Evaluation of sustainability performance of Transforum projects -Biopark Terneuzen-

Jasper Scholten

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 "Biopark Terneuzen" (also referred as: the initiative) 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 "Biopark Terneuzen". Chapter 3 describes which baseline scenario is used to determine the sustainability performance of Biopark Terneuzen. Chapter 4 evaluates the total sustainability performance of Biopark Terneuzen. Chapter 5 closes with the discussion and conclusions.

1.2 The initiative: Biopark Terneuzen

Biopark Terneuzen is an industrial agropark in the port of Terneuzen in which new and existing industrials will exchange waste flows in such a manner that it will affect the sustainability performance of each company. The initiator of this agropark is the port Authority Zeeland Seaports. Figure 3.2 shows the dynamic system of Biopark Terneuzen. This system is dynamic because new flows and industries are coming and going. The industries and flows which were in operation in May 2010 are the heat and CO_2 flow from Yara towards WarmCO_2 and from WarmCO_2 to the Greenhouse complex. In chapter 3 the assessed flows of this system are explained.

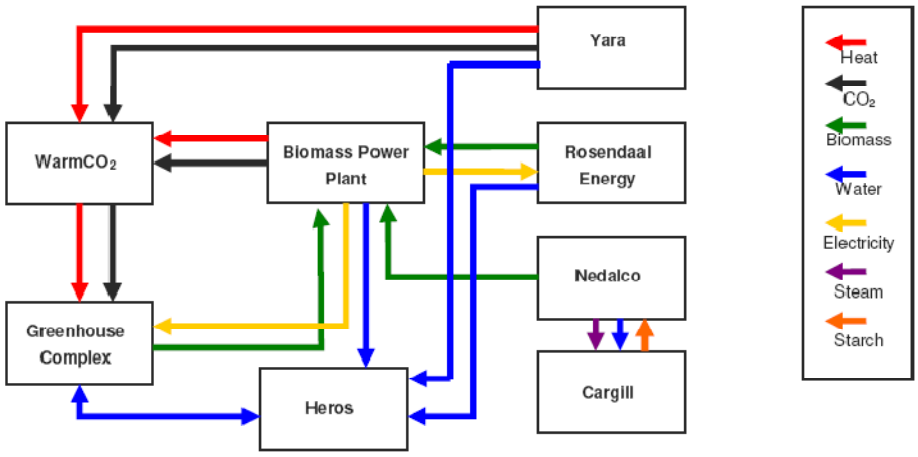


Figure 1.1 Original system of Biopark Terneuzen (van Waes en Huurdeman, 2009)

Besides the literature also the entrepreneurs of the main industries of Biopark Terneuzen and the initiators were involved in this evaluation of sustainability. The following dialogues have taken place in 2010 to get a good understanding of the coherence and sustainability ambitions of Biopark Terneuzen:

- 9th of March: Herman de Boon
- 29th of March: Marc van Waes (van de Bunt adviseurs)
- 9th of april: Erwin Heijnsdijk of Biomassa Unie BV and HEROS.
- 12th of april: Rik Lambotte and Jos van Damme of Yara Sluiskil BV.
- 15th of april: Jan Uilenreef and Marlon Pijpelink of WarmCO_2.
- 17th of May: Dick Engelhardt and Peter Geertse of Biopark Terneuzen and Zeeland Seaports.
- 17th of May: Jan van Duijn, an Aubergine horticulturist within Biopark Terneuzen.

The first sustainability ambitions

The first sustainability ambitions, or sustainability propositions, at the start of the initiative were (Biopark Terneuzen, 2009):

- Developing more jobs within the region.
- Less operational costs for industries within Biopark Terneuzen.
- Less environmental impact.
- A better environment for the residents of Zeeland.

1.3 System definition: Added value through integration

Biopark Terneuzen is assessed through the system definition "*Added value through integration*" (Blonk *et al.*, 2010). This system, as shown in figure 1.2, is characterized as a system with new complex connections between multiple (existing) enterprises and the whole system should be seen as one initiative and should be managed that way during the sustainability assessment. The connection provides added value, economy wise and sustainably wise, for the products of the individual enterprises. Possibly the connection also provides a new product. The innovation is the complex connections between the enterprises. Due to the complexity of the system all the enterprises are considered part of the initiative. Each enterprise can have its own suppliers.

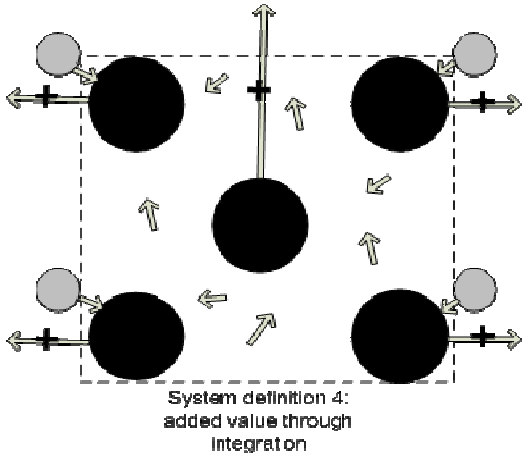


Figure 1.2 System definition "Added value through integration" of Biopark Terneuzen as described in Blonk et al. (2010)

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.

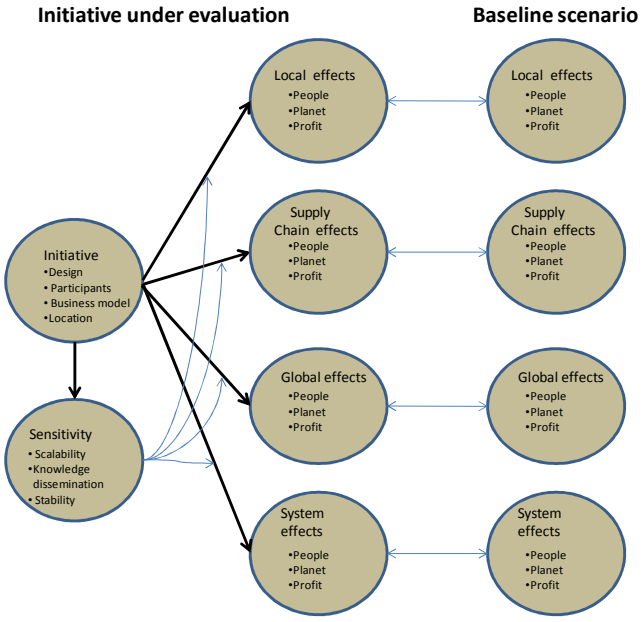


Figure 2.1. Outline of applied evaluation methodology

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) (UNEP, 2009)
- Environmental Impact Assessment *(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

In figure 1.1 the original system is shown. Some parts of this original system are not evaluated because of new insights and a realistic interpretation of flows. The assessed system, as it is being evaluated in this study, is shown in figure 3.1 and differs from the original system (figure 1.1) on the following points:

- The biomass power plant is currently being realized on the site of Heros.
- The biomass power plant of Biomassa Unie BV has been sold to Lijnco Green Energy and the original plans (e.g. biomass input) differ (Heijnsdijk, 2010). This plant could receive biomass from the greenhouse complex within Biopark Terneuzen.
- The new factory of Nedalco has been cancelled so all flows from and out of Nedalco are not realized.
- The facilities of Rosendaal Energy are currently closed because of a bankruptcy so all flows from and out of Rosendaal Energy are not assessed.
- The water flow from the greenhouse complex and Heros has not been realized. The water of the greenhouse complex is deposit on the sewerage.
- The flows of heat and CO_2 out of the biomass power plant to WarmCO_2 are invented and not realistic. The same reason counts for the electricity flow from the biomass power plant to the greenhouse complex.

The baseline scenario used to evaluate the sustainability performance of Biopark Terneuzen is based on the output of products (energy, fertilizers and horticulture products) without the delivery of heat and CO_2 by Yara. In figure 3.2 the baseline scenario and the assessed initiative are graphically shown.

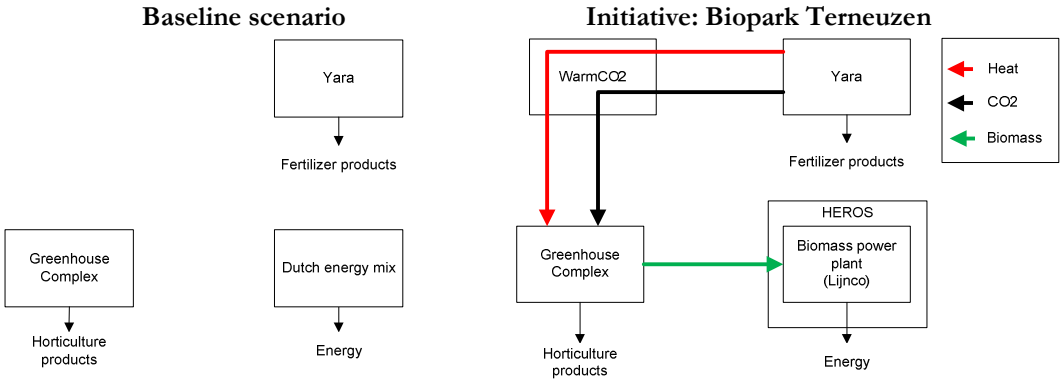


Figure 3.1 Flow chart of the baseline scenario and Biopark Terneuzen including the production of energy, horticulture products and fertilizer products

Baseline for horticulture products

The baseline for horticulture products are horticulture products produced in greenhouses with combined heat and power (CHP) and without lighting. The greenhouse complex does not have an important external supplier which is assessed in this study.

Baseline for energy production

The baseline for energy production in the biomass power plant should be compared to the Dutch electricity mix of 2009. An important external supply for the biomass power plant is biomass. In this study it is attempted to assess this supply.

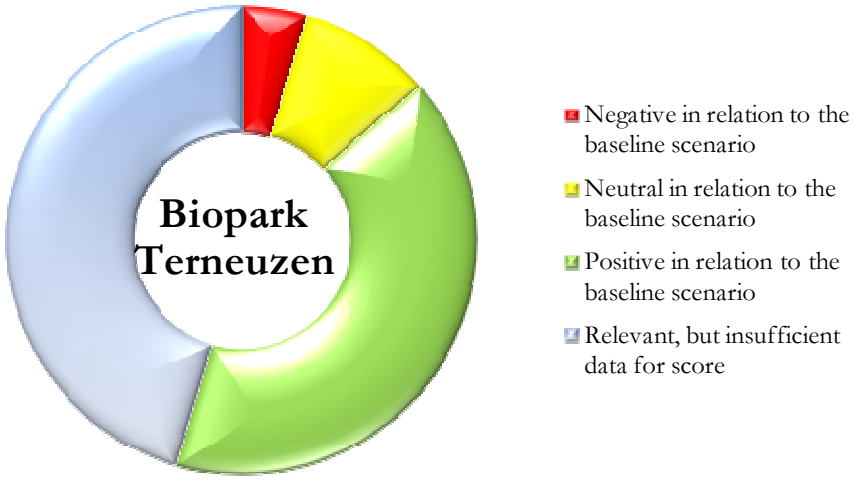
There are no differences in fertilizer production so the baseline is the same as the initiative for fertilizer products. Details of the baseline scenario will be further described in the explanation of each sustainability indicator score described in chapter 4.

4. Sustainability of Biopark Terneuzen

In this chapter the sustainability of Biopark Terneuzen 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.

4.1 Sustainability map

Figure 4.1 shows the sustainability map and figure 4.2 shows the sustainability profile of Biopark Terneuzen 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
- Establishment of greenhouses
- Continued existence of WarmCO2 and Yara

Figure 4.1. Sustainability map of Biopark Terneuzen

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.

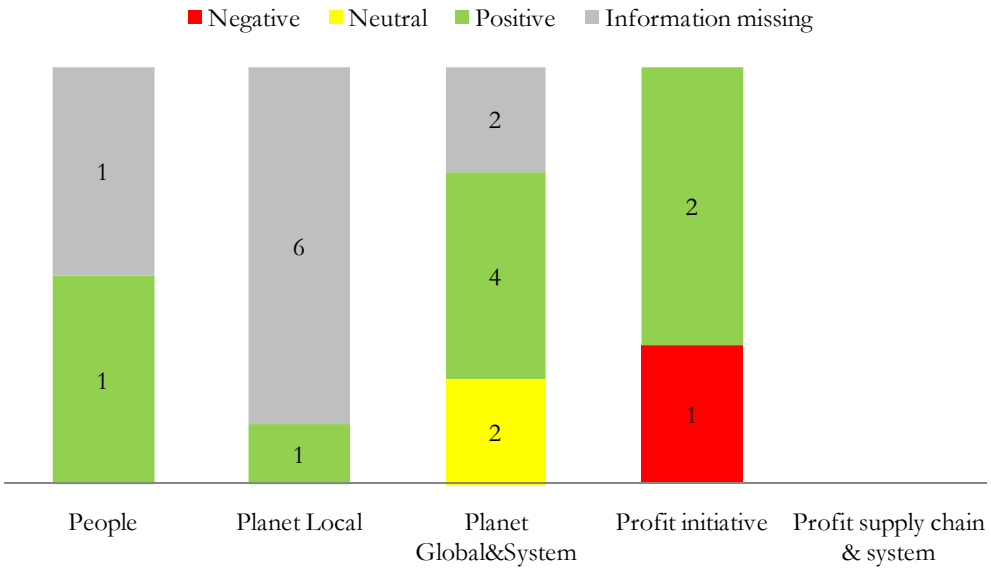


Figure 4.2. Sustainability profile of Biopark Terneuzen

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:

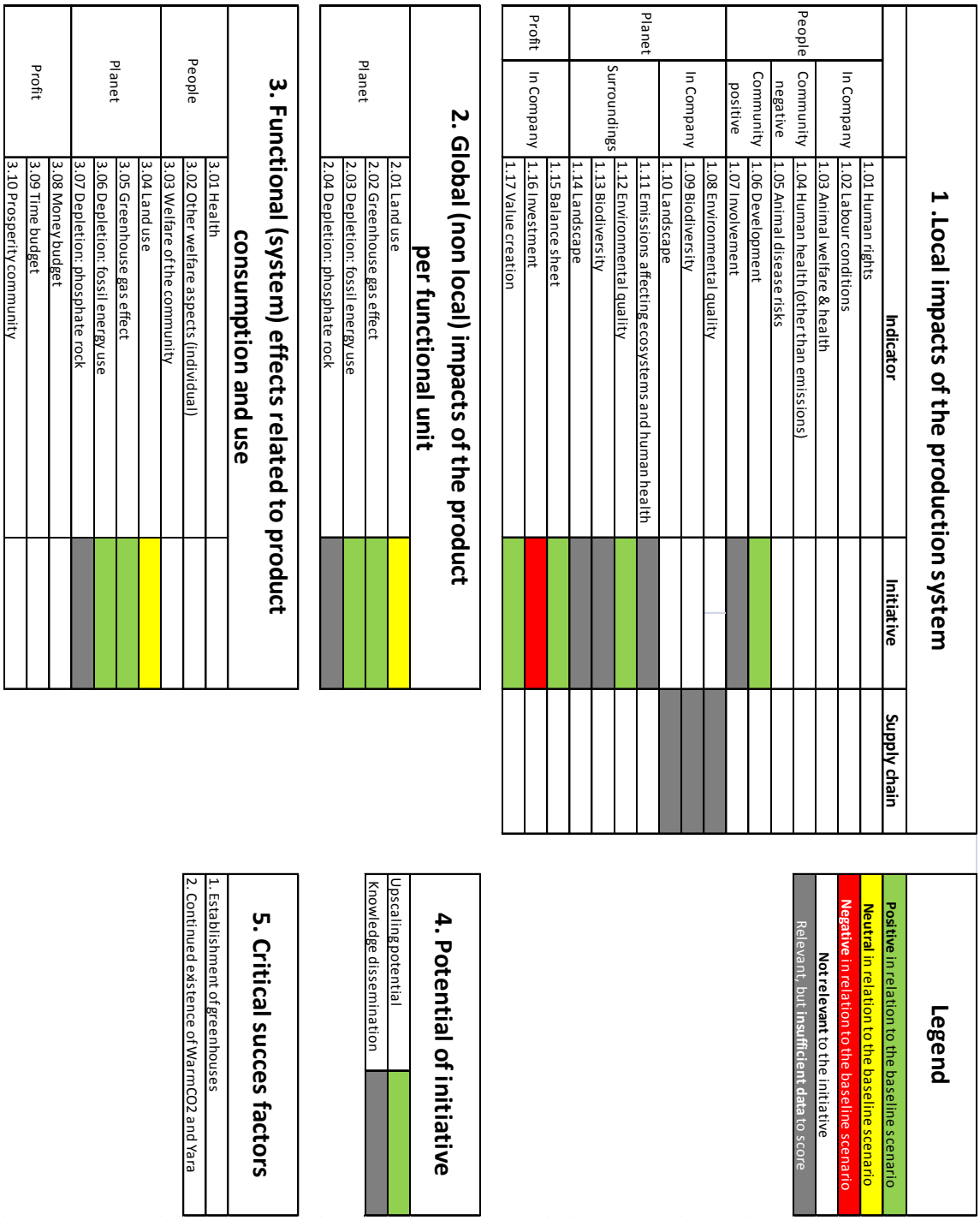
- Red (negative) for economic indicators of the initiative (column 4)
- Red for global planet indicators (column 3)
- Red for system effects (column 3)

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

Table 4.1 shows the sustainability map of Biopark Terneuzen compared to the baseline scenario as described in chapter 3. A detailed explanation about this format and why these sustainability indicators were chosen can be found in the methodology report (Blonk et al., 2010). 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.

Table 4.1. Sustainability table of Biopark Terneuzen



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.

1.06 Development

The indicator development is scored positive because it's possible for new employees of the greenhouse complex to get education in a special greenhouse for education. This indicator is not scored positive because of new employment in the region because almost the same employment would be realized in the baseline scenario.

1.07 Involvement

This indicator is relevant because it is a sustainability proposition of Biopark Terneuzen but there were no positive or negative aspects related to the community within the assessment of this initiative.

1.11 Emissions affecting ecosystems and human health

This indicator is based on emissions with mainly a local impact such as particulates (PM10), ammonia, heavy metals and emissions due to plant protection materials. No information, or information for a quantitative analyses, could be found within the assessment of the initiative to score this indicator. This indicator would probably score neutral.

1.12 Environmental quality

The environmental quality of the surrounding is scored positive because in the baseline the heat produced at Yara would be discharged to the Westerschelde. This heat is now used within the greenhouse complex.

1.13 Biodiversity

It was not possible to score this indicator because of not enough information.

1.14 Landscape

This indicator is difficult to score because the appreciation of landscape, a coherence of landscape elements, is very subjective. When looking at the baseline the landscape is the same as the initiative except that 30 hectares of compensation nature, called "*De Groene Knoop*" is realized. When assumed that in the baseline also nature has to be compensated there would be no difference. This indicator is scored neutral compared to the baseline.

When using another baseline, namely the landscape before the realisation of Biopark Terneuzen, the impact on landscape will be negative *(see table 4.2)* when using the perception of landscape elements method, developed by van der Wulp, Veeneklaas and Farjon (2009).

Table 4.2 Weighted impact on landscape of Biopark Terneuzen using the perception of landscape elements method (van der Wulp et al., 2009).

	Element	Area *(Hectares)*	Impact of the element *(van der Wulp et al., 2009)*	Weighted impact
Before Biopark Terneuzen	Agriculture	250	0,24	60
			Total impact:	**60**
Biopark Terneuzen	Residentials	10	0,86	9
	Nature	30	0	0
	Greenhouse complex	200	2,32	464
	Other	10	0	0
			Total impact:	**473**

1.15 Balance sheet

By assessing this indicator only the greenhouse complex is taken into consideration because the impact on the balance of Yara is expected to be negligible. This indicator is scored positive when the balance is positive, so this indicator is not compared to the baseline. It can be adopted that the balance of the individual horticulturists is at least the same as the balance of the baseline, so positive.

1.16 Investment

The investments to realize the infrastructure for the waste flows are high. The investment for realizing the heat and CO_2 flow from Yara towards the greenhouse complex are approximately €80mln (WarmCO_2, 2010). Further investment in infrastructures of waste flows could be a threshold because of the level of the investments. In the baseline these investments are not necessary. This indicator is scored negative.

1.17 Value creation

Value is created, compared to the baseline, at two products of Biopark Terneuzen.

The first value creation is created for horticulture products. Peppers produced within Biopark Terneuzen could be sold with a higher price then Peppers of the baseline. This value is created because of a lower environmental impact (see for example indicator 2.02 and 2.03). The intention is to sell all horticulture products of Biopark Terneuzen because of this advantage (Engelhardt, 2010). It is not known how much value really could be created and if it is possible to apply this for all horticulture products. This value for horticulture products could be an opportunity for Biopark Terneuzen.

The second value creation is created when biomass is applied to produce electricity which is being sold. In the baseline scenario biomass does not directly produce a product with a value.

This indicator is scored positive because a value is created out of biomass.

4.4 Local impacts of production chain - Supply chain

This paragraph describes the relevant local sustainability indicators of the supply chain which are scored in table 4.1. In chapter 3 it is explained that only the external supply of biomass is assessed in this study. Sustainability indicators which were not relevant (blanc in table 4.1) are not addressed.

1.08 Environmental quality / 1.09 Biodiversity /1.10 Landscape

The composition used in the biomass power plant was known but because this plant is sold the composition of biomass is not known. Some stakeholders claim that only agricultural products (e.g. maize) are used and other stakeholders of Biopark Terneuzen claim that only by-products (e.g. manure)

and waste (e.g. plant material out of greenhouses) is used. Because of not enough, and contradictory, information these three indicators are relevant but not scored.

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 sustainability indicators (land use, greenhouse gasses and fossil energy) are calculated for the horticulture product Aubergine which is produced at the greenhouse complex of Biopark Terneuzen. The used method to calculate these global effects is described in detail in Blonk et al. (2009).

2.01 Land use

The land needed to produce the products (horticulture products or fertilizers) of the system do not differ from the baseline. This indicator is scored neutral.

2.02 Greenhouse gas effect

The effect of the delivery of heat from Yara towards the greenhouse complex on the carbon footprint (CF) of horticulture products is shown in figure 4.3. In this study the Aubergine is taken as example. There are two baseline Aubergines. The first baseline Aubergine is produced without combined heat and power (CHP) so heat is only generated by a boiler. The second baseline Aubergine is produced with use of CHP and a boiler. The second baseline is the most obvious in the Netherlands. The Aubergine of Biopark Terneuzen is produced with use of 90% heat from Yara and 10% heat from a CHP at the Yara plant (WarmCO_2, 2010). It must be noted that the carbon footprint of Yara fertilizers stays the same because the reduction is totally allocated to the horticulture products. The technical production data (e.g. yield, application of fertilizer), out of KWIN (2008), are kept equal for all three production systems.

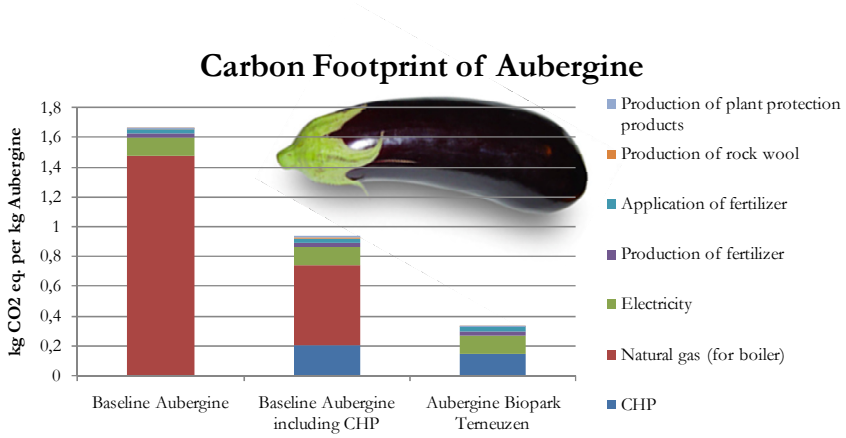


Figure 4.3. Carbon footprint of Aubergines from the baseline scenario and Biopark Terneuzen.

The CF of an Aubergine from Biopark Terneuzen is reduced by 80% compared to an Aubergine produced in a greenhouse without CHP and a 44% reduction of the CF has been accomplished compared to an Aubergine produced in a greenhouse with CHP. This indicator is scored positive because the CF is at least 10% better than the baseline (10% was the critical border between a neutral score and a positive score).

It is expected that the reduction of the CF is approximately the same for all horticulture products of Biopark Terneuzen.

2.03 Depletion: Fossil energy use

The effect of the delivery of heat from Yara towards the greenhouse complex on fossil energy use of horticulture products is shown in figure 4.4. Here, as in indicator 2.02, the Aubergine and the same baselines are taken as example. It must be noted that the fossil energy use of Yara fertilizers stays the same because the reduction is totally contributed to the horticulture products.

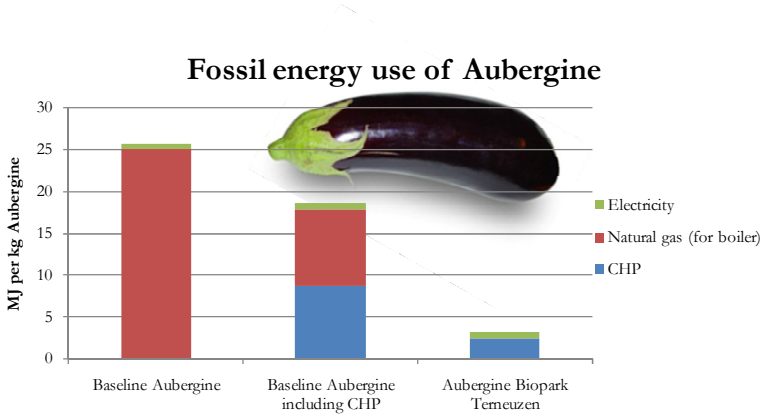


Figure 4.4 Fossil energy use of Aubergines from the baseline scenario and Biopark Terneuzen.

The fossil energy use of an Aubergine from Biopark Terneuzen is reduced by 88% compared to an Aubergine produced in a greenhouse without CHP and a 83% reduction of the fossil energy use has been accomplished compared to an Aubergine produced in a greenhouse with CHP. This indicator is scored positive because the fossil energy use is at least 10% better than the baseline (10% was the critical border between a neutral score and a positive score).

It is expected that the reduction of fossil energy use is approximately the same for all horticulture products of Biopark Terneuzen.

2.04 Depletion: Phosphate rock

The initiative does not have any effect on the amount of phosphate fertilizer produced at Yara or the amount of fertilizers used in the greenhouse complex. A phosphate leakage could occur when minerals in the output of the biomass power plant are seen as waste and not used in plant production systems. The application of these minerals is not known, this is why this indicator could not be scored.

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 were not relevant (blanc in table 4.1) are not addressed.

3.04 Land use

This indicator, land use per euro product, scores the amount of land needed to produce one euro of product. This indicator is strong related with the global impact indicator 2.01 (Land use) in which the environmental impact of the product was expressed per unit mass. Because product prices which are produced within Biopark Terneuzen do not strongly differ from baseline product prices this indicator scores the same as indicator 2.01. This indicator is scored neutral in relation with the baseline.

3.05 Greenhouse gas effect

This indicator, global warming per euro product, scores the amount of greenhouse gasses needed to produce one euro of product. This indicator is strong related with the global impact indicator 2.02 (Global warming) in which the environmental impact of the product was expressed per unit mass. Because product prices which are produced within Biopark Terneuzen do not strongly differ from baseline product prices this indicator scores the same as indicator 2.02. This indicator is scored positive in relation with the baseline.

3.06 Depletion: fossil energy use

This indicator, fossil energy use per euro product, scores the amount of fossil energy needed to produce one euro of product. This indicator is strong related with the global impact indicator 2.03 (Fossil energy use) in which the environmental impact of the product was expressed per unit mass. Because product prices which are produced within Biopark Terneuzen do not strongly differ from baseline product prices this indicator scores the same as indicator 2.03. This indicator is scored positive in relation with the baseline.

3.07 Depletion: phosphate rock

This indicator is not scored because this indicator is strong related with indicator 2.04 which could not be scored.

4.7 Potential

This paragraph describes the sustainability indicators scalability and spreading of knowledge which are scored in table 4.1. These indicators show the potential of the initiative.

Upscaling Potential

The scalability of Biopark Terneuzen is scored positive because new innovative connections between existing and new companies could be facilitated by the initiator Biopark Terneuzen. There are no direct limitations.

Knowledge dissemination

The idea to deliver heat and CO_2 from industries towards greenhouses could be repeated elsewhere but because a lot of technical information is not available this indicator is not scored. Biopark Terneuzen, or its stakeholders, will protect its intellectual property because the initiative is not served by other initiatives which can compete for the establishment of new greenhouses.

4.8 Critical success factors

Establishment of greenhouses

The sustainability performance will alter negatively if the establishment of new greenhouses stops, or some of the already established greenhouses go bankrupt. The sustainability performance will grow if the establishment of new greenhouses grows.

Continued existence of Yara and WarmCO_2

When the existence of Yara or WarmCO_2 is not continued the delivery of heat and CO_2 stops. This has a high impact on the sustainability performance of the initiative because greenhouses must re-invest in their energy supply (e.g. CHP).

5. Discussion and conclusions

To interpret the conclusions on the sustainability performance of Biopark Terneuzen in this study the following has to be taken into account. This study evaluates the sustainability performance of the initiative Biopark Terneuzen divided in four effects (local, supply chain, global and system effects), 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 Biopark Terneuzen. 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

From the sustainability evaluation the conclusions can be drawn that the sustainability indicators in which Biopark Terneuzen can distinguish itself in a positive way, in comparison to the baseline, are:

- A high reduction on global warming and the use of fossil energy for the horticulture products of Biopark Terneuzen.
- A better environmental quality because of a decrease in heat-discharge in the Westerschelde.

Weaknesses

It can be concluded from the sustainability evaluation that the weak sustainability indicators of Biopark Terneuzen, in comparison with the baseline, are:

- The investments for new infrastructures for the delivery of waste and by-products is high.

Opportunities

Some opportunities for Biopark Terneuzen, to develop more sustainability, are:

- The establishment of new greenhouses because of value creation on horticulture products due to a growing demand in environmental friendly products.
- The development of carbon credits (CER's or VER's).

Threats

The main threats are:

- No establishment of new greenhouses, or some of the already established greenhouses go bankrupt.
- When the existence of WarmCO_2 or Yara stops.

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