Evaluation of sustainability performance of Transforum projects -Koelanderij-

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June 2010

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giving shape to sustainability

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Contents

1. Introduction

1.1 Sustainability mapping approach

This document evaluates the sustainability performance of the Transforum project "Koelanderij" according to the approach that is described by Blonk et al. (2010).

A full description of the approach that is used to evaluate the sustainability performance of Transforum projects can be found in the methodology report by Blonk et al. (2010). A short introduction to the applied methodology is described in chapter 2.

Paragraph 1.2 gives a short description of the Transforum project Koelanderij. Chapter 3 describes which baseline scenario is used to determine the sustainability performance of Koelanderij. Chapter 4 evaluates the total sustainability performance of Koelanderij and in paragraphs 4.1 to 4.5 describes in detail all considerations of each sustainability indicator. Chapter 5 closes with discussion and conclusions.

1.2 The project: Koelanderij

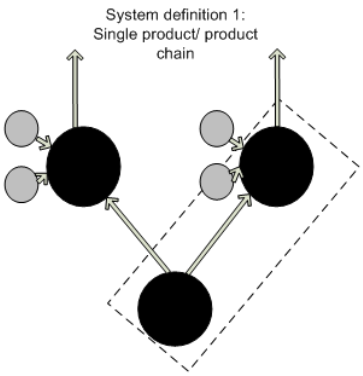
Up to date information about the project is obtained from scientists at the Wageningen UR who are involved with the development of the project (Galama and Beldman, 2010).
The initiators of Koelanderij are developing a plan to realize a large-scale dairy farm into the authentic landscape and with involvement of the community. Currently the plan is conceptual and different scenario's are still open for thought. The farm will be developed during a time period of about 10 years. The first part of the farm should become operational by 2013.

The main goal of the initiators is to develop a large regional land-related dairy farm. The roughage will be produced on arable land and grassland in the region owned by several arable and dairy farmers. The cows will be kept in barns with free range and where the manure is composted. The composted animal manure of the farm will annually be applied to regional arable land. The farm itself does not produce feed, all the feed will be bought from arable and dairy farmers. The feed, both roughage and compound feed, will be collected at and distributed from a central place, the Feed Centre.
At the first stage the dairy farm will have one unit of about 250 cows, held in free-range barns containing herds of 50-60 cows. Step-by-step, units of 250 cows will be added to the farm in the next 5 to 10 years. Each unit will have it's own manager. Employees will be specialized in keeping cows in different stages (calves, heifers, lactating cows and dry cows).
There will be no outdoor-grazing of the animals. The animals are fed with silage and compound feed the whole year and will not be fed with freshly mown grass.
The farm will be developed in a park of about 20 hectares. This land is currently owned by the initiators. The park will also be used for landscape and recreation targets. Additionally, there are plans to graze cows in a natural park around Schoonebeekerdiep. These plans are rather preliminary and not included in this evaluation.
There will be no beef cattle at the farm. Calves will be bred at the farm as much as possible.
The initiators want to compost 100% of the cattle manure in the barns, the floor of the barn consists of compost filled up continually with manure as cattle living/staying on it. The composted manure is removed once a year. The decomposition process will be stimulated by aeration of the manure. It is not decided yet whether how the compost will be aerated. There are 2 ways: 1) permanently by blowing air into the compost , and 2)once or twice a day by rotation of the top-layer of the compost. In this evaluation, it is assumed that the top-layer will be rotated twice a day (arbitrary choice).
Probably the roofs of the barns will be covered partially with solar panels to produce electricity.

Arable farmers in the region will also be involved with the project with producing all the needed roughage. . Storage of feed will not be done on the farm's court yard, because of landscape issues, but will be done on a nearby business terrain (a Feed Centre). Every day, there will be transport of silage and compound feed to the farm.

The first sustainability ambitions
In 2013 the limitations on milk (milk quota) production will be lifted. The initiators suggest that relatively small-scale milk production will develop into large-scale milk production. . In general the development of large scale animal husbandry in The Netherlands recently meets opposition by the community. The initiators of Koelanderij want to avoid this by involving the community with the initiative by communication and offering services as a recreation park and labour. The initiators are also considering the possibility to give the community responsibility in developing the park landscape. So large-scale milk production must incorporate innovations on animal welfare and interact with the community in different kinds of ways in order to make it possible to develop economic sound dairy farms.

1.3 System definition: Single product/ product chain



In the projects that are being evaluated through this system definition there is an initiator that has developed a product that is innovative. In the case of Koelanderij, the innovative product is a new type of dairy farm. The product is claimed to be more sustainable in operation than comparable products. The initiator, designer and user(s) of the product are part of the initiative (black). The initiative has suppliers (grey) that support the use of the product, but they are not part of the initiative. In case of Koelanderij, suppliers are for instance the producers of animal feeds. The feed-centre is part of the supply chain too.

2. Methodology

This chapter gives a brief overview of the methodology used to evaluate the sustainability performance of initiatives. More information about this methodology can be found in Blonk et al. (2010).

2.1 Evaluating initiatives on sustainable performance

Sustainability is a very broad concept dealing with ecological, social and economic consequences of our actions. Absolute sustainability doesn't exist or at least very hard to define. A more workable concept is sustainable development which implies that we are able to define more sustainable directions and thus be 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 a an ongoing process of finding balance between these aspects.

It is often not easy to evaluate the performance at a glance because the implications of an initiative do often not result in an improvement on all different sustainability aspects. Moreover there are many effects and actors involved on different locations and with different timeframes.

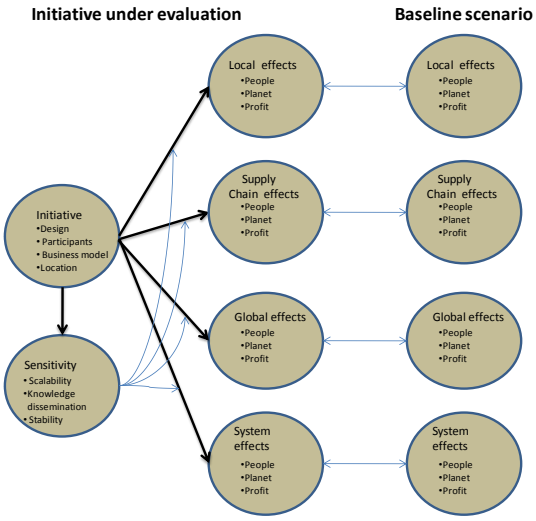


Figure 2.1. Outline of applied evaluation methodology

For evaluating the TransForum initiatives a specific evaluation methodology needed to be developed because existing methods do not cover the total spectrum of effects related to a new initiative. Each initiative generates people, planet and profit effects for different actors and different scales These effects are divided in this methodology in local effects at the initiative, local effects in the supply chain, global effects, and system effects. The ultimate impact of an initiative is also the result of the resilience of the deigns, the potential for upscaling and the knowledge spreading mechanisms involved. Scoring the sustainability performance is only possible in relation to a baseline scenario (figure 2.1).

Our method for measuring sustainable development performance of initiatives is based on a combination of three existing approaches of :

- Lifecycle assessment (Guinee, 2002)(ISO14040, 2006)(ISO 14044, 2006) (ILCD 2010) (SLCA guide 2009)
- Environmental Impact Assessment *(a.o. EU directive 85/337/EEC amended in 1997)*
- Supply chain and company Reporting of Sustainability (Global Reporting Initiative)(ISO 14064, 2006) (Poverty footprint of Oxfam Novib draft 2010)

LCA methodology gives the framework for making a sound evaluation of environmental and (partly) societal impacts over a production chain of products and gives directions how to evaluate the consequences of changes or improvements in lifecycles. EIA methodology is primarily involved with local effects and provides different working methods for evaluating a combination of qualitative and

quantitative information. Furthermore a sound definition of the baseline and alternative scenario's is one of the most important aspects of EIA. A third approach can be qualified as reporting sustainable performance of companies and their supply chain. The Global Reporting Initiative and the poverty footprint methodology of Oxfam Novib set the framework. All these basic methodologies are under continuous development which means that our sustainability mapping methodology is also

The evaluation is preferable carried out in a iterative and interactive way, using a sequence of five steps per round:

1. Define the initiative.
2. Define the baseline scenario.
3. Score local, supply chain, global and system effects.
4. Visualize the scores within the sustainability map *(for an example see figure 4.1)*.
5. Evaluate the results of the evaluation with the main stakeholders.

These steps are explained in the next paragraphs.

2.2 Defining the initiative

Before an initiative can be evaluated on sustainability a clear understanding of the initiative is needed. Which parties are involved? What are the boundaries of the initiative? What are the sustainability propositions (aims)? What's the location of the initiative? Some initiatives must be defined further to come to a business case that can be evaluated. This can be the case when an initiative is still in a preliminary stage of design.

2.3 Defining the baseline scenario

To evaluate the sustainability of an initiative it is necessary to define a baseline scenario. The baseline scenario differs for each initiative and is based on the business as usual for the initiative and the participants. Leading question is what would have been the situation, in a couple of years, if the initiative does not take place?

There are several types of developments relevant for defining the baseline scenario:

- What would the entrepreneurs do if the initiative does not take place?
- What would happen at the location if the initiative does not take place?
- What happens to other locations because of the initiative?
- How would the (environmental) performance of the product autonomous develop if the initiative does not take place?

Which developments are important to include and to what extent depends on the initiative. Sometimes the local aspects are very important and sometimes it is a minor issue.

2.4 Definition of effect categories

This paragraph briefly describes the different sustainability aspects (3P's) with the corresponding sustainability indicators of local, supply chain, global and system effects. A description of all sustainability indicators, and how these indicators are scored, can be found in Blonk et al. (2010).

2.4.1 Local effects of the initiative

Local effects are divided into scales: The first scale is the initiative. The second scale is a regional scale, referring to the surroundings of the initiative. Sometimes a third scale is involved, for instance a national scale when specific themes are interrelated with national governance. Regional and national scales are

relative terms and depends on the type and extension of each specific initiative. These scales have to be defined for each individual initiative.

Initiative
A part of the effects of the initiative are located within the physical borders of the initiative. On the initiative scale there are people, planet and profit effects defined:

- People effects for employees, entrepreneurs and animals (e.g. work conditions and animal welfare).
- Planet effects at the initiative site (e.g. landscape, physical environmental quality and biodiversity)
- Profit effects of the initiative (e.g. balance, investment costs and value creation).

Regional
An initiative also influences the direct surroundings and can have people, planet and profit effects on a regional scale. It can affect residents, companies or employees nearby the initiative. People effects are for example changes in opportunities for recreation and community involvement towards the initiative. Planet effects are related to physical or chemical emissions to the surroundings and changes in landscape and biodiversity. Profit effects on a regional scale are considered as a positive contribution to the community.

National (when appropriate)
For some of the local effects it is necessary to take the national perspective into account. On national scale planet effects are important because they have a strong national dimension based on regulations (e.g. regulations on eutrophication). People and profit effects are not evaluated on a national scale because of difficulties in making these effects operational unambiguously.

2.4.2 Local supply chain effects

Besides local effects at the site of the initiative an initiative can also have comparable local effects at the supplying companies. This can be initiated by selective sourcing, setting sustainability criteria for suppliers, developing sustainability improvements with suppliers, etc. The same thematic framework is used as a starting point for evaluating local effects in the supply chain.

In some cases local effects of downstream business (customers) need to be included in the evaluation, for instance in case of forwarded chain integrations.

2.4.3 Global effects of the product(s) of the initiative

A specific category of effects are those effects not depending on the location of operation and/or emissions. These effects include some specific planet effects and major environmental themes like global warming and land use.

The global effects which are scored are:

- Land use. This indicator is related to land conversion, loss of biodiversity, increasing greenhouse gas emissions, increasing competition between agro functions such as food, bio-based materials and biofuels.
- Climate change.
- Depletion of fossil resources, such as use of fossil fuels and phosphate rock.

These global effects are determined on product level so upstream and downstream processes are also included in the calculations. It must be noted that changes in quality or quantity of land do also have an impact on social or economic viability. The effects on local changes in land quality are evaluated under local people effects of the initiative or the supply chain.

2.4.4 System effects

An initiative ultimately generates products or services that may have an impact on other systems related to the usage of the product. For instance the usage of LED lamps reduces costs of energy of the consumer while at the same time it will reduce the environmental impact per unit light and per unit money.

A change in environmental impact (planet effect) per expended unit money (eco-efficiency) is relevant from a sustainable consumption perspective. A consumer can only use its money once and it is assumed that a lower impact per euro is better. A change in the amount of money expended per function is relevant for determining rebound effects related to the change in costs and behavioural adaptations. System effects of products related to health and improving knowledge of agricultural and/or sustainable production are also scored.

2.4.5 Potential of the initiative

The potential of an initiative refers to the scalability, stability and spreading of knowledge of an initiative. A first question to be answered is whether it is possible for an initiative to be copied at other locations and by other entrepreneurs or is it a one time operation or a specific niche market? The main question to be answered for evaluating "*Spreading of knowledge*" is whether the initiative aims to spread knowledge and/or includes mechanisms to do so?

2.4.6 Critical success factors

Finally, the evaluation gives information on specific parameters in the design or the surroundings of the initiative which are determinant for the realization and up scaling potential. These critical success factors give the actor(s) involved with the initiative essential information on risks and opportunities and can be used for strengthening the design or defining the conditions for (further) investments and making the initiative operational.

2.5 Visualizing the effect scores: "mapping of sustainability performance"

To make interpretation of the results easier we developed two visualizations.

1. A dashboard where the effects are categorized along the following qualification:
   - positive in relation to the baseline scenario
   - neutral in relation to the baseline scenario
   - negative in relation to the baseline scenario
   - not relevant for this initiative
   - relevant, but lack of data

2. A circle diagram which shows the relative amount of scoring positive, neutral, negative or relevant but lack of data.

3. Description of the baseline scenario

The question in defining a baseline for Koelanderij is what would happen to the farm of the initiators after the milk quota will have been ended in 2013.

According to LEI (2006), the Dutch milk production is likely to increase by 20%. Discussions in meetings with farmers concluded that small growth will continue after 2013 and the trend of developing to large-scale dairy farms will continue. Some dairy farmers will make a leap towards large scale production. It is noteworthy that milk quota are not the only restriction when it comes to growth possibilities. Other restrictions are availability of labour, land and funds(Van Well and Rougoor, 2008) and legislation.

Because the trend is that dairy farms will become larger and larger, an autonomous developing large scale dairy farm has been chosen as a baseline to compare with the Koelanderij. It is assumed that the regular farm will become more intensive, maybe by more cows per hectare and by buying more compound feed.

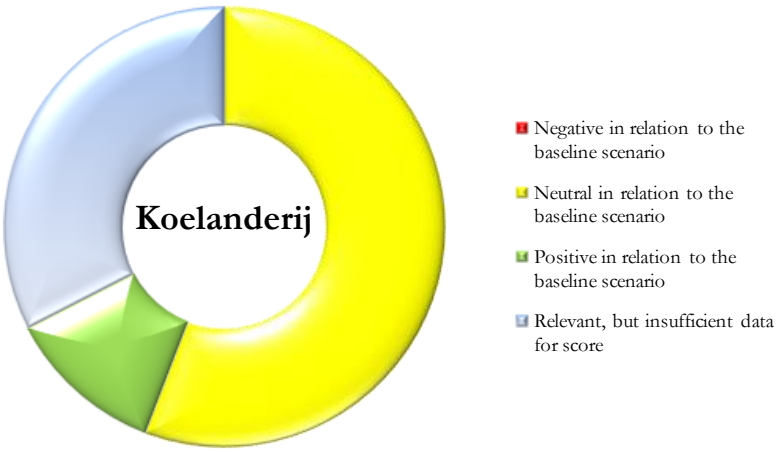
4. Sustainability of Koelanderij

In this chapter the sustainability of Koelanderij is evaluated through a top-down design. In paragraph 4.1 an overall figure, the sustainability map, is shown which is assembled out of a more comprehensive table, the sustainability table, from paragraph 4.2. This sustainability table contains 50 scored sustainability indicators and the critical success factors. The arguing of the scored sustainability indicators is described in paragraphs 4.3 till 4.7. The critical success factors are described in paragraph 4.8.

The Koelanderij-plan is still under discussion, so the sustainability table is a provisional one.

4.1 Sustainability map

Figure 4.1 shows the sustainability map and figure 4.2 shows the sustainability profile of Koelanderij compared to the baseline scenario as described in chapter 3. A comprehensive description of all scored sustainability indicators can be found in the following paragraph of this chapter.



Critical succes factors
- Balance between cost price reduction, extra investments and value creation
- Meeting needs and expectations of the society

Figure 4.1. Sustainability map of Koelanderij.

Figure 4.1 is assembled out of the relevant sustainability indicators from Table 4.1. A weighting of importance of each indicator has not been applied.

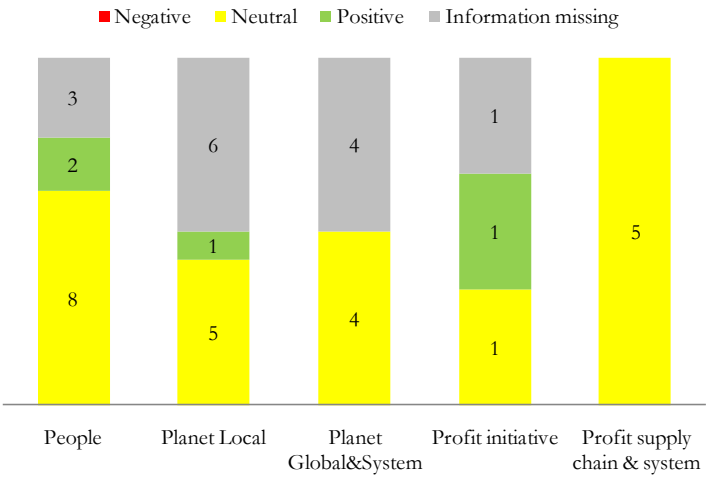


Figure 4.2. Sustainability profile of Koelanderij.

Figure 4.2 is assembled out of the relevant sustainability indicators from table 4.1. A weighting of importance of each indicator has not been applied.

A red score can refer to many different situations of which three are of special importance:

- Red (negative) for economic indicators of the initiative (column 4)
- Red for global planet indicators (column 3)
- Red for system effects (column 3)

If the green scored area in the donut is relatively low, one may wonder if the initiative must be qualified as a sustainability initiative. It depends, however, greatly on what the relative weight of the green area is. A well thought initiative is aware of these hot spots of sensitive sustainability issues. The relative contribution of the "grey area" (relevant, but not enough information) gives information about the extent of issues that could not be evaluated. In this area there may be possible threats as well as opportunities. (For further explanation see Blonk et al. 2010).

4.2 Sustainability table

A detailed explanation about this format and why these sustainability indicators were chosen can be found in the methodology report (Blonk et al., 2010). In the following paragraphs the scores of the sustainability indicators are argued.

Table 4.1 Sustainability table of Koelanderij.

1 .Local impacts of the production system

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

Legend

Legend
Positive in relation to the baseline scenario (Green)
Neutral in relation to the baseline scenario (Yellow)
Negative in relation to the baseline scenario (Red)
Not relevant to the initiative (White)
Relevant, but **insufficient data** to score (Grey)

2. Global (non local) impacts of the product per functional unit

	Indicator	Initiative
Planet	2.01 Land use	Yellow
	2.02 Greenhouse gas effect	Grey
	2.03 Depletion: fossil energy use	Grey
	2.04 Depletion: phosphate rock	Yellow

3. Functional (system) effects related to product consumption and use

	Indicator	Initiative
People	3.01 Health	Yellow
	3.02 Other welfare aspects (individual)	Yellow
	3.03 Welfare and involvement community	Green
Planet	3.04 Land use	Yellow
	3.05 Greenhouse gas effect	Grey
	3.06 Depletion: fossil energy use	Grey
	3.07 Depletion: phosphate rock	Yellow
Profit	3.08 Money budget	Yellow
	3.09 Time budget	Yellow
	3.10 Prosperity community	

4. Potential of initiative

Upscaling potential	Yellow
Knowledge dissemination	Green

5. Critical succes factors

1. Balance between cost price reduction, extra investments and value creation
2. Meeting needs and expectations of the society

4.3 Local impacts of production chain - initiative

This paragraph describes the local sustainability indicators 1.01 till 1.17 of the initiative which are scored in table 4.1. Sustainability indicators which were not relevant (blanc in table 4.1) are not addressed.

1.02 Labour conditions

It is assumed that the work is attractive for young, specialized employees. An automatic milking system will be taken into consideration. The employees of the farms only have to take care for cows at a certain stage (young, adult), not for any arable activities. Employees will have a maximum of 40 hours labour a week. At the baseline scenario, it is expected that the farmers will have to work more hours a week , but also with more variation during the day and during the year. Another aspect is that the Koelanderij is more focused to society which may be a positive aspect for employees involvement in their work It is not obvious whether the other labour conditions at the Koelanderij farm will be experienced positive or negative. Hence, the indicator is coloured grey, which impies that the indicator is relevant, but cannot be scored because of a lack of data.

1.03 Animal welfare and health

Cows are able to recognise 50-60 group members and a stable hierarchy can develop within this group size (Bos, 2009). Larger groups increase the risk for fights and stress in the herds. The stables of Koelanderij will contain 60 cows at maximum, taking into account the stability of hierarchy. In units of baseline farms, group size is not restricted to 50-60 cows.

The cows in Koelanderij will be able to free-range in the stables. On average, each cow has more space and the conditions stimulate their natural behaviour more in comparison with a traditional barn in the baseline farm. In a free range barn for each cow there is on average 20 m2 available whereas in a traditional cubicle barn this is about 5 m2

The initiators expect less foot problems, because the cows live on soft, dry compost. This is partly based on practice experiences by farmers using thuis system in the USA (Courage 2010) but this is also confirmed by Dutch research Ruis & Pinxterhuis 2007)If the compost is not dry enough however, the risk for mastitis can be relatively high.

The temperature of the compost can increase up to 40 degrees Celsius. It can be a disadvantage for animal welfare because cows feel comfortable at temperatures below 20 degrees of Celsius,. The cows will not lay down at the warm compost surface. The cows of Koelanderij do not graze outside, but possibly they will get access to an outdoor area next to the barns. In wintertime however, the warmth of the compost can be an advantage.

At Koelanderij there will be no pasturing (or outdoor-grazing). According to Van Well and Van der Schans (2008), about 80% of the Dutch dairy cattle grazes in pastures in 2006 and 2007. In 63% of the large Dutch farms - that have more than 110 cows - the dairy cattle pastures . Van Well and Van der Schans expect that in the near future (2016) 17-28% of the cattle will be kept inside permanently.

In general pasturing is positive for cow welfare because it satisfies essential needs as feeding, , exercise, space and a soft surface to lie on The Dutch branch organization for veterinarians (KNMvD) underlines the importance of pasturing for the animal welfare and health (Van Herten, 2007). Nevertheless requirements as a spacious resting spot, a soft surface and good feed can also be provided by a well designed barn. Only for grazing (pulling off and taking up grass in the mouth) pasturing is indispensible. But there is no scientific support that grazing is an essential need of cows (Bos e.a., 2009, Dixhoorn 2010)

At the Koelanderij the welfare in the barn is positive compared to traditional barns due to a large available space per cow and a soft and dry compost floor. The question however is in what degree the compost barn can be a comparable replacement for pasturing in meeting the requirements of a cow. On this moment there is not enough scientific insight to answer this question so this indicator is marked grey.

1.04 Human health (other than through emission)

Establishing a Feed Centre away from the farm will result in very much traffic every day from the Feed Centre to the farm. Trucks will drive through the rural area from the Feed Centre to the farm, possibly resulting in a higher pressure on small rural roads. We suppose that more traffic means a larger risk of road accidents. The roughage will be transported from the field to the Feed Centre at irregular times. It is not clear whether the roughage will be transported using trucks or tractors. It is likely that there will be more traffic in the region in comparison with the current situation but it is not obvious whether this is different from the baseline. Because also in the baseline it is expected that transport of feed will increase, although uncertain in what degree, with dairy farms increasing in scale. Currently many farmers in the region have their land on a relatively large distance from their farms. When these farms becomes bigger, it is inevitable that there will be more traffic.

The risk for zoonose is not expected to be different from the baseline. It is low for cows anyway.

In conclusion, the indicator marked grey, which implies that it is relevant and there is not enough knowledge yet to say whether Koelanderij scores positive or negative compared to the baseline.

In conclusion, the indicator marked grey, which implies that it is relevant and there is not enough knowledge yet to say whether Koelanderij scores positive or negative compared to the baseline.

1.05 Animal disease risk

The initiators expect less animal diseases, because the employees will be more specialized and the management will be better. In general, the hygiene will be better organised in a large scale farm, but this will not be different in Koelanderij compared to the baseline farm.

It is uncertain whether the use of a Feed Centre will increase the risk for animal diseases. Theoretically, this may be a place where diseases can be exchanged. But in practice, measurements will be taken to prevent the Feed Centre will become a source for all kinds of diseases.

The indicator is scored neutral.

1.06 Development

The initiators intend to invest in hiking paths in the park where the farms will be build and small scale recreation in the Schoonebeekerdiep will be developed, both in cooperation with the community. Although it is obvious that Koelanderij can sustain the economic stability of the region, it does not contribute to the development of the region. Hence, Koelanderij is scored neutral compared to the baseline.

1.07 Involvement

Koelanderij will establish a club 'Friends of the Koelanderij' in which the initiators will try to establish positive binding between inhabitants of the area and the rural area of the Koelanderij. The community will be involved in developing the park. The Koelanderij also wants to sell milk with the community spirit in mind. Inhabitants can come to the farm and get their own milk from a tap. Research on environmental psychology shows that knowledge of agricultural production does not simply lead to adjusted (more sustainable) consumption patterns (Hoogland, 2006). This means that making knowledge available to consumers does not contribute to consumers making better choices. A more active kind of involvement includes participating in sustainable agricultural production. By making consumers part of the production process they start to feel a certain responsibility for the production process. Making consumers part of the production process can be done by organising weeding days or helping days when hay needs to be harvested. Because Koelanderij does not have plans for active involvement at the development of the farm, the score is equal to the baseline.

1.08 Environmental quality

There is not much to say about the in company environmental quality, because only the barns have to be taken into consideration. This indicator is not relevant for the initiative.

1.09 Biodiversity

The farm will be build in a park of about twenty hectares, that currently are in use as arable land. Within a park, more biodiversity can develop. However the initiators do not have plans yet to develop activities on nature conservation. The indicator is marked grey because it is not known how biodiversity will be protected or stimulated by Koelanderij.

1.10 Landscape

The centralized storage and distribution of the feed in the Feed Centre makes silos on the farm unnecessary. The absence of the silos may be positively experienced by the community. However, if all the roughage is stored at one location, this will demand a huge silage storage, . The Feed Centre will have an industrial look.. It is unknown to what extent the decentralized storage of feed is experienced as a problem by the community.

The initiators want to fit the farm into the landscape in order to keep the landscape as authentic as possible. Also the Feed Centre will be fit into the landscape by using trees etc.

The Koelanderij does not provide grazing cows in meadows during spring and summer time, which can be seen as a disadvantage for the landscape. On the other hand the barns will be very open so year round the cows are visible in the barn from outside. For evaluating the impact of the above described change for the (experience of)landscape not enough information is available.

In conclusion, the indicator is marked grey because it is unknown what is more positive for the landscape: a centralized Feed Centre or cows grazing in meadows .

1.11 Emissions affecting ecosystems and human health

Research results into emissions of ammonia or odour from compost barns to the environment are yet not known. Research on ammonia and greenhouse gas emissions from compost barns started recently and results are not available yet Based on other figures the following can be stated: Kool *et al* (2008) assumed that 2.5% of the nitrogen of pig- and chicken manure will be emitted in ammonia when composting this manure. This percentage was derived from the emission factor used for large industrial compost plants by the National Inventory Report (protocol 6D www.broeikasgasemissies.nl). It is hard to say whether the emission from compost barns will be in the same order of magnitude. If so, than it is much less the emission from in conventional cubicle barns, which is 8%.(Blonk ea 2008)

Due to the fact that no representative figures are available yet the indicator is scored grey compared to the baseline farm.

1.01 1.13 Biodiversity and 1.14 Landscape

See 1.09 and 1.10: relevant, but insufficient data to score

1.15 Balance sheet

Although quantitative information is not available it is expected that the balance of the initiative will be positive.

1.16 Investment

The initial investment costs per cow are less at Koelanderij compared to the baseline farm, because Koelanderij does not buy arable land. The barns at Koelanderij may be more expensive, because the area per cow is larger so the barns must be relatively bigger than the common cubicle barns. Besides that no

separate manure storage is needed which saves investments. Koelanderij also needs to built the feed storage (Feed Centre) and probable needs to invest trucks that transport the feed to the farms. At Koelanderij there seems to bee much more variable costs such as for feed production and labour. The costs for roughage may vary every year, depending on the yield.Althought Koelanderij will try to avoid strong fluctuations in prices by contracting feed supply on long term basis.
Moreover, the costs for the composting process are significant. To initiate and sustain the process it is necessary to add pruning or sawdust to the top layer of the manure, maybe every day. At www.courage2025.nl it is explained that this can cost about 80 eurocent per cow per day. The compost must be rotated twice a day to stimulate the composting process, which costs money for labour and fuel.(or needs investments if automated)

Since quantitative information is lacking, the indicator is marked grey.

1.17 Value creation
There is no added value to the milk or cheese; the added value of Koelanderij is the park around the farm which will be accessible for public recreation. This does not result in more income. So the indicator is scored neutral compared to the baseline.

4.4 Local impacts of production chain - Supply chain

The needed roughage of Koelanderij will be bought from regional arable and dairy farmers, who take it to the Feed Centre. In the baseline, the dairy farmer himself will grow the roughage he needs for his farm as much as possible. It could be that he also has to buy part of the needed roughage. Compared to the baseline, the supply chain of Koelanderij is larger, more farmers are involved in it. It is questionable whether these farmers will grow the roughage in a different way than the dairy farmer does. A difference can be that the arable land of the Koelanderij suppliers is fertilized with composted animal manure, which could result in an increased soil organic matter content. It is assumed that also fertilizers will be used by the farmers in the Koelanderij supply chain. Moreover, there may be more composted manure than can be applied to the arable fields. The application is restricted to a maximum of 170 kg N per hectare per year. The surplus of composted manure can be applied to nearby arable land..

Storage of feeds will not be done on the farm"s courtyard, because of landscape issues, but will be done on a regional business terrain (the Feed Centre).
Another part of the supply chain concerns the compound feed. Because all roughage is bought Koelanderij may be more flexible in choosing which roughage is used in the ration. Instead of grass lucerne can be fed or imported components of the compound feed may be replaced by crops grown in the region. This affects the composition of the compound feed and the impact on sustainability. Because at this stage the initiative is not concrete filled in for this particular aspect we assume the compound feed comparable to the baseline. . Maybe, Koelanderij can buy the compound feed for a lower price, because of the huge amount of compound feed they need, but this is not obvious yet.

1.02 Labour conditions
No differences are expected between the supply chains of Koelanderij and the baseline farm. The indicator is scored neutral.

1.04 Human health (other than emissions)
Establishing a Feed Centre at a different location than on the farm will result in transport from storage to the farms. This means that daily large trucks will drive through the rural area from the Feed Centre to the dairy farms, possibly resulting in higher pressure on small rural roads and leading to more accidents.

Every day, several transports will occur. On the other hand, there will be less tractor traffic from the arable farms to the dairy farms. It is hard to say whether there will be more or less traffic and risks for accidents compared to the baseline. Other human health effects are not expected. Therefore the indicator is scored neutral.

1.06 Development

The Koelanderij creates chances for regional arable farmers to keep their farm economically sound. They can sell the main part of their crops to Koelanderij. If they wish so, they can fine-tune their production plan to the Koelanderij farm. This however can lead to a dependence of the arable farmers to Koelanderij, what can be a disadvantage. The Koelanderij creates employment in the region and a economic structure. It is uncertain what will happen to the arable farmers without Koelanderij at this location. Maybe, they go bankrupt, or they sell their land to a large-scale dairy farm.
Koelanderij seems to preserve the economy of the community, and could result into more employment. The park may be attractive for tourists.
In conclusion , the indicator is scored positive.

1.07 Involvement

The community will mainly be involved in the development of the natural park, and not with the supply chain. So the score of this indicator is neutral, because the involvement also lacks in the baseline

1.08 Environmental quality

It is assumed that the regional arable farmers will apply the composted animal manure to their land. The barns will be emptied once a year. Application of compost results into an increase of the soil organic matter content (SOM). This SOM increase is considered as an increase of the environmental quality, because a high SOM is better for soil fertility and the soil water holding capacity. It can not be excluded that there will be no liquid manure supply.

As far as can be considered, this indicator can be scored positive for the Koelanderij supply chains.

1.09 Biodiversity

It is expected that the arable farmers develop more variation in the production plan. Whether or not this affects the biodiversity is not obvious. The indicator is scored neutral.

1.10 Landscape

There is a need for about 600 hectares arable land to produce the roughage needed for 1000 dairy cows. But this is not different from the baseline farm, hence the indicator is scored neutral.

1.11 Emissions national (affecting ecosystems and human health)

No differences are expected between the supply chains of Koelanderij and the baseline farm. The indicator is scored neutral..

1.12 Environmental quality

The composted manure will be applied above ground and not using emission reducing techniques (like injection slurry manure into the soil). Assuming compost contains less nitrogen than manure, application of compost leads to less emission of ammonia. Kool *et al* (2009) estimated a reduction of about 40%. In the case of Koelanderij it is not obvious what the composition of compost, in particular N content , will be. Besides that no data are available about ammonia emission from composted manure. Because of that uncertainty this indicator is scored grey

Opmerking [KCC1]: Dat is inderdaad de vraag misschien moeten we dit grijs scoren

1.13 Biodiversity and 1.14 Landscape, 1.15 Balance sheet, 1.16 Investment and 1.17 Value creation
No differences are expected between the supply chains of Koelanderij and the baseline farm .The indicators are scored neutral..

4.5 Global Effects

This paragraph describes the global sustainability indicators 2.01 till 2.04 which are scored in table 4.1.
The global environmental themes (greenhouse gasses, land use and fossil energy) are considered from feed production until retail.

2.01 Land use
Land use on global scale is mainly determined by the use of compound feed.. A changes in feed use is not expected at Koelanderij compared to the baseline, hence the indicator is scored neutral.

2.02 Greenhouse gas effect
The feed for the animals is assumed not to be different, although at the baseline the cows may be fed with more compound feed, which may decrease CH_4 emissions by ruminal fermentation.
The animal manure at Koelanderij will be composted. The manure will be aerated to prevent anaerobic conditions. Composting under anaerobic conditions results in large amounts of N_2O. Reports about greenhouse gas emissions from in compost barns are not available, if existing. It is sure, that methane and laughing gas can and will be produced in the composting process. Protocol 6D (www.broeikasgasemissies.nl) claims that 2.4 kg CH_4 and 0.096 kg N_2O will be produced when composting 1000 kg biodegradable waste. Storage of slurry manure causes emissions of 1.8 kg CH_4 and 0.008 kg N_2O, which is much less. The IPCC 2006 reports 10 fold higher emissions of laughing gas from solid manure in comparison with slurry manure. It seems reasonable to assume a larger emission of greenhouse gas from Koelanderij compared to the baseline farm.
The composted manure will be applied on the soil surface, not below. Above soil application of solid manure leads to a 50% decrease of N_2O emissions compared to subsurface application of slurry manure. This can decrease the greenhouse gas emission of an average farm with about 10%. It is not obvious whether this decrease can be extrapolated to the application of composted manure.
In conclusion, there is not sufficient information about the emissions from Koelanderij. There are only estimates, indicating that the greenhouse gas emissions from Koelanderij farms are larger than at baseline farms. Nevertheless, the indicator is marked grey, which implies that the indicator is relevant and sufficient information is not available.

2.03 Depletion: fossil energy use
There is no information available on energy use. Maybe the roofs of the barns will be covered partially with solar panels, which would reduce the use of electricity from the electricity network.
The compost needs to be aerated. This can be done by rotation of the top layer twice a day, or by continuous aeration. Both activities needs energy.
The climate control in a compost barn may be different from common cubicle barn. It is not known whether more or less energy will be used.
Moreover, there is a lot of transport of the feed. First from the arable land to the Feed Centre and second from the Feed Centre to the farms. It is not clear yet how many times trucks will travel every day from the Feed Centre to the farms and how much fossil energy will be used for the transport.

Quantitative information about (fossil) energy use is not available, so the indicator is marked grey, which implies that the indicator is relevant and sufficient information is not available.

2.04 Depletion: phosphate rock

The efficiency of phosphate used in dairy farming is mainly affected by feed intake and manure management. Concerning feed intake not enough information is available for Koelanderij. Concerning phosphate efficiency in animal manure no difference is expected between Koelanderij and the baseline. The indicator is scored neutral.

4.6 System effects

This paragraph describes the sustainability indicators (the system effects) 3.04 till 3.07 which are scored in table 4.1. Sustainability indicators which are not relevant (blanc in table 4.1)are not addressed. When the global environmental effects, which are calculated in paragraph 4.5.1 are expressed in consumer money results can change.

The costs for the milk production at Koelanderij are unknown, but it is assumed that the milk from Koelanderij will be sold for about the same price as the baseline milk.

3.01 Health

Koelanderij cows are not fed with fresh grass, which can result in milk containing less CLA (conjugated linoleic acid) compared to milk from cows from the baseline farm. However, it is possible to adapt the composition of compound feed in order to produce milk of the same quality. Hence, no differences for this indicator are expected between the Koelanderij and the baseline farm and the indicator is scored neutral.

3.02 Other welfare aspects (individual)

No differences are expected between the Koelanderij and the baseline farm. The indicator is scored neutral.

3.03 Welfare community

It is expected that Koelanderij creates employment in the region and sustains the development of the regional economic structure. The welfare of the community is positively affected by Koelanderij.

3.04 Land use

The land use per kg milk from Koelanderij does not differ from the land use for a kg milk form a baseline farm. Hence, the indicator is scored neutral.

3.05 Greenhouse gas effect

In 4.5.1, it was concluded that sufficient information was not available to be sure about the global indicator greenhouse gas effect. Therefore, also the system indicator greenhouse gas effect is marked grey.

3.06 Depletion: fossil energy use

In 4.5, it was concluded that sufficient information was not available to be sure about the global indicator depletion: fossil energy use. Therefore, also the system indicator depletion: fossil energy use is marked grey.

3.07 Depletion: phosphate rock

The efficiency of phosphate used in dairy farming is mainly affected by feed intake and manure management. Concerning feed intake not enough information is available for Koelanderij. Concerning

phosphate efficiency in animal manure no difference is expected between Koelanderij and the baseline. The indicator is scored neutral.

3.08 Money budget
It is assumed that the products from Koelanderij will be sold for the same price as the baseline milk. Hence, the indicator is scored neutral.

3.09 Time budget
There will be no difference in the time consumers need to buy products from Koelanderij, because the main part of the milk will be sold in supermarkets. So, this indicator is scored neutral too.

4.7 Potential

Upscaling potential
If this plan can be performed successfully in Drenthe, it can also be performed in other agricultural regions in the Netherlands or elsewhere in Europe. However, the expansion can not continue unlimited. If too much milk will be produced, the milk looses his value and cannot be sold above the cost price. Hence, upscaling (meaning the initiating of initiatives comparable to Koelanderij) is possible but limited.

Knowledge dissemination
The Koelanderij is a new concept of dairy farming in the Netherlands. Wageningen University and Research Centre is involved in developing the concept.

4.8 Critical success factors

Does milk produced by Koelanderij have an enhanced value which will result in a higher milk price, or does the upgrade to large scale milk production provide the survival factor due to cost reduction? There seems to be a tension between the two. Cost reduction due to upgrading to large scale milk production could be the main factor why Koelanderij will economically be successful, while the social and environmental efforts provide acceptation by the community. If the social and environmental efforts enhance the economical value of the milk the initiative might be more successful. It is very important that the community accepts the development of large scale dairy farms.
The critical succes factors for this initiative are:

- The balance between cost price reduction, extra investments needed to comply a higher level of sustainability (for instance the compost barn) and the possible economic value creation resulting from this level of sustainability.
- To what extend can Koelanderij meet the expactations and needs of the society concerning sustainable dairy farming?

5. Discussion and conclusions

To interpret the conclusions on the sustainability performance of Koelanderij in this study the following has to be taken into account. This study evaluates the sustainability performance of the initiative Koelanderij divided in four effects (local, global, supply chain, system), based on the methodology that is described in Blonk et al. (2010). Within this differentiation different sustainability indicators, which are ordered in the three categories people planet and profit, are evaluated. The total evaluation of the sustainability performance depends on each sustainability indicator and the importance (relative weight) of each indicator. A weighting of importance of each indicator has not been applied in this study.

The results of this study are based on the intentions and plans of Koelanderij. If the implementation deviates from those intentions, this could have consequences for the sustainability performance evaluation. This can have either positive or negative effects on the final evaluation. If such deviations from the original plan and intentions occur, this needs to be evaluated before conclusions can be drawn about sustainability.

Strengths

- Koelanderij offers a guaranteed market for roughages produced by arable and or dairy farmers in the region.
- Application of composted manure from Koelanderij on arable land increases soil quality.
- The compost barn meets more the requirements of a cow (concerning animal welfare) than a traditional dairy barn

Weaknesses

- No weaknesses are determined

Opportunities

- The 20 ha park offers the possibility the develop biodiversity, landscape and nature.
- Estimates indicates that ammonia emissions from Koelanderij may be lower compared to the baseline. Nevertheless this is uncertain and research has to confirm this.

Threats

The ambition of the initiators is to incorporate innovations on animal welfare to meet the expected opposition by the community due to the enlargement of farm scale. Unless this ambition the cows do not have access to the meadow which is a negative aspect concerning landscape .May be more important keeping the cows inside all year round will contributes to the opposition by the community Although the advantages of pasturing cows above a barn in which all requirements (like feed, space, soft surface) are met can not be founded scientifically

- Koelanderij seems to have relatively more variable costs such as for feed production and labour. Althought fluctuations in feed costs will be reduced by using contracts. Moreover, the costs for the composting process are significant. These costs may be a threat for the balance in a situation where the revenues from milk may be at pressure because of the end of the milk quota after 2013.
- An increase in traffic on public roads which may decrease traffic safety in the region.
- Estimates indicates that greenhouse gas emissions from Koelanderij may be higher compared to the baseline. Nevertheless this is uncertain and research has to confirm this.
- Energy use for feed transport and managing the compost in the barn may be higher and also greenhouse gas emissions may be higher due to composting the manure.

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