1. Annual trend in per capita meat consumption in Singapore from 2000 to 2010 (AVA, 2012).

The general steps for the research approach are illustrated in Fig. 2.

3. Life cycle greenhouse gas analysis

In order to generate a complete GHG emissions profile generated from a production chain, a life cycle approach was used to analyze the GHG emissions associated with a product. Similar to Life Cycle Assessment (LCA), which is recognized as a systematic and comprehensive environmental impact accounting tool (Mouron et al., 2006), the life cycle greenhouse gas analysis approach identified all activities involved in the production, consumption and retirement/disposal of a product, analyses the relevant energy and material requirements, and evaluated the emissions from the product's life cycle. The results of the life cycle greenhouse gas analysis can then be used for the GHG emission labels, known as carbon labels, which allow consumers to make more informed consumption decisions (Ruviaro et al., 2011; Gössling et al., 2011).

The results of the life cycle-based CF study can be used to influence consumer behaviour through initiatives such as carbon labelling of products. While Tesco has abandoned its carbon

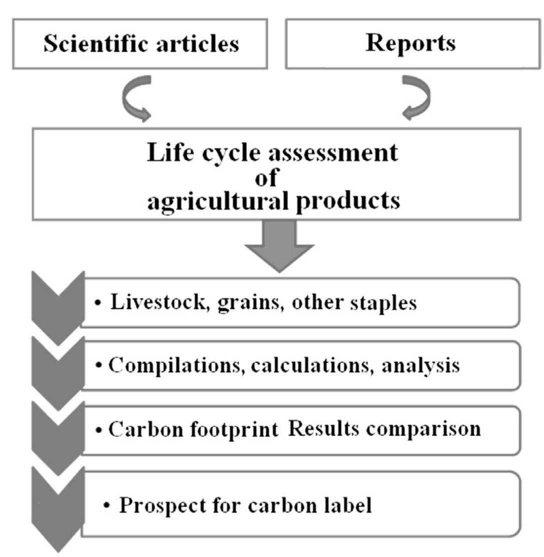

Fig. 2. Stages involved in investigating carbon labelling prospects based on life cycle approach.