1

Introduction

Peter de Jong
NIZO Food Research BV, Ede, The Netherlands

Abstract: Sustainability is sure to be a major topic in the dairy industry in the years to come. More needs to be invested in new technologies and production chains that result in lower energy consumption and more effective use of milk sources. The reason is not primarily because society seeks a lower carbon footprint for dairy products, but simply because of the scarcity of raw materials. It has been shown that dairy products have a relatively high nutrient density, but also a high environmental impact. It is therefore worthwhile to explore the possibilities for a (much) more sustainable dairy chain, which will help with food scarcity problems in the near future. This book is intended to inspire all those who share this aim. Various points of views are discussed: dairy business and marketing, environmental impact, farmers and supply chains.

Keywords: communication, nutrient density, resource scarcity, sustainability hype

© 2013 John Wiley & Sons, Ltd. Published 2013 by John Wiley & Sons, Ltd.
1.1 Sustainability and the dairy industry: hype or trend?

Some trends cannot be ignored. The global population is steadily growing and an increasing number of mouths need wholesome food in order to stay alive, including our children. It is clear that this situation demands timely and dedicated action from politicians and captains of industry to tackle future resource scarcity. However, such trends are often accompanied by intensive publicity or hype which overestimates the impact of the trend, be it the increasing population or the future shortage of energy resources and drinking water. This hype makes it difficult to define a clear road map for the future. Should we, for example, introduce carbon footprint labelling on food products, or should we be investing heavily in renewable energy, or should we do everything together at the same time?

Up till now, politicians have tried to clarify the impact of population growth and limited resources through detailed analysis. In 2006 the European Commission published a report on the relative impact of products on the environment throughout their life cycle. It was concluded that food and drink are responsible for 20 to 30% of the environmental impact, in which meat and dairy products are most important (European Commission, 2006). A number of studies followed, including from the United States (US Dairy, 2010). National governments have taken the step of setting targets for food companies to reduce energy use and to reduce greenhouse gas emissions. Companies are increasingly obliged to report their use of resources and to agree on reduction targets over a period of 10 years or longer (Government of Australia, 2008; Agentschap NL, 2010).

Since about 2000, a number of food companies have included green annual reports as an addendum to their conventional main annual reports. Such reports were used to communicate companies’ good intentions to government, nongovernmental organisations and interested consumers. The main achievements in improving energy efficiency were obtained through closing less-efficient factories and upscaling production (Ramírez-Ramírez, 2006). Nowadays, sustainability has become one of the major messages communicated by a food company and is to be found on the home page of their websites. Companies and branch organisations are transparent about their sustainability goals although it is not entirely clear how sound these goals are and how and when they will be achieved. Here are some examples of food companies’ sustainability goals:
Introduction

‘Halve environmental footprint of our products and source 100% of agricultural raw materials sustainably.’ (Unilever, 2011)

‘CO₂ neutral in 2020 and global number one through partnerships.’ (Danone, 2010)

‘In 2020 40% of energy used on dairy farms from renewable source, 30% reduction of water use, 50% recycled packaging material.’ (Dairy UK, 2008)

In conclusion, it is a clear trend that sustainability will be on the agenda of the worldwide dairy sector for the coming decades. As shown by the simplified scheme in Figure 1.1, scarcity of resources demands more sustainable dairy production.

Figure 1.1 Scarcity means that sustainability must be on the agenda.

- ‘Halve environmental footprint of our products and source 100% of agricultural raw materials sustainably.’ (Unilever, 2011)
- ‘CO₂ neutral in 2020 and global number one through partnerships.’ (Danone, 2010)
- ‘In 2020 40% of energy used on dairy farms from renewable source, 30% reduction of water use, 50% recycled packaging material.’ (Dairy UK, 2008)

In conclusion, it is a clear trend that sustainability will be on the agenda of the worldwide dairy sector for the coming decades. As shown by the simplified scheme in Figure 1.1, scarcity of resources demands more sustainable dairy production.

3 www.dairyuk.org/environmental/milk-roadmap.
1.2 Quantifying the issue: measuring footprints

Manufacturers of food products are looking for quantitative measures to control the environmental impact of their products. This is not an easy task. A common measure is the carbon footprint, the equivalent of carbon dioxide (CO₂-eq) emission per product quantity. Although the calculation in itself is rather simple, the number of factors influencing the carbon footprint is enormous. In the case of dairy, a number of these factors are not known or differ from farm to farm and even from cow to cow. For example, in the United States a recent study showed that farm management, farm size, farm location and forage level accounted for an almost 50% variation in the final footprint (Rotz et al., 2010). This is probably the reason for the large variation in the reported carbon footprint of pasteurised milk. Table 1.1 lists some reported carbon footprints of milk.

This all stresses the need for standardisation and generalisation. The International Dairy Federation, for example, has published a common approach to quantify the carbon footprint for dairy (IDF, 2010). This is a first step towards a standardised measure of carbon footprint for the dairy sector, addressing conversion factors and allocation factors of co-products during manufacturing.

<table>
<thead>
<tr>
<th>Reference</th>
<th>kg CO₂-eq per kg milk</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlsson-Kanyama et al., 2003</td>
<td>0.3–0.5</td>
<td>5 MJ/kg</td>
</tr>
<tr>
<td>Sevenster &amp; de Jong, 2008</td>
<td>0.9–1.8</td>
<td>Based on literature search in 10 countries (Europe, US, Canada, Oceania)</td>
</tr>
<tr>
<td>IDF, 2009</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Smedman et al., 2010</td>
<td>1.0</td>
<td>Sweden</td>
</tr>
<tr>
<td>FAO report: Gerber et al., 2010</td>
<td>1.3–7.5</td>
<td>North America–Africa, global average: 2.4</td>
</tr>
<tr>
<td>US Dairy, 2011</td>
<td>1.8–2.5</td>
<td>United States, average 2.1</td>
</tr>
</tbody>
</table>
In the discussion of the sustainability of dairy products, several benchmarks have been produced. For example, the carbon footprint of milk has been compared with a number of other beverages such as fruit juices, water and soya milk, as shown in Figure 1.2. Mineral water turns out to be by far the most sustainable choice. However, this is definitely not the whole story! If someone was to consume mineral water only, they would probably die within a month. This leads to the conclusion that labelling of food products with a high focus only on their carbon footprint can be misleading.

Smedman et al. (2010) made a first attempt to relate the climate impact of food products to their nutrient density. They defined a so-called Nutrient Density to Climate Impact (NDCI) index:

\[
NDCI = \frac{\text{nutrient density (kcal, protein, vitamins, minerals, ...)}}{\text{greenhouse gas emission (CO}_2\text{-eq)}}
\]

Assuming that a human being needs a certain amount of nutrients to stay alive, the environmental impact is minimal when a person eats food with a high NDCI value. When NDCI is calculated for the products in Figure 1.2, another choice than mineral water becomes sustainable (Figure 1.3). Unsurprisingly,
milk has the highest NDCI value. In other words, people who drink milk to obtain their daily intake of nutrients and calories have a low impact on greenhouse gases. From this point of view, dairy products are already among the top sustainable food products.

1.4 Structure of this book

This book gives an overview of the main aspects of a sustainable dairy production chain. It follows more or less the approach a dairy company can apply to upgrade their degree of sustainability in terms of energy use, carbon footprint and water footprint. At the end some examples of real-life company approaches and new production design concepts are presented.

After this introduction, Chapter 2, ‘Greenhouse gas emissions from global dairy production’, mainly based on a report from the Food and Agriculture Organization in 2010, examines the subject from a political and social perspective. In Chapter 3 the main tool to assess the degree of sustainability of a product or process is addressed: ‘Life cycle assessment’. It explains how to quantify the carbon footprint of a product and which aspects
have to be taken into account. The sustainability of the dairy chain is very much based on the farm. This aspect is considered in Chapter 4, ‘Sustainability and resilience of the dairy sector in a changing world: a farm economic and EU perspective’. The production of dairy products from raw milk has a long history. Process operations have not changed that much. Chapter 5, ‘Dairy processing’, outlines some possibilities for increasing the sustainability of dairy processing, and an outlook on breakthrough technologies for the next steps in processing is presented. Besides the farm and the way of processing, packaging has a major impact on the carbon footprint of dairy products, addressed in Chapter 6, ‘The role of packaging in a sustainable dairy chain’. Next, two business cases are described: Chapter 7, ‘The business case for sustainable dairy products’ and Chapter 8, ‘A case study of marketing sustainability’. This shows that sustainability is not only a political and social issue but also an opportunity to generate new business and profit. In Chapter 9, ‘Cradle to Cradle for innovations in the dairy industry’, some thoughts are presented on new concepts to make dairy products 100% sustainable with no negative environmental impact. The book concludes with a vision, ‘The future of dairy production and sustainability’.


