

Measuring the sustainability performance of agro-food chain initiatives

*a method for estimating the potential sustainability performance of
initiatives in which TransForum participated*

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June 2010

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I Introduction

TransForum is a Dutch public organization that promotes innovation and develops knowledge for sustainable agriculture and liveable rural areas. It seeks a better understanding of sustainable metropolitan agriculture by learning from innovative, multi-stakeholder project development. TransForm's own role is primarily process orientated. After screening the sustainability ambitions at the start of a project, TransForum only incidentally influences the parameters that determine the project's sustainability performance.

Between 2004 and 2010 TransForum participated in more than thirty projects to improve the sustainability of agro-production. As this period draws to an end, TransForum wants to review and assess the sustainability performance of the projects they were involved in. As its own input was primarily process orientated and it gained only limited knowledge of the actual sustainability performance of the different initiatives, TransForum asked environmental consultants Blonk Milieu Advies (BMA) to evaluate the sustainability performance of a number of these initiatives. Because no methodology was available to measure each aspect of the sustainability performance of an agro-food chain initiative (environmental, economic and social indicators), we developed a new, integrated method. The method was developed in an interactive development process in which we drafted, tested and adjusted the method in several iterative rounds while evaluating the TransForum initiatives (as test cases).

This report has two main aims. The first is to present the method we developed and used to evaluate the TransForum initiatives. We explain the basic framework for evaluating the initiatives and discuss the issues to be considered and guidelines for evaluating a specific initiative. The report also presents more general considerations when measuring sustainability performance.

The second aim of this report is to attempt to compile a general method for measuring the sustainability performance of initiatives. The method is based on a consistent framework that builds on several important existing methodologies and standards, such as life cycle assessment (LCA), environmental impact assessment (EIA) and global reporting of sustainability (GRI). It consists of an extensive set of indicators and a method for scoring these indicators. We are confident that the chosen approach gives accurate results for the most important indicators in our method. For some indicators, the approach needs to be developed further.

In Chapter 2, we explore the effect mechanisms at work when initiatives cause a change in agro-production systems. The main questions in this exploration are: What are relevant impacts, and at what scale do they affect actors or ecosystems? Answering these questions resulted in an overview of measurement issues and optional indicators. In Chapter 3, we explain how sustainability performance can be measured by comparing the initiative with a business-as-usual (baseline) scenario. This comparison means that the sustainability of existing companies, products and locations also needs to be measured and taken into account when assessing the sustainability performance of an initiative. Both quantitative and qualitative methods are used for scoring sustainability performance. In Chapter 4, we explain the operational method for evaluating performance and present the final assessment framework. In Chapter 5, we reflect on the pros, cons and status of the method used for evaluating the TransForum initiatives and give some recommendations for its further development.

2 New initiatives and sustainability impacts

2.1 Overall framework for evaluating sustainability performance

‘Sustainability’ is a very broad concept relating to the ecological, social and economic consequences of our actions. Absolute sustainability does not exist, or is at least very hard to define. A more workable concept is ‘sustainable development’, which implies that we are able to define more sustainable pathways and thus are able to measure a more sustainable performance. Sustainable development includes nature and environmental aspects (planet), social aspects (people) and economic aspects (profit). It refers to an ongoing process of finding a balance between these aspects.

Measuring sustainability performance is complex because an initiative does not necessarily result in improvements in all aspects of sustainability. There are many effects involved at different locations and with different timeframes. For example, an improvement in environmental performance through more efficient production is often accompanied by a decline in other sustainability indicators, such as animal welfare and employment opportunities. These negative effects may become manifest within the company that takes the initiative, but may also appear elsewhere in the supply chain. It is precisely these types of initiatives that are the subject of this study. The TransForum initiatives seek to make alterations (transitions) in the agro-production system to improve some specific sustainability aspects, but the implications for the overall sustainability impact are not known. The aim of our method is to make this overall impact assessable.

We developed a specific evaluation method for the TransForum initiatives. Figure 2.1 shows the outline of our evaluation framework. Each initiative generates people, planet and profit impacts for different actors and at different scales. Impacts can be divided into four levels:

1. local effects where the initiative is or will be established;
2. local effects in the supply chain;
3. global effects;
4. system effects.

The ultimate impacts of an initiative have to be determined for each level and these four levels must be compared with a baseline scenario (Figure 2.1). Estimating the sustainability performance of TransForum initiatives also involves an evaluation of the potential and the resilience of the initiative.

Implementing the initiatives results in a physical change in production and/or consumption. Changes have a certain magnitude, occur in specific locations and affect specific communities. An initiative not only has impacts on its own territory, but also in the surrounding area (ranging from metres to hundreds of kilometres) and affects producers and suppliers and their environment. Some impacts are relevant on a global scale and the actual location of the activity is not important for the effect mechanism and the impact (e.g. global warming, depletion of raw materials). Initiatives can also have impacts at the system level arising from the consumption and use of the products. Finally, to determine the potential extent and spin-off of the initiative it is important to evaluate the possibilities for upscaling and the stability of the design of the initiative. Important factors are therefore dissemination of knowledge, entrepreneurial activity, and the nature and size of the market for the initiative.

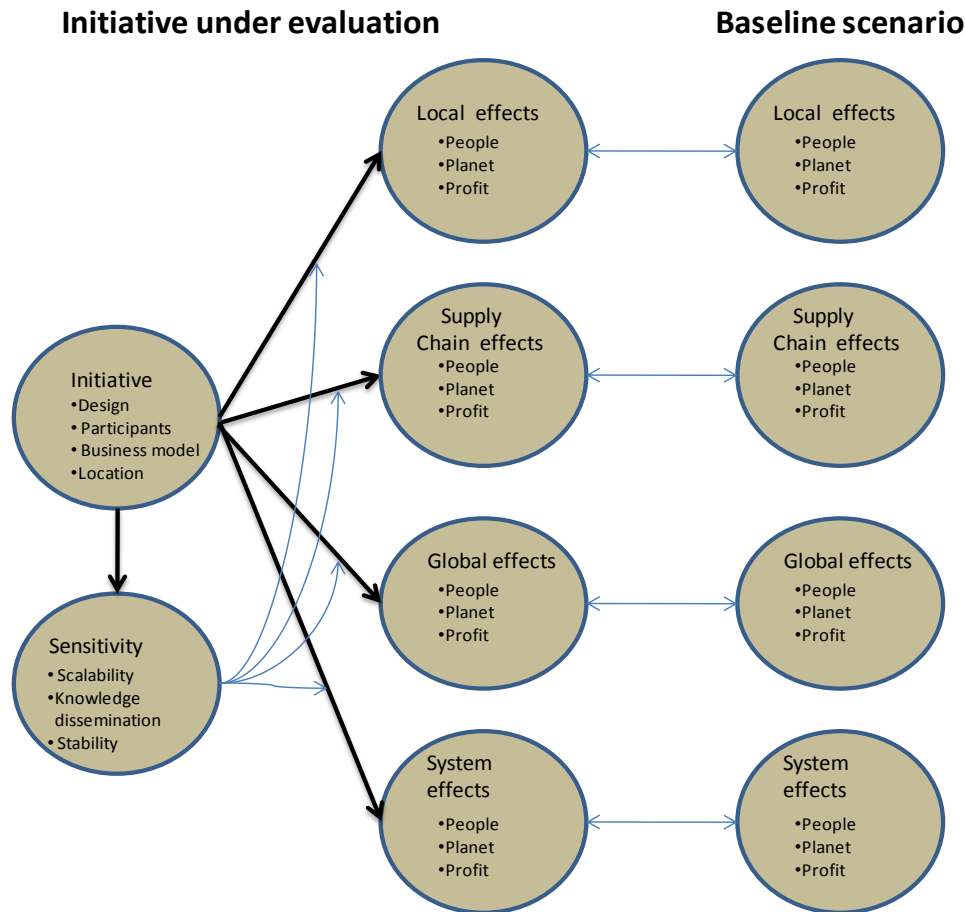


Figure 2.1. The initiative has an impact on sustainable development at different scales (local, supply chain, global and system) compared with the sustainable development of a hypothetical situation without the initiative (baseline scenario).

The method for evaluating the TransForum initiative is based on three sustainability assessment methodologies:

- LCA: Life Cycle Assessment (ISO14040:2006; ISO 14044:2006; Guinee 2002; JRC 2010)
- EIA: Environmental Impact Assessment (EU Directive 85/337/EEC amended in 1997)
- Global Reporting of Sustainability (incl. Global Reporting Initiative;¹ ISO 14064)

The life cycle assessment (LCA) methodology is applicable for assessing the effects of products (existing or new) and production chains or changes in product chains. It provides a clear framework for the identification, quantification and assessment of environmental effects. The LCA methodology is currently limited to environmental aspects, but work is progressing on extending it to social aspects (social LCA or SLCA; see, for example, Makishi 2006; Joilliet 2007). A first guide to the use of SLCA was recently published by the United Nations Environment Programme (UNEP 2010).

The Environmental Impact Assessment (EIA) methodology provides tools for assessing the environmental impact of initiatives on location. Within the framework of the EIA methodology, different forms of multicriteria analysis have been developed.

¹ GRI: <http://www.globalreporting.org/ReportingFramework/G3Guidelines/>

The Global Reporting Initiative provides a starting point for evaluating the sustainability performance of a company and its production chain. The method is particularly useful for larger firms in industrialized countries with locations and a supply chain in developing countries. The main aim of the GRI method is to identify, list and monitor sustainability issues and it can be considered to be a descriptive method. What all methods have in common is that they improve our understanding of sustainability aspects in their specific focus area, providing a basis for the definition of improvement options. This is also an important objective of the method for the assessment of TransForum initiatives.

The method we propose was designed to evaluate initiatives which include a new production activity in one or more locations that involves a change in the agro-production system, resulting in new products, new services, or even new functionality which can be added to existing products or production. The first task is to determine the scale of the evaluation of impacts. The impacts of activities can be determined at the business level, the field level and sometimes the production level, depending on the relevant impact mechanism. Roughly speaking, three types of impacts are relevant:

1. local impacts of the initiative, the supply chain or the customer chain;
2. global impacts related to the total life cycle of products;
3. system impacts related to the (change in) value of products.

Impacts are assessed at the predefined scale. Then the initiative's potential is assessed. This potential is the result of the scope for upscaling the innovations and products of the initiative and the 'robustness' of the initiative (adaptive capacity of entrepreneurs and the resilience of the concept).

Other frameworks have been developed to monitor sustainability aspects and to define hotspots for improvement by others. Boone and Pierick (2005), for instance, have developed a sustainability scan for agro-production which also focuses on sustainability performance. These methods were designed for use in developing a Corporate Social Responsibility (CSR) policy or structure within existing companies. The primary concern is accountability and not innovation. This is a crucial difference with the evaluation of the TransForum initiatives, in which the companies involved want to realize new products and new activities. Blonk (2007) discusses the essential difference between CSR and sustainability-focused innovation and the consequences for the framework and tools needed to support both activities. Innovations in sustainability are often made by companies that do not have any CSR achievements yet, but are inspired by new businesses that provide solutions for sustainability issues. This also holds for most of the TransForum initiatives.

2.2 Defining the initiative

Table 2.1 summarizes the TransForum initiatives to be assessed and their sustainability proposition. Nine of the ten initiatives are located in the Netherlands. Five are limited to improving agro-production itself. The other five initiatives also have a retail orientation.

Table 2.1 TransForum initiatives to be evaluated

	Initiators and location	Sustainability proposition
1. Regionale Voedselketen / Mijn Boer	Innovative supply chain for retailers. Mijn Boer contracts local producers of fruit and vegetables to supply retailers. The initiative also involves sustainable produce from developing countries.	<ul style="list-style-type: none"> * Supply of high quality fruit and vegetables and socially responsible products * Creating added value for local farmers and foreign farmers of high quality produce * More sustainable production of vegetables and fruit
2. Biopark Gent-Terneuzen	Network of participating companies, the provincial government of Zeeland and other governmental organizations.	<ul style="list-style-type: none"> * Production of several goods based on industrial ecology principles (connecting energy and material flows) resulting in a lower impact than the reference 'stand alone' production systems. <p>Among the products are:</p> <ul style="list-style-type: none"> • Horticulture produce • Ammonia • Biofuels (ethanol, diesel)
3. Rondeel (Het Gulden Ei)	G. Kwetters & Zn. B.V. (marketeer) and Vencomatic B.V. (manufacturer of poultry housing systems). The housing system is primarily meant for Dutch production.	* New housing system with a better performance on animal welfare, combined with (partly) direct retailing of eggs or selling eggs with a better sustainability performance.
4. Nieuw Gemengd Bedrijf	Combining Kuipers Kip (broilers) and Houbesteyn (pigs and piglets) and an anaerobic digester in northern Limburg to form an integrated large-scale farming system.	<ul style="list-style-type: none"> * Combined large-scale production of broilers and pork which increases environmental and economic performance and the welfare of broilers * Large-scale production replaces local smaller-scale production in more sensitive areas
5. Green Care	Group of farmers around Amsterdam creating added value by providing care services for residents of Amsterdam.	* Developing new products and the organizational structure of dairy farmers leads to the conservation of agriculturally valuable land around Amsterdam and creates new social care products.
6. Heuveland	Network of municipalities, developers, local entrepreneurs and agriculture in Limburg.	Adding value (care and tourism) to agriculture by exploiting high quality landscapes supports conservation and delivery of social care.
7. Greenport Shanghai	Cooperation between several Dutch research institutes and Chinese industrial investors.	Greenport Shanghai is a showcase for innovative, sustainable production of high-quality food in a metropolitan area. Greenport Shanghai is a 27 km ² agro-food park next to Dongtan Ecocity on Chongming Island.
8. Koelanderij	Large park-like and community-orientated dairy farm in the south of Drenthe, initiated by two brothers named Wilms.	* Large-scale milk production supported by the community, while reducing production costs. The brothers Wilms see this as the main strategy for milk production when the milk quota are abolished in 2013.
9. Noord Friese Wouden	Initiative by 6 foundations, including local dairy farmers for agriculture and nature conservation in Friesland.	* Creating value in the NFW area and the NFW economy, e.g. through more sustainable agricultural production.
10. Landmarkt	Landmarkt is a new retail company planning to open 30 stores during the next 10 years, starting in Amsterdam. It is a cooperative venture between a group of entrepreneurs and investors.	<ul style="list-style-type: none"> * Supply of local sustainable produce * Creating value for local farmers * Conservation / improvement of Dutch rural community and landscape

A closer look at the different TransForum initiatives reveals that they can be categorized according to the role of the participating actors (companies/entrepreneurs) and the definition of the actual innovation. We defined four types of initiatives with different system definitions:

1. System definition 1: Single product/product chain
2. System definition 2: New product concepts developed with (exchangeable) suppliers
3. System definition 3: Added value through connection
4. System definition 4: Added value through integration

System definition 1: Single product/product chain

Some initiatives are focused on a single product or production chain. The initiator, designer and user(s) of the product are part of the initiative (Figure 2.2). In some initiatives suppliers support the use of the product, but are not a part of the initiative, and there are no specific activities involving these suppliers.

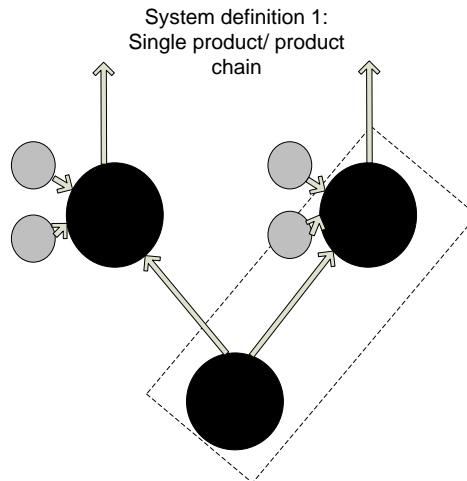


Figure 2.2 System definition for single product/product chain initiatives. The black circles are initiators and the grey circles are suppliers. The dotted line indicates the boundary of the initiative. The top two arrows are products sold.

The Rondeel project can be defined as single product or product chain. The Rondeel housing system is the innovative product developed by the project initiators and farmers are the users. To use the housing system, farmers need suppliers of animal feed. These suppliers are not part of the initiative, but they are considered to be part of the supply chain. The initiative is therefore the product, as part of a production system in operation. The supply chain is relevant for the inputs needed for the operation of the product.

System definition 2: New product concepts developed with (exchangeable) suppliers

Several TransForum projects involved new product concepts with (exchangeable) suppliers (Figure 2.3). In this system the initiator defines and implements an innovative product concept. An example is the introduction of a more sustainable grocery range in a supermarket. Such a concept depends on multiple suppliers who have to be able to meet the demands for the products. The initiator selects the suppliers. The combination of the products is part of a bigger marketing concept and the links between the initiator and the suppliers is not necessarily continuous, which means the suppliers are exchangeable.

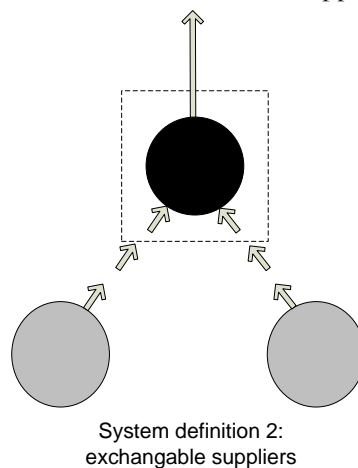


Figure 2.3 System definition for initiatives with exchangeable suppliers. The black circles are initiators and the grey circles are suppliers. The dotted line indicates the boundary of the initiative. The top arrow represents products sold.

Evaluated projects falling within this system definition are Regionale Voedselketen/Mijn Boer, Landmarkt and Green Care. The innovation is designed and implemented by the initiator and the suppliers (farmers) are selected for their products, but are exchangeable.

System definition 3: Added value through connection

The third type of project definition is used to evaluate projects that are characterized by new connections between multiple (existing) enterprises (Figure 2.4). The connections consist of an actual exchange of material or energy flows between the participating facilities and adds value to the products of the individual enterprises. The connection often also involves new products. The initiative is evaluated in two steps. First the total complex of activities involved in the connections between enterprises are evaluated against a reference 'baseline situation' in which the connection does not exist. It is possible that some of the innovative activities would have been realized without the connections. The effects of changes in the connections, such as alterations in flows of materials and energy, are evaluated in a sensitivity analysis.

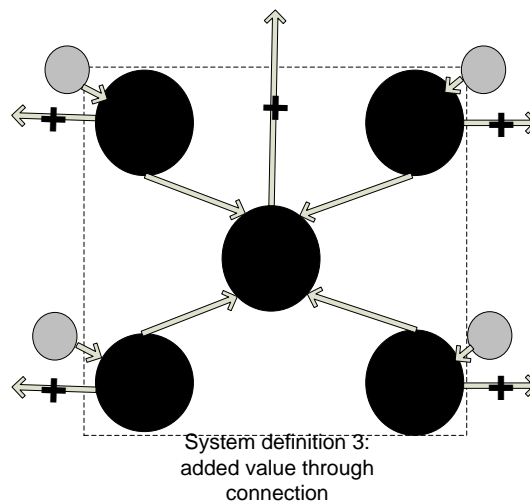


Figure 2.4 System definition for initiatives that add value through connection. The black circles are initiators and the grey circles are suppliers. The dotted line indicates the boundary of the initiative. The arrows marked with a '+' are products sold.

Heuveland is a project with new connections between multiple (existing) enterprises. The connections between the 'integrated community' of businesses and inhabitants and the farmers – including care services, products and recreation – will help sustain and/or improve the landscape. The sustainability performance of the farms may improve and the farm product may gain added value from the connection. Without the link there is simply a community and farmers, and there would most probably be no improvement in the landscape. Other projects evaluated according to this system definition are Nieuw Gemengd Bedrijf and Biopark Terneuzen.

System definition 4: Added value through integration

Added value through integration means that the new connections between multiple (existing) enterprises have become so complex that the entire system should be seen as a single initiative and should be managed that way (Figure 2.5). The connection provides added value for the products of the individual enterprises and may generate a new product. The core element of the innovation is the connection between the enterprises. Due to the complexity of the system, all the enterprises are considered to be part of the initiative. The connections between the enterprises are usually continuous and the initiative will not succeed if some enterprises decide not to take part. Each enterprise can have its own suppliers.

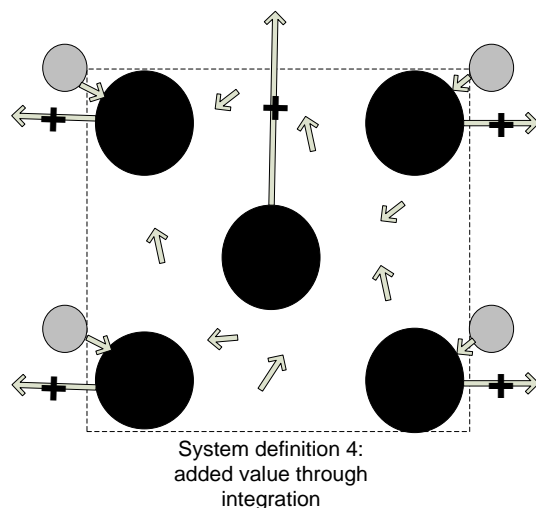


Figure 2.5 System definition for initiatives that add value through integration. The black circles are initiators and the grey circles are suppliers. The dotted line indicates the boundary of the initiative. The arrows marked with a '+' are products sold.

Greenport Shanghai and Noord Friese Wouden were evaluated according to this system definition. There are multiple enterprises involved in the initiatives and the connections between the enterprises are complex.

2.3 Local impacts of the initiative and in the supply chain

Local impacts arise from the performance of the activities in the production chain. They affect the site or sites where the initiative is located as well as the production locations in the supply chain. Sometimes it may be relevant to include downstream locations in the production chain in the assessment, depending on the characteristics and implications of the initiative. Local impacts are differentiated into company impacts and impacts in the surrounding areas (planet) or community (people). Local company impacts are limited to the site where the activities take place. We call them 'in company' effects because the different locations are almost always the property of the companies involved.²

Company effects are evaluated on different scales. The first scale is the 'in company' scale. The second scale is a regional scale, covering the surrounding area or the community living in the surrounding area. Sometimes a third scale is used, for instance a national scale when specific themes are related to national governance (e.g. waste handling, manure application) These scales are defined for each initiative individually.

In our method for the evaluation of TransForum initiatives, we identify 17 different local impact themes, categorized under 'people', 'plant' and 'profit', and within these themes subdivided into 'in company', 'surroundings' and 'community' (Table 2.2). All the impacts are also actor related.

² Some activities not carried out on company property are still considered to be local, like transport, which uses public infrastructure.

Table 2.2 Overview of the local impacts associated with the initiative and the supply chain

1. Local impacts of the production system					
		Theme	Initiative	Supply chain	Customer
People	In Company	1.01 Human rights			
		1.02 Labour conditions			
		1.03 Animal welfare & health			
	Community negative	1.04 Human health (other than emissions)			
		1.05 Animal disease risks			
	Community positive	1.06 Development			
		1.07 Involvement			
Planet	In Company	1.08 Environmental quality			
		1.09 Biodiversity			
		1.10 Landscape			
	Surroundings	1.11 Emissions affecting ecosystems and human health			
		1.12 Environmental quality			
		1.13 Biodiversity			
		1.14 Landscape			
Profit	In Company	1.15 Balance sheet			
		1.16 Investment			
		1.17 Value creation			

We use the same impact categories for the supply chain as for the initiative. Their relevance, however, may differ, depending on the specific situation at the location of the activity. Human rights, labour conditions and community development are more important themes in developing countries than in the Netherlands, where most of the initiatives are located. On the other hand, conserving aesthetic values like landscape is typically an issue in developed countries. The choice of indicators within a theme is also location dependent. For instance, some environmental issues like water depletion or acidification are strongly tied to location.

In the following sections we explain the different themes and the indicators used for assessing sustainability performance. To measure the performance within themes, performance indicators have to be defined. The definition of performance indicators for local themes is case specific and may differ depending on the nature of the activity, the impacts and data availability. The criteria for deciding whether an initiative performs better or worse than business as usual are explained in Chapter 4.

2.3.1 People – In company

1.01 Human rights

The human rights of employees are defined by the International Labour Organization (ILO):³

- Freedom of association and collective bargaining
- Elimination of forced and compulsory labour
- Elimination of discrimination in respect of employment and occupation
- Abolition of child labour

European and North-American owned businesses are particularly alert to potential problems in the supply chain with labour exploitation ('slavery') and child labour. The social policies of companies or the quality

³ <http://www.ilo.org/ilolex/english/docs/declworld.htm>

standards they apply often address these aspects.⁴ Using these standards can often be seen as a kind of extended risk management and is not automatically the same as actively improving human rights conditions within companies.

One would expect that in Dutch companies human rights are not structurally or severely infringed, but discrimination based on gender, race and ethnic origin is still sometimes a problem and this is recognized by the Dutch government.⁵ However, in the evaluation of the TransForum projects we concentrated on the human rights issue in the supply chain because we assumed that the issue of safeguarding human rights there is much more important. We based our method on the framework of the Global Reporting Initiative (GRI). The GRI have defined the following indicators for measuring human rights for monitoring progress on this aspect.⁶

INVESTMENT AND PROCUREMENT PRACTICES

- 1 Percentage and total number of significant investment agreements that include human rights clauses or that have undergone human rights screening.
2. Percentage of significant suppliers and contractors that have undergone screening on human rights and actions taken.
- 3 Total hours of employee training on policies and procedures concerning aspects of human rights that are relevant to operations, including the percentage of employees trained.

NON-DISCRIMINATION

- 4 Total number of incidents of discrimination and actions taken.

FREEDOM OF ASSOCIATION AND COLLECTIVE BARGAINING

- 5 Operations identified in which the right to exercise freedom of association and collective bargaining may be at significant risk, and actions taken to support these rights.

CHILD LABOR

- 6 Operations identified as having significant risk for incidents of child labor, and measures taken to contribute to the elimination of child labor

FORCED AND COMPULSORY LABOR

- 7 Operations identified as having significant risk for incidents of forced or compulsory labour, and measures to contribute to the elimination of forced or compulsory labour.

SECURITY PRACTICES

- 8 Percentage of security personnel trained in the organization's policies or procedures concerning aspects of human rights that are relevant to operations.

INDIGENOUS RIGHTS

- 9 Total number of incidents of violations involving of indigenous people and actions taken.

Some initiatives use standards like Global GAP or 'ethical' standards like Fair Trade as the main instrument for safeguarding or improving conditions. Sometimes they develop their own social policy for inclusion in their purchase conditions and to educate buyers on this issue (ethical trading initiative).

⁴ See for instance Global GAP (Global Good Agricultural Practice).

⁵ See for instance <http://www.cgb.nl/artikel/discriminatievrije-werkvloer> commissie gelijke behandeling.

⁶ From the quick reference sheet http://www.globalreporting.org/NR/rdonlyres/DDB9A2EA-7715-4E1A-9047-FD2FA8032762/0/G3_QuickReferenceSheet.pdf

1.02 Labour conditions

Labour conditions refer to everything that determines working circumstances, including the protection of employees' health, for example by creating appropriate physical conditions (light, space, furniture, weight, temperature, working hours, etc.) and preventing contact with hazardous substances. Labour conditions are not only relevant to employees, but also to contract workers. The GRI Performance Indicators on Labour Practices and Decent Work can serve as a basis for drawing up indicators.

GRI Performance Indicators for Labour Practices and Decent Work

EMPLOYMENT

- 1 Total workforce by employment type, employment contract, and region.
- 2 Total number and rate of employee turnover by age group, gender, and region.
- 3 Benefits provided to full-time employees that are not provided to temporary or part-time employees, by major operations.

LABOR/MANAGEMENT RELATIONS

- 4 Percentage of employees covered by collective bargaining agreements.
- 5 Minimum notice period(s) regarding operational changes, including whether it is specified in collective agreements.

OCCUPATIONAL HEALTH AND SAFETY

- 6 Percentage of total workforce represented in formal joint management-worker health and safety committees that help monitor and advise on occupational health and safety programs.
- 7 Rates of injury, occupational diseases, lost days, and absenteeism, and number of work related fatalities by region.
- 8 Education, training, counselling, prevention, and risk-control programs in place to assist workforce members, their families, or community members regarding serious diseases.
- 9 Health and safety topics covered in formal agreements with trade unions.

TRAINING AND EDUCATION

- 10 Average hours of training per year per employee by employee category.
- 11 Programs for skills management and lifelong learning that support the continued employability of employees and assist them in managing career endings.
- 12 Percentage of employees receiving regular performance and career development reviews.

DIVERSITY AND EQUAL OPPORTUNITY

- 13 Composition of governance bodies and breakdown of employees per category according to gender, age group, minority group membership, and other indicators of diversity.
- 14 Ratio of basic salary of men to women by employee category.

Most TransForum initiatives do have part of their supply chains in developing countries, and some initiatives aim to improve the social conditions within those supply chains. They use buying standards like Global GAP or 'social' certificates like Fair Trade as their main instrument to safeguard or improve labour conditions. Sometimes they develop their own social policy for inclusion in their procurement conditions and to educate buyers on this issue (ethical trading initiative) (van Heeren 2006; Blonk 2008).

1.03 Animal welfare and health

Animal welfare and animal health concerns the overall wellbeing of farm animals within companies, including transportation to the next production stage. The animal welfare aspects of initiatives to be developed can only be measured on the basis of the housing system design and the management system. For initiatives in operation, measurements can also be made of actual welfare, stress and health indicators, and slaughter results.

Animal welfare and animal health must be evaluated against the background situation in the baseline, which may differ considerably from country to country. For initiatives that aim to make improvements on the current average production conditions in a country it is important to define the attributes of the housing and management systems that guarantee an improved welfare. In the Netherlands this is defined in a variety of standards. For example, there is the index for sustainable livestock production,⁷ the *Beter Leven* label of the Dutch animal protection organization *Dierenbescherming* and the standards for free range and organic production. Indicators to measure better animal health used in Dutch ecolabelling standards include lower mortality rates in weaning and fattening and lower rejection rates at slaughterhouses for some liver and lung diseases. The baseline also differs considerably between countries of production. Reliable data on this issue are often hard to obtain.

2.3.2 People – Community negative

1.04 Human health (other than through emissions)

The human health of a community living in the surroundings of a company can be affected by environmentally related mechanisms, such as emissions of substances, noise and radiation, or extraction and use of local resources (like water or land). These impacts are categorized as environmental themes (planet, see theme 1.11). Here we focus on the remaining human health implications of other effect mechanisms, like the spreading of disease, or as a direct consequence of activities linked to the operation of the company, like transportation or changes in infrastructure. Spreading diseases can be relevant in animal production systems and also in vegetable production systems through the application of manure (e.g. Vogt & Dippold 2005).

1.05 Animal disease risk

The spread of animal diseases to other farms depends on the design of the farm production system, the characteristics of the surroundings (density of farms, for instance) and any precautionary management actions taken to prevent the spread of diseases. Prevention of contamination and maintaining animal health are important measurements. Animal health can be improved in several ways. Disease problems can be solved by management measures or by adapting the housing and management system. Starting with a pathogen free population is very important and certain pathogens can be eliminated from farms with targeted medication and/or vaccination. Eijck (2003) describes a variety of ways farms can raise their animal health status. The supply of animals is the most important risk factor for the introduction of diseases. ‘Closed-system’ farms helps to reduce the number of shipments.

In the evaluation of TransForum initiatives we assessed the risks of the design of new businesses and the expected management practices using a qualitative scoring method as applied in Kool (2008).

2.3.3 People – Community positive

1.06 Community development

Businesses may have a positive impact on the wider community, depending on several factors. Of more importance even than the magnitude and nature of the activities of the business is the background situation of the local community. Creating employment is not a distinguishing factor as such; what matters is the nature of employment, which is especially valuable when it matches the desired local economic development or contributes to a more socially coherent community. What is desirable and

⁷ Maatlat duurzame veehouderij (<http://www.smk.nl/nl/s357/smk/programma-s/c264-maatlat-duurzame-veehouderij>)

valuable may be very different depending on the stage of development, prosperity levels and local social and economic needs.

An activity is only considered to be positive if it can be very clearly demonstrated that it promotes a particular development or ends a certain shortage. Certainly for the Dutch situation one may wonder whether the TransForum initiatives add something of substance to community welfare. Here we do not include the positive effect of maintaining or improving the landscape, which is classified as a separate issue (themes 1.11 and 1.14). For other community welfare aspects linked to a production activity in the Netherlands it is presumed that without the TransForum initiatives other activities would have been realized in the baseline that meet the same needs. The impact on products or services, such as creating more recreational resources or more care facilities, is dealt with under system effects.

The contribution to community development in developing countries can be evaluated using Oxfam's Poverty Footprint (draft 2010). Indicators are classified in five themes, two of which fit within our evaluation definition of positive development of the community:

- Value Chain:
 - ability of poor people to access good quality employment
 - earn a living wage
 - sustain a business
 - participate in the market
- Macro economy
 - distribution of profits
 - shareholder dividends
 - taxes
 - employment

At the time of writing this report (April 2010) the Poverty Footprint was not fully available, and so the indicators have not yet been defined and specified. For the bigger production locations a number of points can be checked:

- Does the company pay tax to the country of residence?
- Does the company have employees from the country of establishment or does it import employees?
- Is a considerable proportion of turnover in the country of settlement spent in the form of local purchases, wages, taxes and dividends?
- Are there arrangements for suppliers and distributors of the company, such as social services, savings facilities, marketing assistance, insurance, assistance with risk reduction?
- Does the company provide its specific knowledge and experience on a voluntary basis to the local population instead of giving donations?

What is good or better practice depends on the country and the local situation. In the evaluation of the TransForum initiatives we were not able to determine whether initiatives scored better than average.

1.07 Community involvement

Community involvement is about sharing information on production activities and being transparent about the activities and internal conditions of the company, with the aim of involving the public in agricultural production and, above all, the sustainability aspects of agricultural production. Increased understanding of the sustainability of agricultural production systems can lead to better acceptance of and

commitment to innovations. Examples are a dialogue between entrepreneurs and the public and initiatives that actually involve the community in agricultural production, such as production in city farms or on unused areas in cities.

It is hard to define performance indicators for initiatives. Studies in the area of environmental psychology show that enhanced knowledge of the sustainability aspects of agricultural production does not necessarily lead to adaptations in consumption behaviour (e.g. Hoogland 2006). The opposition of the community to the Nieuw Gemengd Bedrijf initiatives also shows that enhanced knowledge about improved sustainability does not simply lead to more acceptance. Termeer et al. (2009) and Pot (2009) showed for this case that at some point more communication can even lead to opposite effects. Simply becoming more transparent and ensuring wider dissemination of information is no guarantee for greater involvement in sustainable innovations and acceptance of new sustainable products. Initiatives that become more transparent often lack specific objectives for knowledge dissemination and most do not focus on certain target groups. Opening the doors for ‘passengers’ usually attracts people that are already supportive. Reaching those who are disinterested or oppose your initiative presents a greater challenge.

For this evaluation we think that good practice in community involvement includes setting educational targets for specific target groups to increase knowledge of sustainable agro-production. It also includes a second form of community involvement, participation in the production process, which gives inhabitants of the community a certain amount of responsibility for agricultural production. An example of this is the development of community management agreements for landscape conservation. We think that this type of participation can be qualified as a positive.

2.3.4 Planet – In company

1.08 Environmental quality

The environmental quality of an area is only considered relevant for field production. It refers to the physical condition of the field relevant to soil and water management and contamination of the soil by toxic substances. Indicators which are important (but not always measurable):

- physical soil conditions (organic matter, water buffering capacity, nutrient reserves);
- soil contamination by metals or pesticides;
- water condition (preservation of local water resources).

What is relevant needs to be assessed per region. For the Netherlands the loss of organic matter and contamination by heavy metals such as copper, zinc and cadmium are especially relevant (Bonten 2008; CBS 2006, CBS 2009). In developing countries, soil erosion, depletion of soil minerals and water resources are the main issues (Steinfeld 2006; Bai 2008), but also contamination with heavy metals and pesticides in agricultural soil (Zheng Guozhang et al. 2006).

In the evaluation it is important to recognize measures and management practices that improve the environmental quality of the agricultural land, such as:

- measures to reduce the amount and intensity of land management (for example, no tillage of pasture, using fixed routes for machinery), improving soil flora and fauna, soil structure and organic matter content;
- the amount of irrigation and choice of irrigation techniques;

- measures to reduce the input of heavy metals, such as standards on the metal content of fertilizers or a rational application of manure (which is also an important source of metals on land);
- standards on pesticides use: less toxic, less persistent, lower dose.

Farm practices that improve or maintain environmental quality parameters of the field may be included in quality standards like Global GAP, integrated farming standards (like the Dutch ecolabel or company guidelines) or organic farming.

1.09 Biodiversity

Biodiversity is a comprehensive concept that covers the variety of life forms and genes. Biodiversity can be defined at different levels: the diversity of genes, varieties within species, species, populations and ecosystems. Biodiversity is also often related to concepts of completeness and naturalness of ecosystems. Biologists and nature conservationists are interested in the degree to which ecosystems develop in a natural succession and can be considered healthy. Biodiversity is also about rareness and the existence of endemic species, habitats and ecosystems. What is considered as valuable biodiversity may vary between regions, depending on local perspectives and policy. Conservation of biodiversity has a subjective component.

A further complicating factor in the assessment of the status of biodiversity is the uncertainty of the original state of the natural area. For Western Europe a long-held view was that the greater part of the area consisted of contiguous forests, while nowadays it is assumed that ruminants like wild cattle and horses caused a more variable 'park like' landscape, with forests and open fields.

This brings us to the next complicating factor: species and habitat richness depend on physical factors like gradients, barriers and the extent of the area. The larger the natural area, the more species it will have, but the rate of increase falls off according to the island biogeographical theory of McArthur and Wilson (1967).⁸ This complexity means that biodiversity needs to be considered and measured at different scales. For this project we apply three scales:

1. Biodiversity on and around the farm, which includes:
 - a. diversity of the farm animals and crops
 - b. agriculture-related functional biodiversity
 - c. biodiversity of agricultural elements
2. Biodiversity in the area that surrounds a farm (a few kilometres around the agricultural holding) (see theme 1.13)
3. Biodiversity on a global or continental level (see themes 2.01 and 2.02)

Theme 1.09 focuses exclusively on biodiversity at scale 1, which involves the biodiversity of herbs, insects, birds, soil organisms, etc. related to the means of agricultural production, and the biodiversity associated with landscape, which in itself is not productive but affected by farm management, such as wooded banks, hedges and ditches

Better farm management measures which may improve biodiversity include:

⁸ They derived a relationship between the rise in the number of species present due to an increase in area: $S = cA^z$, in which S represents the number of plant species, A is the size of the area (m^2), c stands for the species richness factor and z is the species accumulation factor.

- reducing the amount and intensity of land management (for example, no tillage of pasture, use of fixed row tracks) to improve soil flora and fauna, soil structure and organic matter content;
- optimization of applied minerals (a reduction of mineral inputs in many Western countries);
- optimization of applied pesticides;
- protection of farm birds;
- measurements to safeguard important farm features;
- no spraying of ditches and banksides.

Organic production will not automatically lead to increased biodiversity. For example, Stortelder et al. (2007) found that on Dutch organic dairy farms biodiversity could be low and not significantly different from that on conventional farms. The attitude of the farmers towards nature conservation on their farms appeared to be a very important factor, as well as external factors such as the surrounding landscape and biodiversity. Nevertheless, organic farming is generally thought to increase soil biodiversity because of the attention to maintaining and improving soil conditions. It is also generally considered to be more favourable for biodiversity than conventional farming because pests are controlled and prevented with non-chemical toxic substances, such as non-synthesized toxics and metals like sulphur and copper.

1.10 Landscape

Many farming activities need a large area of land and therefore affect or even define the landscape. In our evaluation of the landscape impacts of an initiative we restrict ourselves to field farming activities in the Netherlands.⁹

This restriction has to do with the aim of several TransForum projects to safeguard or improve landscape values as part of viability (social value) or biodiversity (planet value) goals. Like the community involvement indicators, indicators for improving or safeguarding landscape value are difficult to define in generic terms. The fact that initiators have incorporated landscape aspects into their design of new activities and buildings is not enough for a positive evaluation; local authorities often safeguard landscape quality when deciding on planning and construction permits for new development. In the evaluation of TransForum initiatives we describe specific landscape measures in the design of new facilities. However, in most cases it is hard to determine whether this will really make a positive contribution.

We evaluate initiatives to safeguard or enhance landscape values in relation to the underlying mechanisms, looking at what arrangements have been made to carry out the proposed landscape maintenance or improvement. Examples of arrangements are agreements with stakeholders that state the landscape goals and activities.

2.3.5 Planet – Surroundings

1.11 Emissions affecting ecosystems and human health

The business/initiative causes a number of emissions that lead to local environmental impacts, for example:

- acidification by ammonia or nitrogen oxides:

⁹ Landscape and biodiversity overlap where landscape elements are living, such as trees and hedges. The species richness and diversity of these elements are allocated to biodiversity. The more aesthetic or heritage values are allocated to landscape.

- eutrophication of minerals in surface water;
- photochemical smog formation of carbon hydrogen substances from freight movement;
- emissions of metals and pesticides to surface water;
- nitrate emissions to groundwater.

Also relevant for human health are odour and noise emissions, but these may be perceived differently by different people. Almost all these emissions only have an effect on the local environment, but some emissions, such as eutrophication and persistent and mobile toxic substances (a group of heavy metals and pesticides) also have effects on a larger scale. Some emissions therefore need to be evaluated on a larger geographical scale.

The effects should be evaluated in three ways:

1. for the entirety of the initiative;
2. per unit area for land-based farming systems;
3. per unit of product produced.

The evaluation at the scale of the initiative compared with the actual background situation is the most straightforward and correct method when the size of the operation is known. However, in many cases the change in production or operation of the initiative is known, but the exactly scale at which they occur is not. It is then useful to take two types of indicators into consideration: emissions per unit area (field operations) and emissions per unit product. Both indicators give quite different information. The first indicator gives information on the environmentally relevant fluxes per unit area. The actual impact on the environment depends on the areal density of substances (fluxes per hectare) and the sensitivity of the local environment, which can differ for each emitted substance. The second indicator gives information at the product level and is useful for scenario calculations with different production volumes. Both indicators give complementary insights into the environmental effects of an initiative or a certain production method. For instance, organic farming often has a somewhat worse emissions profile per unit product than conventional farming, but a better profile per unit area (see among others Sukkel et al. 2007 and Blonk et al. 2007). This means that in a certain location organic farming may be preferable from an environmental perspective, but will require more land, which can lead to other environmental effects elsewhere.

The LCA methodology (ISO 14044; Guinee 2002; JRC 2010) is useful because it gives a set of impact categories and equivalency factors for converting emissions of substances to those impact categories. We concentrate on case-specific emissions whose impacts need to be assessed locally. With regard to agricultural production, we may therefore include:

- acidifying emissions (NH₃, SO_x, NO_x, of which NH₃ is generally dominant);
- eutrophication emissions (P, N);
- pesticides (amount of active ingredient or specific toxic substances);
- particulate matter emissions;
- noise;
- odour.

The LCA impact calculation is based on an average background situation regarding ecosystem parameters and inhabitants. A complete impact assessment, however, will also include the specific sensitivity of the background. More specific site-dependent impact modelling is available for some impact categories, like

acidification and eutrophication (Posch et al. 2008) and is often available as part of the assessment for legal procedures for establishing or expanding an initiatives.

1.12 Environmental quality (other than related to emissions)

This issue relates to the physical environmental condition in the area surrounding the initiative, affected not via the emission of substances but via other physical mechanisms. Quality indicators which are important (but not always measurable):

- impact on water resources (preservation of quality and quantity of water resources);
- soil condition (soil content, organic matter content, water binding capacity, etc.).

The most direct impact mechanism is water extraction. Water extraction for use on one site can affect water levels across a much wider area. More indirect impact mechanisms include building an electricity generating dam, which has great implications for water and soil conditions of the downstream areas, and clearing forests on hillsides, which often affects soil and water conditions across an extended area.

Water levels may also be deliberately altered. Examples are lowering the groundwater level in peat soils to create better grazing conditions for cattle farming or growing conditions for oil palm plantations, or for making open pit mining possible.

Whether these effects occur and are relevant depends on the activities and their specific local conditions. For larger activities, at least in developed countries, an environmental impact assessment has to be carried out as part of the statutory procedures, which is a source of information on impact mechanisms. For many agricultural and related activities in developing countries there is no legal framework to generate and collate this knowledge, but information on adverse impacts can often be found in publications of research institutes or non-governmental organizations (NGOs).

1.13 Biodiversity

For this project we consider three scales of biodiversity:

1. Biodiversity on and around the farm (1.08), which includes:
 - a. diversity of the farm animals and crops
 - b. agriculture-related functional biodiversity
 - c. biodiversity of agricultural elements
2. Biodiversity in the area that surrounds a farm (a few kilometres around the agricultural holding)
3. Biodiversity on a global or continental scale (see indicators 2.01 and 2.02)

Here we focus on the effects of an activity on biodiversity in the immediate vicinity of the initiative. Two situations can be distinguished: the assessment of an existing situation and the assessment of a new situation in which the use of land changes, or land is converted from one situation to another. In both situations it is important to define how big an area is involved and what the effects of this land use are on the biodiversity in the surrounding area. In an existing situation it is important to define the ecological impacts in the surrounding area, both positive and negative. For example, the area of an activity may be a barrier to migration or foraging for certain animals, but can at the same time be important as a breeding ground for other animals. Changing the use of an area may involve fertilizer applications or field operations with machinery. These changes in operation mostly alter the suitability of an area for breeding or foraging. Another type of change is local expansion or reduction in areas. The biodiversity impact assessment then starts with the inventory of land use changes at different locations, followed by an

assessment of the impacts on biodiversity of these changes. Kool (2008) applied this method to the Nieuw Gemengd Bedrijf case.

1.14 Landscape

Many farming activities need a large area of land and therefore affect or even define the landscape. In our evaluation of the landscape impacts of an initiative we restrict ourselves to field farming activities in the Netherlands. We use the same line of reasoning as for the landscape of the surroundings (1.10).

2.3.6 Profit – In company

There are many indicators available to evaluate the profit aspects of an initiative. Here we restrict the economic evaluation to companies directly affected by the initiative: the company that initiated or performs the activity and the companies affected in the supply chain or, where relevant, the customer chain.

1.15 Balance sheet

The balance sheet of an initiative is the revenue minus the costs of the operation. A positive balance (without major subsidies) can be seen as a requirement for realizing the initiative. Realizing a better (positive) financial result than competing companies is a big incentive for innovation. It can be expected that sustainability innovations that have a positive result that is at least comparable to competitors will be more successful than innovations with a less favourable financial result. A favourable balance sheet can be achieved by reducing costs and/or increasing turnover. As many entrepreneurs are too optimistic about the costs of the operation and the market value of their products and market penetration rate, implementation can therefore be hampered by cost overruns and revenue shortfalls.

It is not always easy to interpret the balance sheet drawn up as part of the business plan for an innovation. Estimations will still need to be made on costs, market value and market penetration. However, it is possible to assess the sensitivity of the different estimations. A high dependence on subsidies or a high anticipated market value based on uncertain developments in consumer appreciation can be identified as weak points. The same goes for a financial result which is lower than that of the competitors. Financial results are available for many agricultural activities, which makes it possible to benchmark against averages for the sector.

We also include changes in the balance sheet of actors in the chain, usually in the supply chain. Two mechanisms are relevant here. First, the positive mechanism of striving for a 'fairer' partitioning of revenues over the production chain. This can be organized in different ways. At one end of the spectrum there is equal sharing of the costs and revenues to retailers and farmers on the basis of participation ('Landmarkt model'): when the retailer earns a profit the farmer does too. However, when the retailer makes a loss on sales of the product, the farmer does too. At the other end of the spectrum is giving a fixed price to the farmer to guarantee certain production conditions and the living standards of the farmers.

The second mechanism is related to setting higher quality standards, including the sustainability performance of the farming activities of suppliers. This can be seen as an autonomous development by retail organizations as part of their quality and risk management. Introducing additional standards, however, may also lead to faster upscaling of farming activities as the additional standards put the financial results under pressure. As the extra costs for realizing higher quality standards are often not fully compensated in the price of the products, production is made more efficient, in turn leading to an increase in the scale of production, pricing smaller farms out of international trade. In our method we do not

assess the impacts of applying higher standards as such on the long-term economic consequences. However, it remains an interesting question for follow-up research if the combined improvement of quality, labour standards, rationalization and upscaling must be considered as most favourable from a sustainable development perspective.

1.16 Investment costs

Apart from the financial results, we identified the relative size of the investments as an important parameter for the potential success of a business initiative. Our basic assumption is that when innovations have an equal potential to improve business results and sustainability performance, the cheapest one will be more favourable and applied more often. This seems trivial, but in projects which are to a large extent financially supported, the criterion of investment costs can easily be lost from sight. This is an important consideration for the TransForum projects that focused on more complex multi-stakeholder innovations.

1.17 Value creation

There seem to be even more definitions of value creation than of sustainability. In short, value can be regarded as a trade-off between benefits and sacrifices. An operation can create value by increasing product value or decreasing production costs at the same level of production (higher efficiency). We do not consider the mechanism of efficiency improvement further. Innovations that lead to a higher cost efficiency will also lead to a better balance sheet and are covered under (1.15).

The other side of value creation is related to the (perceived) functionality of products and the value of the company brand. The value of products is determined by only one stakeholder, the customer. Customers define the product value in a certain market. If the consumer appreciates the innovative product and wants to pay a higher price, then value is created. The value of a company brand is determined by many stakeholders, including employees, contractors, shareholders and civil society organizations.

Not all sustainability initiatives lead to an immediate improvement in the financial results of the operation. However, for performing CSR activities it is now generally accepted that they must fit into the concept of valuation of the company, internally for employees and shareholders and externally for civil and public organizations. To the customer, sustainability efforts and concepts are becoming increasingly integrated into the quality concept of products. Investors appreciate companies that take CSR to a higher level above companies that do not take any action.

Value creation by increasing (perceived) company or brand value is often hard to determine for a specific innovation. We think that a CSR innovation creates this value when it fits into the overall strategy and activities of the company on sustainability. This means a coherent strategy and activities on six aspects (Tulder et al. 2009):

- Public Affairs department and relationships with the community at large
- Human Resource Management department
- Marketing and consumer orientations
- Purchasing and supplier relations
- Financial Management – relationship with shareholders
- Relationship with competitors – strategic management

Tulder et al. (2010) developed a benchmark for retail companies to measure their relative position in a ‘quadrant’ of non-active, reactive, active and pro-active, and proposed the concept of alignment. A choice between adopting an active strategy or not has to be decided according to many determinants and

different strategies can be successful in the same market. An important part of becoming more successful is to align activities. It is not very wise to develop a proactive approach on only one aspect while doing nothing on others. On the other hand, a certain imbalance in activities will often occur as a result of the will to make progress and set priorities. A temporary imbalance may then be acceptable.

When evaluating the TransForum initiatives we were not able to determine whether an innovation was compatible with a sensible or balanced process of company value creation according to the Tulder method. Qualitative control points are the availability of a plan for implementing CSR activities and the actual efforts made to embed CSR within the company (bringing the plan into operation). This may involve, for example, a bonus for managers for sustainability performance or CSR education for employees or involving employees in CSR activities. If there is no apparent vision on the value of CSR for the company it is unlikely that a sustainability initiative which is not financially profitable will lead to value creation.

2.4 Global effects of product life cycles

New initiatives lead to changes in existing product life cycles. Some impacts of a product life cycle can be accurately calculated without taking the locations of activities in the product life cycle into account. This is not the case with social and economic impacts and for many environmental impacts, as we have seen above. The indicators in Table 2.3 can be made operational without taking the locations into consideration in the impact model. All indicators concern global environmental impacts.

Table 2.3 Overview of the global impacts associated with the lifecycle of products

2. Global performance indicators associated with the life cycle of products	
Planet	2.01 Land use
	2.02 Greenhouse gas effect
	2.03 Depletion: fossil energy use
	2.04 Depletion: phosphate rock

Social and economic impacts can only be determined in relation to the actors involved in an activity in combination with local background conditions and local needs. However, several social and economic parameters can be meaningfully recorded and added up over a life cycle, such as numbers of employees involved, the number of employees earning a wage under or above a certain threshold, or working conditions meeting or not meeting certain minimum standards. The interpretation of these results, however, remains difficult without associating them with a local context.

In many LCAs many environmental impacts are calculated without including local background conditions in the impact assessment. For our evaluation framework we chose not to do this for three reasons. The most fundamental reason is that for agriculturally relevant environmental impacts like eutrophication or toxic emissions of some metals, which also are micronutrients, the local background situation determines whether emissions must be considered as desirable or adverse. However, the total cumulative emissions of nutrients or micronutrients to agricultural soils can be non-information if they contain emissions of nutrients that are either in surplus or in deficit (see e.g. Blonk & Spriensma 2001). Adding up emissions in these cases is fundamentally wrong. Without including the sensitivity of the background ecosystem, totals

are also difficult to interpret when soils are affected by acidification (Posch2008). Such drawbacks also affect the calculations of the other impact categories used in LCA.^{10,11}

A second, more practical reason is data availability. Making full LCAs for agricultural production chains requires a huge input of data that are not easy to obtain. For instance, data on pesticides use is often poor and the impact on the ecotoxicity of pesticides use is extremely dependent on the specific active ingredients applied. A lack of data can have an extremely high impact on the results.¹²

A third consideration is that if the most recent LCA weighting method (ReCiPe) is used to calculate a single impact score for agricultural products, the land use, greenhouse gas effect and fossil fuel use determine on average 90% of the impact (Sevenster 2010). Combining this insight with the fundamental and practical objections to performing full LCAs makes a defensible case for concentrating on these four indicators. An important feature of the impact assessment of global impacts is that the calculated results concern products or services which can be compared with alternative products.

2.4.1 Planet

2.01 Land use

Land use is the use of an area of land over a certain time. The impact of land use depends on the activity carried out in the area, which determines the remaining biodiversity. As previous life cycle studies of agricultural products have shown, the major contributing activities in land use are agricultural field operations such as arable farming or cattle grazing. Activities like mining of minerals and fossil fuels hardly add any land use.

According to the ReCiPe method (Goedkoop 2009) the potential biodiversity loss per agricultural activity differs by a factor of 2.0 between extensive fertile grassland with the lowest loss (0.69) and monoculture arable land with the highest loss (1.39) (Table 2.4).

Table 2.4 Potential disappeared fraction of species for some activities (land use equivalency factors)

Land use type	Total effect PDF.m ² .yr
Intensive Crops/Weeds	1.33
Intensive Fertile Grassland	0.92
Extensive Fertile Grassland	0.69
Monoculture Infertile Grassland	0.85
Extensive Infertile Grassland	0.44
Intensive Tall Grassland/Herb	1.05
Extensive Tall Grassland/Herb	0.75
Broad-leaved plantation	0.81
Coniferous plantations	0.91
Mixed plantations	1.10
Continuous urban	1.4
Vineyards	0.86

¹⁰ For two impact categories, ozone depletion and depletion of raw materials, this is not the case, and the totalled result is meaningful information. However, in both cases it is hard to obtain reliable data, especially for the TransForum initiatives that have no objectives for these items[?]. For depletion we chose two important indicators for which data can be collected with reasonable effort.

¹¹ Also the recently developed water footprint.

¹² 0.1% of the active ingredients used can be responsible for 99% of the ecotoxicity score, which actually means that the impact per kg pesticide varies by a factor of 1000.

It must be emphasized that land use per unit product also has social and economic implications. A more efficient use for agro-production will result in more space for other functions.

2.02 Greenhouse gas effect

The impact of emissions on the enhanced greenhouse gas effect can be accurately calculated over a production chain without taking the location of emissions into account. In the model for calculating the greenhouse gas effects it is not relevant where the oxidation of fossil fuels and other fossil raw materials (like limestone) or the emission of other gases (like nitrous oxide or methane) takes place. However, the inclusion of the specific background situation is highly recommended for obtaining reliable estimates of some greenhouse gas emissions of agricultural and forestry activities. The IPCC guidelines (2006) for calculating greenhouse gas emissions for countries provide a Tier 1 approach which is very much independent of the local performance of activities and the local background situation. However, to obtain a more precise estimate of greenhouse gas emissions it is advisable to define more specific calculation rules related to the local situation. For instance, the emission of methane from manure storage depends on storage technology, storage time, temperature and composition of the manure. All these factors are different per region or country. The local situation should also be taken into account when calculating the GHG emissions from clearing natural land for agricultural purposes or the loss of soil organic matter due to agricultural activities. An important difference with the local impacts like acidification or eutrophication is that the location where the emissions occur is not important for calculating the greenhouse gas impact.

2.03 Depletion: fossil energy use

Fossil energy use covers all fossil materials used as a fuel (natural gas, fossil oil, coal and peat). Fossil energy use also contributes to the enhanced greenhouse gas effect, but is also important in relation to depletion of resources. For agricultural products in particular, fossil energy use only partly accounts for the greenhouse gas scores. This means that in a comparison of alternatives the greenhouse gas scores and the fossil energy use scores can give opposite results. Meat replacers often make a lower contribution to the greenhouse gas effect, but have a higher fossil energy use in production (Broekema 2009).

2.04 Depletion: phosphate rock

Mineral phosphate reserves (ores) are finite and after use as fertilizer and reuse as manure in agriculture they are no longer available. There is no materials cycle (such as nitrogen or water); rather, the resources go through downcycling. Phosphate accumulates in the soil (bound as iron or aluminium phosphate minerals) or ends up in sewage sludge. In both cases it is no longer available to agriculture and will 'disappear' via erosion to the bottom of lakes, seas and oceans (Haes et al. 2009).

In our evaluation we use the amount of the net phosphate use, calculated by the input of fertilizer P minus the reuse of P from manure, as an indicator. Phosphate leakages include phosphate in fresh meat products, most of which will end up in sewage sludge.

2.5 System effects related to new functionality of products

An activity or initiative delivers products that are used in another system at a higher scale, where the functionality at this level will have effects on the user. These effects are called system effects related to the new functionality of products, or in short, 'system effects'. System effects can affect the health or wellbeing of the individual or of the community if infrastructure products are involved, such as roads and harbours. System effects also have implications for economic indicators for users, such as time and money budgets or prosperity (community level). A third category of system effects are eco-efficiency indicators. For the global environmental themes in particular it is useful to combine product-level environmental

information with the price of the products to the user. Innovations should ideally lead to better eco-efficiency, which can be expressed as an amount of environmental impact per expended euro, the lower the value the better.¹³ No methodology for classifying and evaluating product-related system effects is yet available. We propose using 10 categories (Table 2.5)

Table 2.5 Overview of the product-related system effects associated with the initiative

3. Functional (system) effects related to product consumption and use	
People	3.01 Health
	3.02 Other welfare aspects (individual)
	3.03 Welfare of the community
Planet	3.04 Land use
	3.05 Greenhouse gas effect
	3.06 Depletion: fossil energy use
	3.07 Depletion: phosphate rock
Profit	3.08 Money budget
	3.09 Time budget
	3.10 Prosperity community

A new product often has multiple system effects for the user. Using a LED light instead of conventional lighting reduces both fossil energy use and greenhouse gas (GHG) emissions and also delivers cost savings for the user. It is an eco-efficient innovation when the fossil energy use and GHG emissions per euro spent falls. Some authors have tried to define which level of fossil energy use per euro can be considered sustainable. Te Riele and Blonk (2002) estimated a sustainable greenhouse emission per euro spent on Dutch final consumption. The GHG emission level is derived from the assumption that a 50% reduction in GHG emissions (from 1990 levels) in the Netherlands should be achieved by 2030. Assuming an average annual growth rate of 2.5%, this requires a reduction in greenhouse gases per euro of turnover of 4% to 5% per year. In absolute terms, this means that the target for the greenhouse effect per euro of consumer expenditure is on average 160 grams CO₂ eq./euro. A kilogram of chicken or pork is responsible for emissions of on average about 600 grams CO₂ eq./euro (Blonk et al. 2007). This means that about a 75% reduction has to be achieved. This can be done by increasing the efficiency of production and reducing GHG emissions, but also by creating added value. This approach also sheds light on the higher greenhouse gas scores for the organic production of meat, which are compensated by higher product prices (Blonk et al. 2007). The value of 160 grams CO₂ eq./euro is not an achievable target for every product, but it defines the magnitude of the reduction needed for the total basket of products.

It is questionable whether the continual pursuit of increasing efficiency per unit of product is desirable for the agro-production sector. In his book *The End of Food* Paul Roberts (2008) shows that the continuous pursuit of greater efficiency in agro-production leads to a more vulnerable situation for the farmer and greater vulnerability of the production system. In our assessment of the sustainability performance of TransForum projects we take no position on this, but show both the effects at the system level for the consumer and the profit level for the producer (especially the economic aspects 1.15–1.17). Evaluation of system effects related to the consumption of the product need to take the place of consumption into account.

¹³ Many business publications use the inverse indicator; see for instance the guide on measuring eco-efficiency for companies by WBCSD 2000 (Verfaillie 2000). In life cycle based eco-efficiency studies the money unit is used in both the denominator and numerator.

2.5.1 People

3.01 Health

Agricultural products can affect the health of the consumer. This may be due to the specific health qualities of food, but a proper evaluation of the health of a product needs to be made within the context of the overall diet, which varies between countries and regions. A food product may make a valuable contribution in a situation with deficits (high-quality proteins or fruit and vegetables), but may not be relevant in another country. For example, the introduction of a meat hybrid product with lower animal and total protein content will have a different effect in a country with a protein surplus in the diet than in a country with a shortage of high-quality proteins.

In a Western (surplus) situation it is very hard to determine whether a food product is good or bad for human health. However, certain trends can be deemed to have a positive contribution (for example, the reduction of sodium content, replacing saturated fatty acids by omega 3 fatty acids, or the prevention of pesticides (residues)). In general, we are very cautious in evaluating food health claims positively.¹⁴

Agricultural products can also affect the health of consumers in other ways. For example, staying at a care farm may have a positive contribution to the health of the care consumer. For these other mechanisms too there must be sufficient evidence for positive (or negative) effects to make an evaluation.¹⁵

3.02 Other welfare aspects (individual)

Products can provide new functionality or value for the consumer. Evaluating these effects requires knowledge of the background situation. For example, products like vacuum cleaners and washing machines were of great value in the 1930s, 1940s and 1950s for the emancipation of women in Western countries because of the tremendous time savings they gave. Time budget effects are considered to be primarily a profit aspect and are further explained under 3.09. Here we focus on the effect of expanding possibilities for consumers. Mobile phones, computers and the internet are all examples of products and services that increase opportunities for consumers. New functionality associated with agro-products is rather less striking. Although many innovations in food and materials technology also expand the opportunities of users.

3.03 Welfare of the community

New products may increase the wellbeing of the community as a whole through the creation of new opportunities arising from the development of a product, particularly infrastructure products (products or institutional capacity building). This can be important for the development of a regional community, depending on the background situation. New infrastructure or institutions may have both positive and negative impacts on the community.

¹⁴ Care should be taken with health claims of organic products. A study conducted by the Louis Bolk Institute in 2005 showed that organic milk contains more healthy components than milk from conventional farming. A long-term study at the University of California showed that organically grown tomatoes contained almost twice as many antioxidants as conventionally grown tomatoes (an average of more than 97% and 79% more kaempferol quercetin). On the other hand, the Dutch consumers association concluded from a comparison of 15 vegetables that organically grown vegetables did not have a health advantage. In 2009 the UK Food Standards Agency carried out an extensive literature study of all scientific research in this area and came to the conclusion that there is currently no scientific basis for organic foods being healthier than non-organic foods.

¹⁵ Another important category of products that improve the health of users are those products which improve ergonomics at work or in the home. These products are outside the scope of the TransForum initiatives.

2.5.2 Planet

3.04 Land use

Land use per euro expenditure by consumers ($\text{m}^2 \cdot \text{year} / \text{euro}$) gives an indication of the effects of a new/adapted product at the macro level. The lower the land use per euro spent, the better. This can be achieved in two ways: either through adaptations to raise the efficiency of production by reducing the amount of land needed for a certain functional unit (or reference flow), with no significant changes in price, or by creating more added value than the optional increase in price justified by the innovation. Innovations that only lead to an increase in price also score positively. This may be problematic in a situation with a limited budget, in which case the negative effect on the money budget is scored under indicator 3.08.

In situations in which there is a shift in land use type to more or less intensive arable farming or grazing, we recommend the use of the land use equivalency factors in Table 2.4. However, these factors are not accurate for all situations. Factors for overgrazed land or degrading arable land are not available yet and differences in background biodiversity are not included.

3.05 Greenhouse gas effect

Greenhouse gas emissions per euro expenditure by consumers ($\text{CO}_2 \text{ eq.} / \text{euro}$) gives an indication of the effects of a new/adapted product at the macro level. The lower the GHG emission per euro spent the better. This can be achieved in two ways: either by efficiency adaptations in production to reduce greenhouse gas emissions for a certain functional unit (or reference flow), with no significant changes in price, or by creating more added value than the optional increase in price caused by the innovation. Innovations that only lead to an increase in price also score positively. This may be problematic in a situation with a limited budget, in which case the negative effect on the money budget is scored under indicator 3.08.

3.06 Depletion: fossil energy use

Fossil energy use per euro expenditure by consumers (MJp / euro) gives an indication of the effects of a new/adapted product at the macro level. The lower the fossil energy use per euro spent the better. This can be achieved in two ways: either by efficiency adaptations in production to reduce the fossil energy needed for a certain functional unit (or reference flow), with no (significant) changes in price, or by creating more added value than the optional increase in price justified by the innovation. Innovations that only lead to an increase in price also score positively. This may be problematic in a situation with a limited budget, in which case the negative effect on the money budget is scored under indicator 3.08.

3.07 Depletion: phosphate rock

Depletion of phosphate per euro expenditure by consumers ($\text{kg P}_{\text{mineral}} / \text{euro}$) gives an indication of the effects of a new/adapted product at the macro level. The less $\text{P}_{\text{mineral}}$ used per euro spent the better. This can be achieved in two ways: either by efficiency adaptations in production so that less phosphate rock is needed for a certain functional unit (or reference flow), with no (significant) changes in price, or by creating more added value than the optional increase in price justified by the innovation. Innovations that only lead to an increase in price also score positively. This may be problematic in a situation with a limited budget, in which case the negative effect on the money budget is scored under indicator 3.08.

2.5.3 Profit

3.08 Money budget

Innovative products or services that have a higher price per functional unit will reduce the consumer's money budget compared with the previous product. From a prosperity or welfare point of view that may seem to be a negative impact. However, this depends heavily on the financial situation of the consumer and on the satisfaction the new product or service gives compared with the older one. As a rule of thumb, it can be assumed that in most cases this impact is less significant in developed countries, except for goods and services that account for a substantial part of the total budget, which differs per income group in a society. In developing countries an increase in price can have very undesirable effects, especially for agro-products. In the evaluation of the TransForum initiatives we did not perform a further weighting of the impact of a decrease in money budget due to a higher product price. Every price increase is initially assessed as a negative impact on the consumer's money budget. A lower price is likewise assessed as a positive impact.

3.09 Time budget

Innovative products or services may change the time spent by the consumer on a certain activity. An increase in time needed for an activity is initially assessed as negative, a decrease in the time needed as positive. However, this assessment clearly depends on the time budget of the consumer and the valuation of the activity by the consumer.

3.10 Prosperity community

New products may increase the prosperity of the community as a whole through new opportunities arising from the implementation of a product, particularly infrastructure products (products or institutional capacity building). This can be important for the development of a regional community, depending on the background situation. New infrastructure or institutions may have both positive and negative impacts on the community.

2.6 Potential and robustness of the initiative

The impacts of an initiative are assessed at the scale at which they are defined by the parties involved. Consideration needs to be given to whether the initiative has the potential to upscale, and by which mechanism, and whether the initiative has a degree of robustness in relation to internal and external system changes (resilience).

With regard to the upscaling potential of the initiative, the following issues are relevant:

1. To what extent does the developed knowledge become publicly available, and by which mechanism?
2. To what extent do stakeholders involved in the initiative learn and adopt new knowledge on sustainable innovations?
3. Do stakeholders inspired by the initiative develop follow-up actions on sustainable innovation?
4. Is it possible for entrepreneurs to develop new business around the initiative?
5. To what extent can knowledge be used to embed innovation more widely across the sector or other sectors?

These questions can be evaluated qualitatively based on the content of business plans and the vision of the entrepreneurs and stakeholders involved.

It is also relevant to question the extent to which the success of the initiative depends on the participation or opposition by stakeholders and how the relevant economic operators of the initiative respond to negative developments (adaptive capacity). This is not easy to assess in advance on the evidence of the plans. But much can be learned from the vision and actions of the entrepreneurs in response to negative developments (is there a plan B or C?) and their ability to respond adequately to changing conditions during the development of the initiative.

A final aspect concerns the robustness/flexibility of the design (resilience). A design may depend on a great number of building blocks, but what happens if one of them is removed? For example, the environmental performance and profitability of agro-production parks are highly dependent on the exchange of materials and energy and the monetary flows between the agro-production activities. There are many reasons why one activity might be removed, such as changes in profitability or legislation, or simply a change of plan by the relevant company. A second form of robustness relates to external developments. To what extent is a system and its sustainability performance sensitive to external changes, such as the loss of grants or government support, the price of oil, changing knowledge about sustainability aspects, etc? These aspects can only be assessed qualitatively on the basis of the plans, track record and vision of the economic operators. In the evaluation we determine the most critical success factors.

3 Assessing the sustainability performance of a change

3.1 Definition and delineation of changes in the baseline

To determine the sustainability performance of an initiative it has to be compared against a reference situation without the initiative, the baseline situation. That is not the current situation, but a situation that would arise in the coming 5 to 10 years, the timeframe within which most TransForum initiatives come into operation and lead to a physical change in production and consumption. All kinds of developments arising from trends and changes in policy, legislation, market and demographics need to be taken into account.

When constructing a baseline various autonomous trends on several levels must be taken into consideration, such as:

1. the operating actors (companies) involved in the initiative: what would they do without the initiative;
2. production: will production become more efficient without the initiative, or not;
3. the markets and consumption of products;
4. the needs of the community involved;
5. the location: what would happen at the locations involved without the initiative, both the locations of the initiative and elsewhere in the supply and customer chain.

We assume that in the baseline the actors starting the initiative would pursue a business as usual scenario, following trends in the market and in technology. This means, among other things, that they will have to develop processes and products to safeguard or improve their position in the market. In addition, they have to anticipate all sorts of upcoming regulations. In section 3.2 we will explain this in more detail.

3.2 Relevant background trends

Trends that affect the business of companies

The most important actors in the initiative are the companies that develop and invest in innovations in agro-production. These companies have to operate in a very competitive market and are subject to different types of 'pressure' from stakeholders. Most companies have to cope with a continuous drive for greater efficiency (cost) and now also with a more critical but equally unpredictable consumer. In addition, they must anticipate legislation, new policies, and agreements between government and the sector on energy savings or reductions in emissions.

A well operating company has a vision of which trends they need to anticipate and in what timeframe. It can choose to be reactive or proactive on sustainability aspects (see e.g. Of Tulder 2009 and van Wijk 2008). Either strategy can make sense, depending on the market and the specific position of the company in the market. Some trends and their relevance for the assessment of sustainability performance are summarized below. This is not an exhaustive list and is primarily intended to assist in the formulation of baseline scenarios. We focus on the background situation for companies acting in the Netherlands and Western Europe.

West European Food Market

There are some important developments in the Western European consumer market and retail sector which will affect the sustainability performance of companies and products in agro-production in the coming years:

1. Retail companies are increasingly held accountable for the sustainability performance of their product range and their operation (shops, logistics, etc.). Kremer (2008) and Blonk (2008) sketch a few important developments. In the coming years, supermarkets will improve their performance on sustainability, while NGOs will measure progress against public benchmarks and use 'name and shame' tactics to speed up the process.¹⁶ The sustainability performance of supermarkets will become increasingly important for the brand, corporate communication and communication to the consumer. Once a proactive stance has been taken on sustainability it is hard to pull back, and as long as NGOs continue naming and shaming as well as conducting a positive dialogue on improvements, the process of improvement will continue. Some other countries are far ahead of the Netherlands. In the UK and Switzerland this process has been in operation for much longer.
2. Arising from the first development is the trend of carbon footprinting products for retail. The British retail sector began doing this at the beginning of 2007 by labelling some products and developing a protocol with the government. This prompted many other initiatives to develop protocols and studies on products, and now many suppliers in Europe, North America and South East Asia are having the carbon footprints of their products drawn up. Whether this will eventually lead to comprehensive labelling of products is highly debatable (Stichting DuVo 2008, Blonk 2009). Nevertheless, many vendors are receiving questions from retailers about carbon footprint information on their production chain and the action taken to reduce emissions. Suppliers that cannot provide this information may be excluded from discounts or other actions.
3. A different trend, important for some consumers, is the demand for 'real food products'. In many countries the range of products that are more authentic, connected to a region or produced according to traditional methods is increasing. Other countries, such as England, Italy and France, have a stronger tradition, but it is an upcoming trend in the Netherlands too.
4. The need for products that involve less animal suffering will remain a permanent campaigning issue among civil society organizations and the supply of more animal-friendly products will increase. An example is the recently-released 'staring system' of the Dutch animal welfare organization *Dierenbescherming*.

In conclusion, the Western European retail sector is gradually shifting towards a more sustainable product range. In addition, there is room for new sustainability concepts at the level of sales formulas, brand propositions, product characteristics and communication. In the assessment of new initiatives in the area of products, stores and sales, it is important to take these trends into account. What are the competitors doing, what is the basic level of sustainability of the product range in five years, and how does a new initiative fit in with or contribute to these trends?

In the evaluation of the TransForum initiatives the market trends described above are especially important for those initiatives connected to those trends, such as producers and retailers involved with developing and marketing new food concepts. Do their sustainability propositions succeed in creating value?

Some of the trends in production efficiency

¹⁶ Recently, Foodwatch started to expand their activities from Germany to the Netherlands. Foodwatch focuses on full transparency to the consumer and on the prevention of misleading communication by naming and shaming.

The dominant trend in agro-production is the continuing rise in efficiency. This means more production per animal, per hectare or other relevant production units. Many innovations in agriculture and the processing industry are technological innovations to increase cost efficiency by reducing inputs per production unit. Examples of this are increasing the yield of crops or specific plant components (sugar, starch) per hectare, the reduction of feed conversion rate, increased muscle meat content in animals, etc.

In the process, the agro-production chain is becoming more and more knowledge and capital intensive, resulting in larger-scale operations, both in the primary sector and in the agro-industry. A positive aspect from a sustainability perspective is that increasing efficiency often (but not always) leads to a lower input of fossil energy and a reduction in the use of space, and therefore lower greenhouse gas emissions per unit of product. On a system level, this upscaling and maximization of efficiency may lower the robustness of the system (Roberts, 2008). Moreover, focusing on reducing production costs accounts for by no means all sustainability aspects in the production chain, so there may be tradeoffs not visible in the costs. This means that the overall sustainability performance does not necessarily have to run in parallel with costs, energy and area savings.

Conversely, it can also be argued that a sustainability initiative that goes hand in hand with a reduced cost efficiency and efficiency in the use space and energy in the chain has to add considerable value to one or more sustainability aspects. How much additional greenhouse effect is the welfare of a chicken worth?¹⁷

Trends in efficiency are especially important for evaluating the global environmental impact indicators (land use, greenhouse gas effect, fossil energy use, depletion of phosphate). Small improvements by the initiatives may not be significant, given that an improvement of 0.5–1% per year is actually a baseline trend. This means that within the 5 to 10 year period when the TransForum initiatives come into effect, the energy and space efficiency in the baseline might have improved by between 2.5% and 10%. Taking into account uncertainties in the calculation of global issues such as global warming, and in energy consumption in the chain, a score of approximately 10% better than the current average in the sector or a product category is needed for an initiative to be significantly better.

Some trends in sustainability policy

The Netherlands has a substantial body of legislation and policies to improve the quality of nature and the environment. Under these policies a variety of actions have been taken to improve the performance of the agro-production chain. Some of these are:

1. energy savings through government–industry agreements (e.g. ‘Clean and Efficient’ (*Schoon en zuinig*));
2. encouraging the reduction of greenhouse gases emissions by companies (grants and emissions trading);
3. stimulating the use of agro-products for biofuels and bioresources;
4. limiting emissions of e.g. manure, ammonia, odour and dust through regulations;
5. improving animal welfare through legislation (EU directives);
6. realizing natural area quality through the planning system and environmental permits, and area development;
7. developing a consumption policy on animal products.

¹⁷ A sustainability initiative can try to solve this by both altering the production characteristics and changing the production volume.

For the evaluation of the sustainability performance of TransForum initiatives the actions related to improving the quality of nature and environment within the Netherlands are of most interest (4, 5 and 6 in the above list). An initiative can be scored positive when there is an obvious contribution to the achievement of Dutch natural and environmental goals. This means that the performance of an initiative on these themes should be compared with the policy objectives and the pace of implementation rather than to the current performance of similar companies. For example, a housing system with lower ammonia emissions must be compared with the permitted emissions according to legal standards in the near future and the current pace of implementation. Then it can be assessed whether an initiative performs significantly better or makes a special contribution to achieving the statutory targets for a sector.

Locations of agricultural production

If the initiative did not exist, the physical locations of the initiative would also go through a certain development. Land use options are regulated in the land use planning policies of municipalities and provinces. Within this framework, an autonomous regional development can be expected. This could include the establishment of new activities, such as business or residential uses that replace agricultural activities. There are also autonomous developments within agriculture itself, such as the increasing economies of scale, expansion of greenhouse horticulture and the disappearance of livestock from the landscape.

Rijk (2008) analysed the claims on agricultural and horticultural land over the next 30 years in the Netherlands in relation to demographics, business activities, water resource management and nature development, and concluded that the area of agricultural land in the Netherlands will decline by approximately 4%. This is rather low, but the changes can be much larger locally.

Initiatives that focus on the maintenance or development of the quality of agricultural land and natural area can be expected to have an implicit or explicit vision on the development of the land without the initiative. In the evaluation of the TransForum initiatives which affect the creation or conservation of nature or landscape values, special attention is paid to the visions with regard to local developments in the baseline.

Conclusions with regard to defining baseline scenarios

The sustainability performance of an initiative is assessed by comparing it with a situation that would reasonably be expected to have occurred without the initiative. To estimate this background situation, referred to as the baseline, the trends as described above need to be taken into account. A positive sustainability performance is achieved when clearly better results are achieved than in the autonomous scenario.

3.3 Some further considerations on substitution and replacement

New initiatives often set out with the aim of replacing existing products or activities, but in practice this is often only partially achieved. The users/consumers often adopt new products while still using the products that were already available. In other words, they extend their need for functionality. Intriguing examples are new energy-efficient lighting products used by consumers in places previously not lighted. This can also be called as a 'rebound effect'. Another example is the computerization of offices, which was expected to reduce paper use and eliminate the use of the fax. In many offices, though, the fax is still running and paper use has not decreased. This effect can be called the 'accumulation effect', which can refer to functionality but also to activities. An example within the agro-production system are farm outlets for local farm products. This could easily lead to more traffic, because it will not affect the ordinary shopping activities of households. It is therefore very important to understand whether a new solution will

replace something or will only add extra functionality and activities, with possible negative sustainability impacts.

Initiatives that actively promote the replacement of 'old', undesirable production or accelerate the decline of this production have a more definite positive sustainability performance than initiatives that do not. In the latter case, introducing new production may convert a latent need to an additional demand for products and services. In general, making an existing stock of goods sustainable is a much greater challenge than only focusing on the additional investments.

4 Drawing up sustainability scores

4.1 Categories of sustainability of performance

To assess the sustainability performance of TransForum initiatives we used a qualitative method with five scoring categories:

Legend
Positive score in relation to the reference
Neutral score in relation to the reference
Negative score in relation to the reference
Not relevant to the initiative
Relevant, but insufficient data for score

These scores are awarded in the following situations:

- Positive: the initiative performs better against a sustainability indicator than the baseline.
- Neutral: the initiative performs neither better nor worse against a sustainability indicator than the baseline.
- Negative: the initiative performs worse against a sustainability indicator than the baseline.
- Not relevant: the sustainability issue/indicator is not relevant to the initiative to be evaluated.
- No evaluation possible (yet): the indicator is relevant to the evaluation, however essential information on the initiative or on the specific impact mechanism is lacking.

We chose a scoring method that can combine qualitative and quantitative evaluation results. This has several advantages. First, it gives equal attention to aspects that can be quantified and those that can be ranked only qualitatively. This scoring method is particularly recommended for evaluating projects without a specific focus on sustainability issues. It prevents undue attention to the quantitative results at the cost of the qualitative results, which are less articulated but may be of equal or greater importance. A second advantage is that it makes it easy to include other qualitative evaluation categories which add valuable information, but often disappear in a more quantitative evaluation. For example, scoring not relevant as 'blank' is also valuable information because it defines which impacts do or do not matter for specific initiatives. The designation 'relevant but information is lacking' also gives essential information. The sustainability performance of initiatives with a relatively high proportion of 'grey' need further assessment. 'Grey' can involve risks and opportunities, which need to be known sooner or later for the further development of the initiative.

Using a colour categorization is also helpful in interpreting the overall results. The relative proportions of the different colours in visual representation provides an immediate impression of the sustainability performance of an initiative (see also section 4.4).

A drawback with this method is that available information on the extent of improvements or negative results is not used in the evaluation. The primary focus is on mapping positive and negative performance.

4.2 Applying the scoring method to themes and indicators

The issues defined in Chapter 2 are specified to different degrees for evaluation. Some issues are defined with certain indicators in mind; in other cases only general indications are given on the type of indicators appropriate to measure the issues. Here we describe in further detail how we applied the suggested categorization to the different issues when evaluating the TransForum initiatives. The specific line of reasoning and calculations can be found in more detail in the ten case study reports.

Table 4.1 Evaluation methods for the impact themes

Theme	Evaluation method
1.01 Human rights 1.02 Labour conditions 1.03 Animal welfare & health	Evaluation is based on the extent and level of <i>applied standards</i> compared with the baseline situation. Standards may be certification schemes, codes of conduct, supplier conditions, etc. Better means wider use or use of better standards than the baseline.
1.04 Human health (other than emissions) 1.05 Animal disease risks	Evaluation is based on a <i>qualitative risk assessment</i> , drawing on what is known about the applied hardware and management of initiatives compared with the baseline. Better means that there are obvious characteristics of the initiative which make a difference to health risks. While it is mostly possible to determine whether these issues are relevant, it is often difficult to come to an assessment because of a lack of information.
1.06 Development 1.07 Involvement	Evaluation is based on the <i>specific activities of the initiatives</i> aiming to improve community development or involvement which are not common in the baseline. This means that there must be a plan available containing a vision, aims, activities and monitoring, which makes it plausible that a distinct contribution is made to these items.
1.08 Environmental quality 1.09 Biodiversity 1.10 Landscape	Evaluation is based on <i>specific characteristics and activities of the initiatives</i> that contribute to maintaining or improving ecosystems and/or landscape quality above the baseline level. There must be either available measurements or indirect evidence-based literature on comparable initiatives, or a plan (specially for landscape) containing a vision, aims, activities and monitoring.
1.11 Emissions affecting ecosystems and human health	Impacts of emissions are calculated using LCA impact categories or, when available, <i>local valid environmental impact assessment models</i> in relation to the sensitivity of surrounding ecosystems and communities. Indicators often have to be subdivided to evaluate local impacts.
1.12 Environmental quality 1.13 Biodiversity 1.14 Landscape	Evaluation is based on <i>specific characteristics and activities of the initiatives</i> that contribute to maintaining or improving ecosystems and/or landscape quality above the baseline level. There must be either available measurements or indirect evidence-based literature on comparable initiatives, or a plan (specially for landscape) containing a vision, aims, activities and monitoring.
1.15 Balance sheet 1.16 Investment 1.17 Value creation	The evaluation of economic indicators is based on quantitative and qualitative information (argumentation) available in the <i>business plan</i> or other relevant documentation that give basic information on the viability and profitability of the initiative.
2.01 Land use 2.02 Greenhouse gas effect 2.03 Depletion of fossil fuels 2.04 Depletion of phosphate	The evaluation is based on a <i>life cycle assessment</i> in which the initiative is compared with the baseline. Better means 10% lower impact than the baseline. Worse is 5% higher than the baseline. Thresholds are derived from an autonomous improvement trends.
3.01 Health 3.02 Other welfare aspects (individual) 3.03/3.10 Welfare and prosperity of the community	Evaluation is based on a qualitative assessment of product characteristics compared with a baseline situation in which the functionality of the products is absent. Better means that there is obvious evidence of improvement. While it is mostly possible to determine whether these issues are relevant, it is often difficult to come to an assessment because of a lack of knowledge.
3.04 Land use 3.05 Greenhouse gas effect 3.06 Depletion: fossil energy use 3.07 Depletion: phosphate rock	Evaluation is based on a <i>life cycle assessment</i> to calculate the impacts, combined with the expected price of the product. Better means 10% lower impact than the baseline. Worse is 5% higher than the baseline. Thresholds are based on an autonomous improvement trend.
3.08 Money budget 3.09 Time budget	Evaluation is based on the expected impact on the money or time budget across the whole life cycle of the product. Better means a lower time or cost expenditure.

Table 4.1 shows clearly that some themes can be assessed according to a well defined methodology, while others are evaluated using a qualitative assessment which is specific for each case. The qualitative results are more open to subjective assessment.

4.3 Estimating potential for upscaling and definition of critical success factors

The sustainability performance of an initiative is measured by comparing the expected performance of a plan of a certain scale with an alternative scenario on the same scale. The first step is to determine what the potential of this initiative is (multiplier). It is often difficult to translate a plan into a certain amount of physical production or consumption with technical parameters that can be used for determining the sustainability performance, and often even more difficult to assess the potential of the initiative.

To evaluate potential we need an impression of the possibilities for upscaling, the existence of knowledge dissemination mechanisms, the stability of the design and the adaptive capacity of the entrepreneurs (or other key actors in the initiative). This information is only partially available in the plans and other documentation. Interviews with the entrepreneurs and other involved stakeholders are needed to assess these items.

Furthermore, it is not easy to assess whether the potential of initiatives score above or below average. At the moment we do not have a benchmark. However, it is still possible to indicate whether there are certain risks (stability) or that there is active knowledge dissemination and adaptive capacity. These are the items we stipulate in the evaluation.

4.4 Visualization, clustering and interpretation of the results

A sound visualization gives a better understanding of the results and is useful for interpreting the results. The evaluation of sustainability issues covers many dimensions and issues. The most straightforward presentation of the results is the ‘issue-scoring’ table, which gives an overview of all the scores grouped by scale (local production, product and system) and type of impact (people, planet and profit) (see Table 4.2). We also presented the results in two types of diagrams, doughnut and bar charts (see Figures 4.1 and 4.2). These aggregated representations provide a basis for an overall interpretation of the sustainability performance.

4.4.1 The issue-scoring table

The issue-scoring table is used as a basic format for the evaluation and consists of five impacts areas:

1. **Local impacts** related to the locations of the *initiative*, the *supply chain* and the user chain if relevant. This ‘field’ consists of at least of 2 rows and 15 columns but can be extended if necessary for the evaluation. An extension of rows means that an aggregated scoring of one impact category cannot be used as an aggregation of the underlying impacts This can happen if the underlying impact scores do not point in the same direction. For example, in the baseline there is only 1 impact category defined for emissions, while 4 separate underlying impact categories may be relevant, such as soil toxicity, acidification, eutrophication and human toxicity, and the scoring per category is quite different. In this case, we increase the number of rows

(impacts) to the disaggregate level of these six emissions. The number of columns may also be increased if it is necessary to differentiate between locations.

2. **Global** impacts of products, involving 4 environmental indicators.
3. **System** effects related to the functionality of products, involving 10 themes.
4. Potential of the initiative.
5. Critical success factors.

The issue-scoring table also shows those issues rated as not relevant for evaluating the initiative (white fields). The scored fields (grey, green, yellow and red) are followed by an explanation of the underlying argumentation and other qualitative aspects determining the scoring.

Table 4.2 Summary of sustainability effects at the local (initiative and supply chain), global and functional scales

1. Local impacts of the production system			Legend	
Indicator			Positive in relation to the baseline scenario	
In Company			Neutral in relation to the baseline scenario	
Community negative			Negative in relation to the baseline scenario	
Community positive			Not relevant to the Initiative	
In Company			Relevant, but insufficient data to score	
Planet	Surroundings	1.11 Emissions affecting ecosystems and human health		
		1.12 Environmental quality		
		1.13 Biodiversity		
		1.14 Landscape		
Profit	In Company	1.15 Balance sheet		
		1.16 Investment		
		1.17 Value creation		
2. Global (non local) impacts of the product per functional unit			4. Potential of initiative	
Planet	2.01 Land use		Upscaling potential	
	2.02 Greenhouse gas effect		Knowledge dissemination	
	2.03 Depletion: fossil energy use			
	2.04 Depletion: phosphate rock			
3. Functional (system) effects related to product consumption and use			5. Critical succes factors	
People	3.01 Health		1. Local production available	
	3.02 Other welfare aspects (individual)		2. Product prices in store	
	3.03 Welfare of the community		3. Growing pains. Will the relations with the suppliers be maintained?	
	3.04 Land use			
Planet	3.05 Greenhouse gas effect			
	3.06 Depletion: fossil energy use			
	3.07 Depletion: phosphate rock			
	3.08 Money budget			
Profit	3.09 Time budget			
	3.10 Prosperity community			

4.4.2 Clustering and interpreting the overall results

There are several options for obtaining a more condensed overall result. Getting a quick impression of the relative contribution of scoring categories is the most important overall information about the sustainability of an initiative. For this purpose we propose the use of a doughnut diagram (Figure 4.1). Two observations can be made. The relative contribution of the 'grey area' (relevant, but not enough information) gives information about the number of issues that could not be evaluated. Within the area covered by these issues there may be threats as well as opportunities. If this area is relatively large, it will be hard to make an overall evaluation of whether the initiative will lead to a positive or negative sustainability performance. Additional research or a further specification of the initiative by the initiators may then be necessary.

The relative contribution of the green area gives information on how positive the sustainability performance is. A very small green area may mean that the sustainability content of the initiative is limited, but this depends on which aspects have a green score.

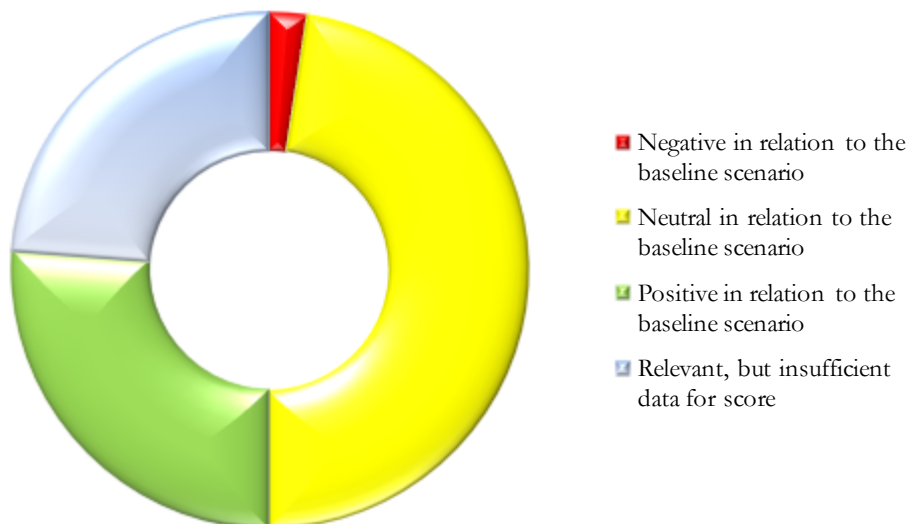


Figure 4.1 Doughnut diagram – a quick impression of knowledge gaps (grey) and positive sustainability performance (green)

We propose a second graph consisting of five bars to come to a further and deeper interpretation (Figure 4.2).

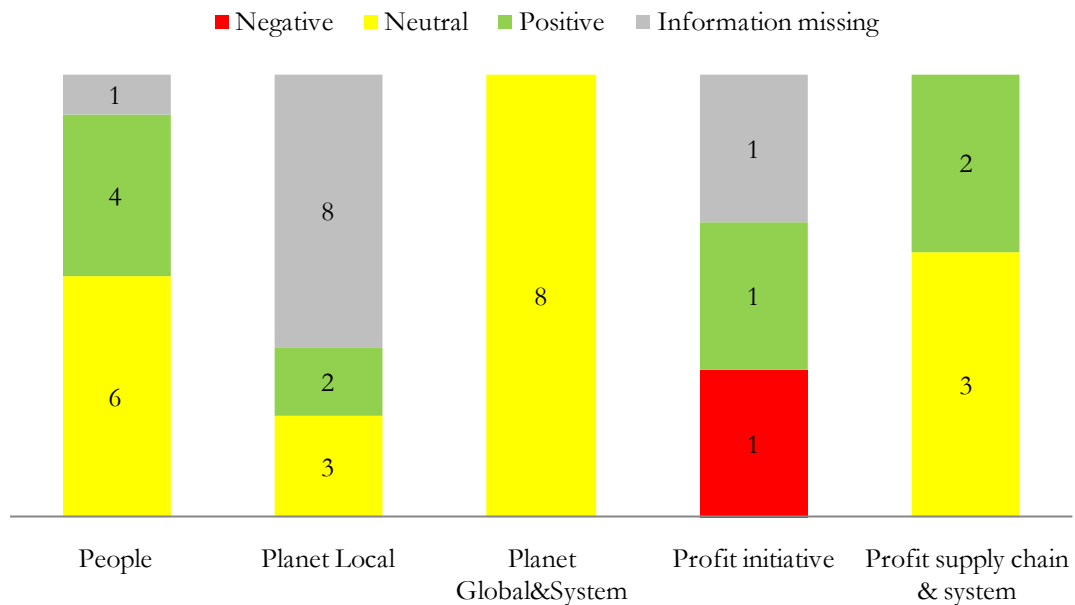


Figure 4.2 Example of a chart with five bars to give an impression of problems and challenges

There is no precedent yet for interpreting the results of the sustainability performance of innovative projects as we have done in this study. Avoiding ‘red’ scores as much as possible might be wise and advisable. A red score can refer to many different situations, three of which are of special importance. Some red scores refer to challenges that have to be met to further develop the sustainability initiative.

Situation 1: Red (negative) for economic indicators of the initiative (column 4)

If an initiative has a negative score for company financial results or value creation, it is highly doubtful that it can be successfully implemented. It is then of vital importance to compile a better business case which ensures profitability or clear added value. What is the unique selling point of the initiative? Much depends on successful market entry, which depends not only on the quality of the concept but also on the quality (creativity) and quantity of marketing and sales efforts.

Situation 2: Red for global planet indicators (column 3)

A negative score for global planet indicators may be an unwanted or unforeseen result of improving specific sustainability aspects on a local scale, like animal welfare aspects, local biodiversity or landscape quality. Solving this contradiction is a major challenge for the initiative. It is reasonable to expect that the consumption needs of a growing world population will make global environmental issues steadily more urgent over the years. In other words, fulfilling local ‘sustainability needs’ will have to be evaluated against the growing global issues of degradation of ecosystems, agricultural land quality and resources. Animal welfare and organic production might then easily be considered as luxury attributes or characterized as unaffordable ‘sustainability’ values.

Resolving these dilemmas presents a major challenge to the initiative, especially in the longer term. Society is not yet fully aware of the trade-off dilemmas between aspects of sustainability. However, in recent years awareness has grown among NGOs. A striking example is the meat consumer guide by Dutch NGO *Varkens in Nood* (Pigs in Need) which gives information on both animal welfare and the environment. This guide makes clear to consumers that in many cases they have to choose between animal welfare or the environment. So, promoting the consumption of meat produced in animal-friendly production systems

must logically be accompanied by the advice to eat less to save the planet. Many initiatives for local sustainability improvements do not anticipate this challenge yet.

Situation 3: Red for system effects (column 3)

Despite the fact that we are not able to understand all system effects yet, we may conclude that a red score for a system effect must be seen as an undesirable result which needs to be understood better, or demands a rethink of the basic characteristics of the initiative. The most clearly quantified system effects are increasing environmental impacts per euro expenditure. This means that adverse effects on a higher scale (overall consumption) can be expected, which will probably offset the intended positive effects of the initiative.

Nevertheless, situations are conceivable in which a rise in environmental impact per euro (or other money unit) might be desirable, for example where people are malnourished because of the unavailability of cheap food of good quality. However, for the entire system of the growing world economy and of all people living above a certain prosperity threshold, these effects are not desirable.

Situation 4: Small green area in people and planet aspects (columns 1, 2 and 3)

If the green area in the doughnut is relatively small, one may question whether the initiative contributes to sustainability. It might be profitable, it might be communicable, but in the end it may make a negligible contribution to making the world more sustainable. However, much depends on the relative weight of the green area. As we think that having red on planet and system effects is highly undesirable, scoring green on those aspects is important. This is certainly true for scoring green on those aspects which are crucial for the 'license to produce' or the 'license to operate'. Reducing and managing issues that are only locally important may be crucial in gaining local acceptance when local stakeholders are able to question the legitimacy of the operation or convince the licensing authority to withhold permission. A well thought out initiative will be aware of these sensitive sustainability issues.

Further considerations on determining the main impacts (possibility of weighting)

By qualifying a red score on plant or system impacts as a most undesirable result, which must be resolved for the initiative to become more sustainable, we have implicitly introduced a qualitative weighting of the different sustainability scores. This position is in line with recent policy documents (Ministerie LNV 2008a; Planbureau voor de Leefomgeving 2009a,b) on the sustainability needs and challenges of the Netherlands and its agricultural production and consumption. Thresholds in the global ecosystem need to be respected to safeguard the world's natural resources for future generations. Within these constraints, the global community needs to evolve to a higher standard of wellbeing. This standard is not defined, because there is no ultimate goal. However, there is consensus on several aspects we want to improve considerably, like malnutrition, infectious disease mortality, child mortality, etc.

Respecting the world's ecosystem boundaries and global community development already present major challenges, such as how to supply the world's population with enough food, fuel and materials in a sustainable way. The urgency of this challenge is of a different order to solving the more local, ethical issues for the community and nature. In the further development of the methodology, the prioritization of sustainability issues can be elaborated in more detail.

5 Discussion and recommendations

In this report we have defined a methodological framework for assessing the sustainability performance of agro-food chain initiatives involving innovations in the (mainly Dutch) agro-production system for more sustainable production and consumption in the broadest sense. We saw the need for such a methodology after surveying existing methods. There was no existing method available for the entire field of sustainability that also give operational indicators for measuring sustainability. Methods can be found that are feasible for measuring progress and or performance in some areas of sustainability, but all these methods have a limited scope.

The LCA methodology is an important source of inspiration, but has some major drawbacks with regard to assessing local impacts on ecosystems and the community. In our opinion it is more fruitful to quantify and assess local impacts using a method best suited to the local situation, with its specific economic, ecological and social background. Some impacts, such as depletion of minerals and fossil raw materials and emissions of greenhouse gases, affect the sustainability of the global system and must be quantified over the total production chain. These impacts can best be calculated using the LCA methodology. They are calculated per unit product and can therefore be compared to alternative products that might be replaced by bringing new production activities into operation.

The global social and economic implications of a new initiative often cannot be defined. Starting from the perspective of the local actor, however, gives an understanding of the actual consequences for people. New methods have become available that try to present an overview of the consequences for a total production chain. Examples are the social LCA and the poverty footprint. An important advantage of these methods is that they give information on the total number of people involved in a production chain and where they are located, which is useful when evaluating the efficiency of improving social standards, for example. From a sustainability value-for-money perspective it might be much more efficient to improve the labour conditions or wages of the farmers (owners and employees) in developing countries rather than realizing higher standards in the parent company in a developed country. Since the TransForum projects rarely made improving social conditions a priority, we did not really miss the accounting element regarding the people involved in a production chain. We recommend involving social life cycle accounting in the further development of the methodology, especially for the purpose of evaluating socially orientated innovations in production chains.

We have introduced the concept of system effects. This category of higher order effects is essential for assessing innovations and may be of much larger magnitude than the first-order effects. How these second-order effects should be understood needs further investigation. In our method we have only been able to make a first attempt at estimating the system effects of new products relating to changes in the behaviour of consumers arising from the initiative, but we are able to quantify the differences in environmental impact per consumer expenditure. This is important information because ultimately the global environmental impact per euro spent has to decrease drastically. A joint creation of added value and reduction of environmental pressure is therefore an important characteristic of a sustainable innovation.

It must be emphasized that the assessment does not include the question of whether the initiative provides the most sustainable way to deliver a certain functionality (Is meat the most suitable solution for high grade protein consumption? Is the introduction of biofuels sensible?). The method can be applied to these questions by adding baseline scenarios. Besides the business-as-usual baseline scenario, other scenarios can be added, such as minimizing environmental impact or maximizing sustainability

performance. This allows the initiative to be evaluated within a broader context of possible innovative scenarios.

We hope this report sets out an inspiring framework for the further development of a methodology for measuring the sustainability performance of innovations. Because a huge number of disciplines are needed for such assessments it is important to define a development path in which scientists from various disciplines as well as NGOs and businesses are involved. A possible starting point could be a workshop to introduce the method to the different sustainability experts, review the assumptions and framework, and invite these experts to participate in the further development of the method.

We believe this method is most valuable when used in the several stages of defining and implementing innovative sustainability initiatives. Further development of the method must therefore also address the question of how to embed sustainability performance assessment into innovation processes. This is relevant for several stakeholders. Businesses can be more effective in defining sustainability innovations and making them operational. Governments can be more effective in defining and supporting of desirable innovation directions. NGOs can use the enhanced transparency to play their role more effectively.

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