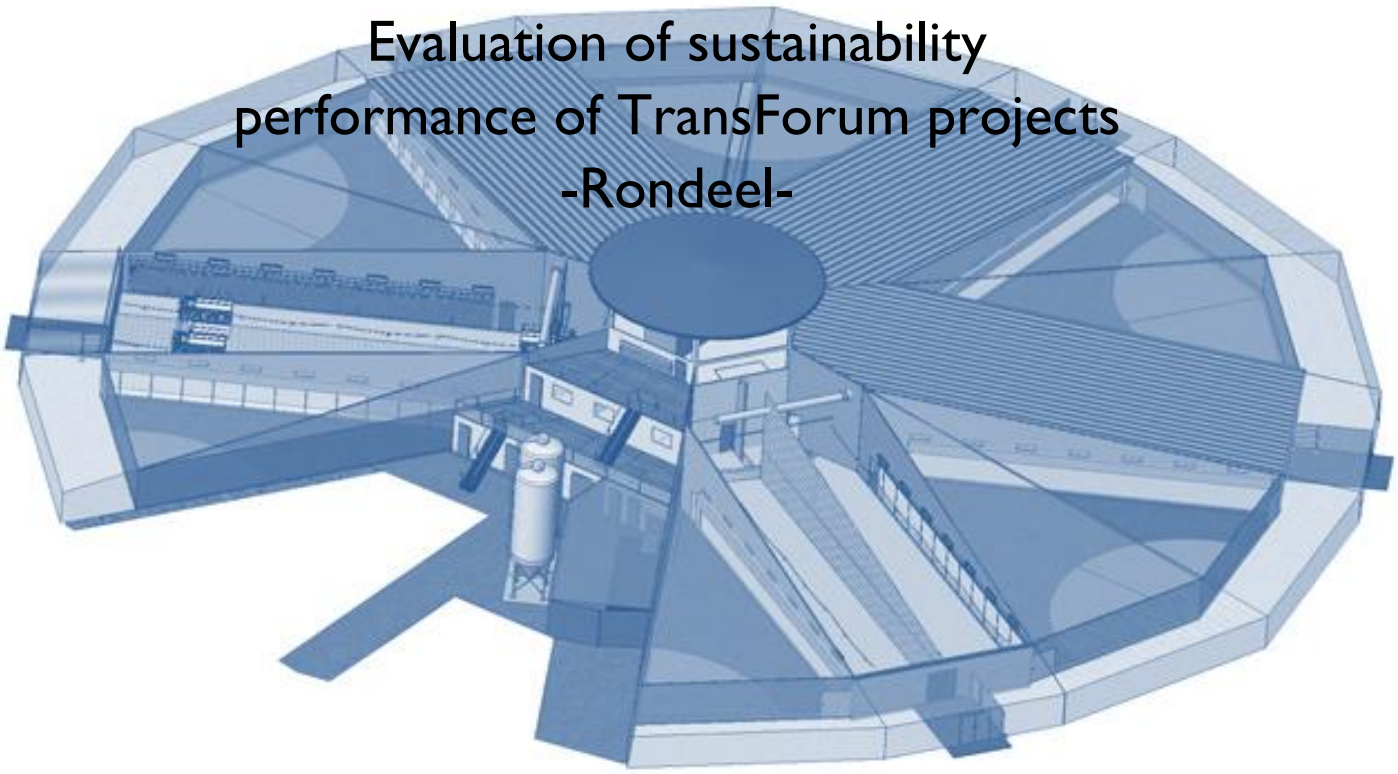
Evaluation of sustainability performance of TransForum projects -Rondeel-



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June 2010

BLONK | MILIEUADVIES

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 "Rondeel" (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 "Rondeel". Chapter 3 describes which baseline scenario is used to determine the sustainability performance of Rondeel. Chapter 4 evaluates the total sustainability performance of Rondeel. Chapter 5 closes with the discussion and conclusions.

1.2 The initiative: Rondeel

Rondeel is a new housing system for laying hens which focuses on animal welfare and new marketing concepts. Rondeel is an initiative with a twofold aim. The first aim is the commercialisation of a sustainable produced egg and the second aim is setting up a new organisation of the production chain. Specific literature which described the TransForum project "Rondeel" were:

- Kick off presentation "Op zoek naar het gulden ei". Fase 2.
- Review: The quest for the golden egg (Phase 1).
- Maatlat Duurzame Veehouderij Rondeel.
- Fowel scores of Rondeel.
- Innovatieve tafeleieren. Augustus 2008 (Vermeij et al., 2008).

Besides this literature the entrepreneurs of Rondeel were involved in this evaluation of sustainability.

The first sustainability ambitions

The first sustainability ambitions, or sustainability propositions, at the start of Rondeel were improving animal welfare and labour conditions for farmers and employers.

1.3 System definition: Single product/product chain

In the TransForum projects which are being evaluated through the system definition "*Single product/product chain*" there is an initiator which has developed an innovative product. The product is claimed to be more sustainable in operation than comparable products. The initiator in this case is the company Rondeel BV and the product is the new housing system also called Rondeel. The initiator and the product are represented by the black spots in figure 1.1. The grey spots are the suppliers and are not part of the initiative. In this case, the two main suppliers, compound feed supply and rearing of laying hens, were chosen.

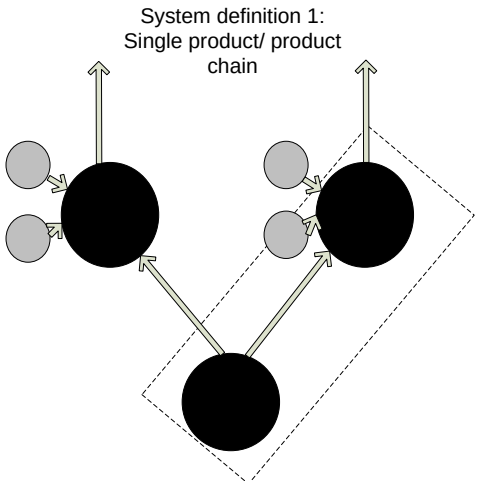


Figure 1.1 System definition of Rondeel as described in Blonk et al. (2010)

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.

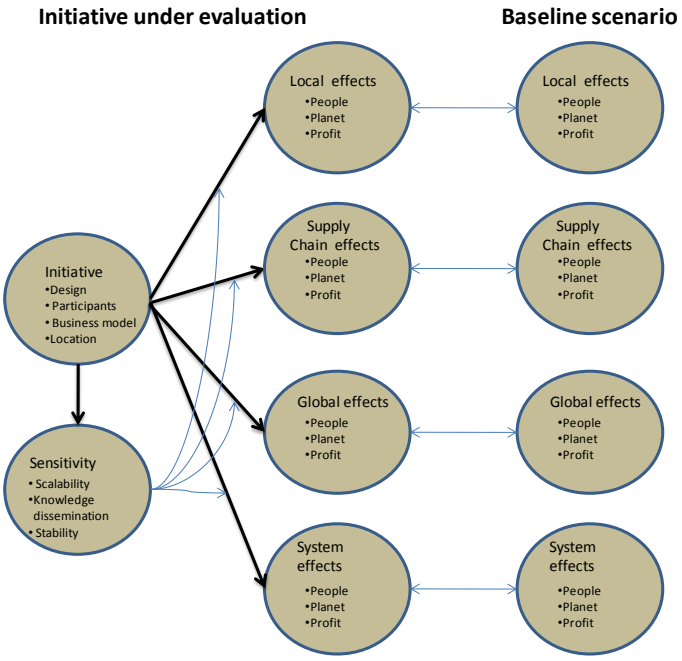


Figure 2.1. Outline of applied evaluation methodology

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) (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 baseline scenario used to evaluate the sustainability performance for the laying hen system Rondeel is based on the weighted average of laying hen housing systems in the Netherlands (PVE, 2009). Cage systems are excluded in this corrected weighted average (see table 3.1) because this system is being banned in 2012 and cage-eggs or not allowed anymore as consumption eggs. The entrepreneurs of Rondeel where involved in the defining of the baseline scenario.

In table 3.1 technical results of the baseline scenario are calculated using the corrected weighted average based on the amount of animals in 2008. It is assumed that technical results of Rondeel are the same as an aviary system because the housing system is being scored as an aviary system in the RAV[1].

Table 3.1. Share of laying hens systems in the Netherlands in 2008 and the corrected share used to calculate technical results of the baseline scenario (CBS, 2008)(PVE, 2009) (KWIN, 2009)

	Share in 2008	**Used share for baseline**	**Mortality (weeks 17 - 20)**	**Mortality (from week 20)**	**Eggs**	**Egg weight**	**Eggs**	**Feed consumption[2]**	**Feed conversion ratio[2]**
	% of the animals in NL	*%*	*%*	*%*	*Amount per hen of 20 weeks*	*kg*	*kg*	*kg/per animal*	*kg/kg*
Cage	47%	0%	0.3	6.50	342	0.0625	21.3	46.2	2.16
Aviary	40%	75%	0.3	10.06	313	0.0625	19.5	47.4	2.43
Free range[1]	12%	22%	0.3	11.00	306	0.0625	19.1	47.1	2.46
Biological	2%	4%	0.3	16.00	286	0.0621	17.8	46.8	2.64
Baseline scenario	100%	100%	**0.3**	**10.5**	**310**	**0.0625**	**19.4**	**47.3**	**2.44**

1 Technical results are from aviary systems including a free-range.
2 Feed and eggs from week 20.

Details of the baseline scenario will be further described in the explanation of each sustainability indicator described in chapter 4.

[1] RAV = Regeling ammoniak en veehouderij / Legislation of ammonia emissions of animal production systems

4. Sustainability of Rondeel

In this chapter the sustainability of Rondeel 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 Rondeel 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.

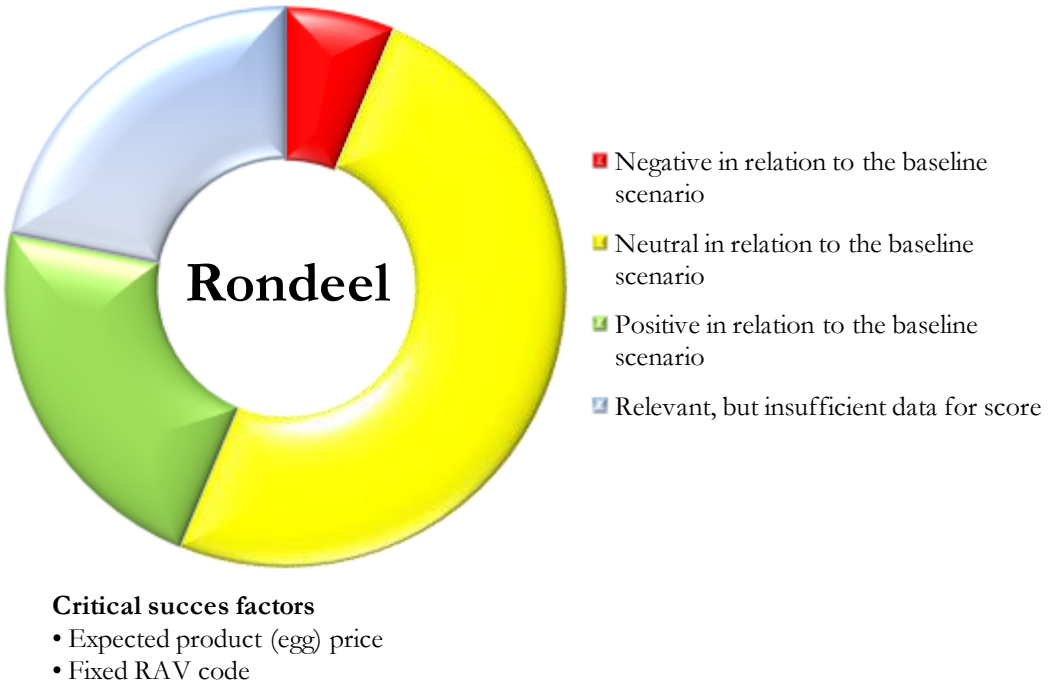


Figure 4.1. Sustainability map of Rondeel

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.

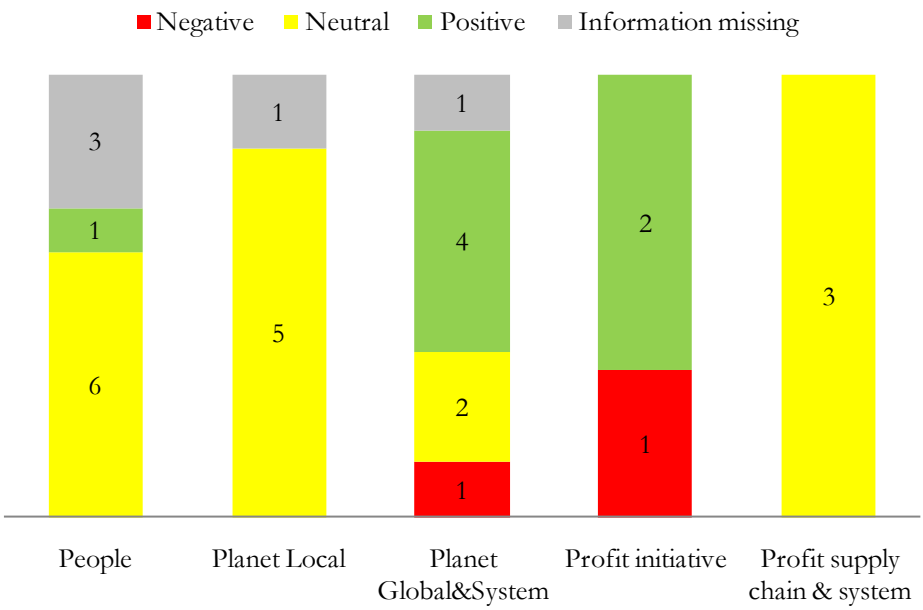


Figure 4.2. Sustainability profile of Rondeel (number in bar represents amount of indicators)

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:

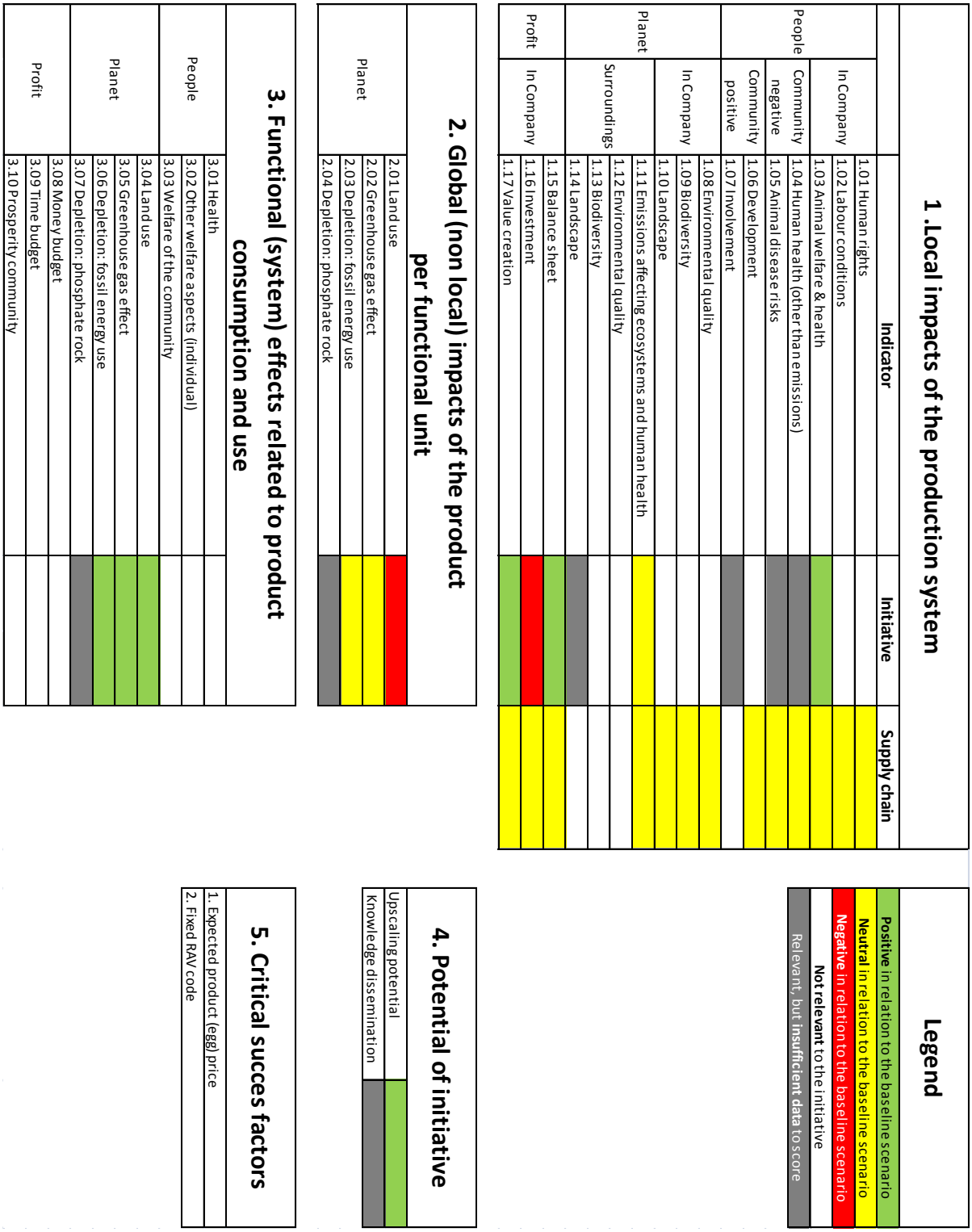
- Red (negative) for economic indicators of the initiative (column 4)
- Red for global planet indicators (column 3)
- Red for system effects (column 3)

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 Rondeel 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 Rondeel



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

1.02 Animal welfare and health

To compare animal welfare in different poultry husbandry systems we used the study by De Mol et al. (2004). This study used the FOWEL system, which compares the systems on twenty five attributes. Some of the important factors in poultry farming are: space per hen, availability of eating places, water, perches and nests, the possibility for dust bathing but also negative factors such as beak and toe trimming and predators.

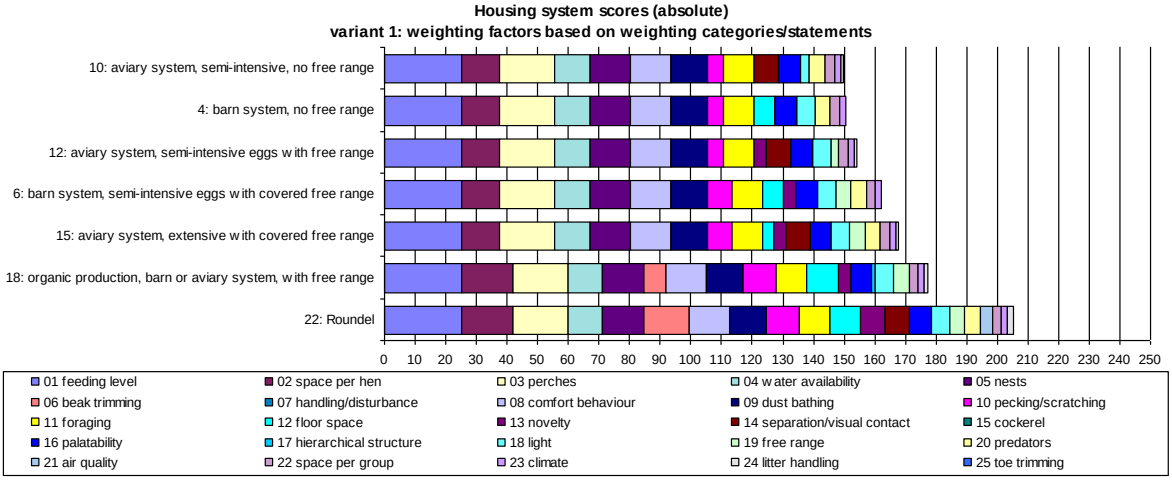


Figure 4.3. Absolute FOWEL housing system scores for seven laying hen housing systems (De Mol, 2009)

Figure 4.3 shows that Rondeel scores better on animal welfare than housing systems of the baseline scenario (organic, aviary and barn system). Rondeel scores better on the following welfare aspects:

- Beak trimming (No beak trimming).
- Novelty (variation in environment).
- Separation/visual contact.

This sustainability indicator is classified as positive compared to the baseline scenario.

1.04 Human health (other than emission)

Rondeel is a housing system with an almost full covered outside run which can be closed. This can reduce the risk of spreading diseases (e.g. zoonoses such as avian influenza) by wild birds towards the people or other farms in the region compared to an housing system with a free range which is not covered. The situation of the baseline is that a part of the animals are accommodated inside (without a free range), another part of the animals is accommodated in a system with a free range which is not covered and a part of the baseline housing systems also have a free range which is covered. The distribution of these parts is not known.

This indicator is evaluated as relevant but because of a lack of information about reduction of disease incursions in several housing systems this indicator is being scored as grey.

1.05 Animal disease risks

The arguing of the previous indicator applies for this indicator too.

1.07 Involvement

The intention of Rondeel is to sell eggs at the production location so consumers can watch and learn about the production of Rondeel eggs. The transparency and accessibility is very high for customers of Rondeel. We assume that these facilities are not present in the baseline scenario.

This indicator is evaluated as relevant but is not being scored because this indicator is hard to score positive. 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.

1.11 Emissions affecting ecosystems and human health

Ammonia

Whether more or less ammonia emissions occur at Rondeel compared to the baseline scenario can be studied in two ways. First we can compare the standard emissions of Rondeel with the maximum legal ammonia emissions in the Netherlands. The maximum for a Dutch laying hen system is 0.125 kg NH_3 per animal place per year and 0.015 kg NH_3 per animal place per year for the storage of poultry manure (LNV, 2005). Rondeel is assigned with the RAV[2] numbers E2.11.3 and E6.4.2 for respectively the animal housing system and downstream technology (Vermeij et al., 2008). The standard emissions of these RAV[1] numbers are 0.025 and 0.002 kg NH_3 per animal site per year. So the expected ammonia emission of the housing system including downstream technology are far below the maximum allowed ammonia emission.

The second approach is to calculate the ammonia emission of the baseline scenario and compare this with the emissions of Rondeel. This emission is calculated at 0.07 kg NH_3 per animal site per year so the ammonia emissions of Rondeel are lower than the baseline scenario.

Odour and particular matter (PM10)

The local emissions particular matter (PM10) and odour emissions are also calculated for the baseline scenario based on RAV emission factors (Infomill, 2009). The odour and PM10 emissions of the baseline scenario are respectively 0,34 odour units per second per animal and 68 gram PM10 per animal per year. The odour and PM10 emissions of Rondeel are respectively 0,34 odour units per second per animal and 65 gram PM10 per animal per year. When comparing the baseline emissions with Rondeel the PM10 emissions are expected to be lower (≈4%) and the odour emissions are expected to be similar for Rondeel.

However, when using the results of the legally compulsory diffusion models (V-stacks) the odour emissions of Rondeel on location are higher than legally permitted. The opposite can be concluded when using the baseline emission based on RAV emissions. A possible explanation for this difference are the differences in structure of Rondeel compared with a normal aviary system (emission points and aeration) with the same RAV numbers. To assess this sustainability indicator we use the approach based on RAV emissions.

Conclusions

The ammonia emissions are expected to be lower than the baseline scenario.
The odour emissions are expected to be similar as the baseline scenario.
The particular matter emissions are expected to be lower than the baseline scenario.

This indicator is classified as neutral compared to the baseline scenario.

[2] RAV = Regeling ammoniak en veehouderij / Legislation of ammonia emissions of animal production systems

1.14 Landscape

Rondeel aims to include the building in the environment by planting trees and shrubs in the outdoor run area and by creating slopes to diminish the view of the building. The municipality Barneveld also authorized the arrival of Rondeel. A decrease in landscape quality because of the development of Rondeel is not expected. The question rises how big the effect will be on landscape and how this will be valued by consumers and inhabitant. Therefore, this indicator is evaluated as relevant but because of a lack of information this indicator is not being scored.

1.15 Balance sheet[3]

Costs

The operational cost prices of Rondeel is scored higher compared to the baseline scenario. The cost price, per 100 eggs, for aviary eggs, free range eggs and biological eggs, based on Vermeij et al. (2008), are respectively € 5.74, € 6.27, and € 10.72. The cost price of the baseline is calculated at € 6.03 per 100 eggs (Table 4.2). The cost price of Rondeel eggs is calculated at a higher level.

The cost price includes labour cost and housing cost. The housing cost for the Rondeel is spread out over 15 years instead of in 5 years as is shown by Vermeij et al. (2008).

Table 4.2. Baseline cost price in € for 100 eggs

Type of egg	%	Cost price (€ per 100 eggs)
Aviary	75%	5.74
Free range	22%	6.27
Biological	4%	10.72
Baseline cost price		**6.03**

Product price

The price of Rondeel eggs is scored higher compared to the baseline scenario. Ruud Zanders of Rondeel estimates that 10% of the eggs will be sold at the industry market, 10% as aviary plus eggs and 80% directly to the retail or consumer as premium eggs. Prices, per 100 eggs, estimated are € 6.56 for aviary eggs, € 7.06 for aviary plus eggs (aviary plus is € 0.5 per 100 eggs higher than normal aviary eggs), € 7.46 for free range eggs, € 12 for other eggs, € 9.73 for premium eggs (KWIN, 2009 and Horne, 2010) and € 4.34 for the industry market. The price for the premium eggs is based on the average price between free-range and biological eggs.

In the baseline scenario the average price for 100 eggs is calculated at € 6.69 (Table 4.3). The expected price for Rondeel eggs is higher compared to the baseline scenario.

In this calculation several aspects are based on assumptions because Rondeel is not operational yet.

- The division of egg sales is based on expectations by Ruud Zanders of Rondeel and not on real sales data.
- Some Rondeel eggs are expected to be sold as aviary plus eggs with an added price of €0.50 per 100 eggs. It is unclear at this time if this is reasonable.
- The price for premium eggs is assumed to be the average price of free range and biological eggs.

[3] Data used in this evaluation is based on the "*Marketing Rondeel*" housing system which is described in Vermeij et al. (2008) and confidential information received from Rondeel BV is omitted in this report.

- All type of eggs are of the same size. In reality eggs from the category other are a slightly smaller than ground and aviary eggs.

Table 4.3. Baseline product price in € per 100 eggs

Type of egg	%	Price (€ per 100 eggs)
Aviary	67%	6.56
Free range	19%	7.46
Biological	3%	12.0
Industry	10%	4.34
Baseline price		**6.69**

Table 4.4. Product price in € per 100 eggs

Type of egg	%	Price (€ per 100 eggs)
Aviary plus	10%	7.06
Premium	80%	9.73
Industry	10%	4.34
Average price		**8.92**

Balance

The balance for Rondeel is higher compared to the baseline scenario. The cost price of Rondeel is higher than the baseline. The sales price of Rondeel is expected to be higher than the baseline. It is expected that the ratio between costs and income will plentifully cover the additional investments. This indicator is classified as positive compared to the baseline scenario.

1.16 Investment[4]

The investment costs of Rondeel is scored negative because these are considerable higher compared to other laying hen housing systems. The investment per animal capacity (maximum number of animals) is more than twice as high compared to aviary and free range and thirty percent higher compared to biological housing systems (Vermeij et al., 2008).

The investment cost include cost for the housing system as well as the inventory needed. In the case of Rondeel we used the data of the Rondeel Marketing housing system. Investment costs of Rondeel Production are slightly lower than Rondeel Marketing but are still much higher than aviary, free range, and biological housing systems.

1.17 Value creation

It can be said that the housing system as well as the product has an own identity resulting in a significantly higher balance (see indicator 1.15). So the indicator value creation is scored positive

[4] Data used in this evaluation is based on the "*Marketing Rondeel*" housing system which is described in Vermeij et al. (2008).

4.4 Local impacts of production chain - Supply chain

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

1.01 Human rights

The intention of Rondeel is to set requirements on feed for the compound feed producers (sustainable soy or raw materials which are labelled (e.g. EKO/Milieukeur). This might have a positive impact on human rights. At this stage it is not sure if applying these standards is possible from an economic point of view. When Rondeel is in production the deployed requirements can be evaluated on human rights. This sustainability indicator is scored neutral.

1.02 Labour conditions

The intention of Rondeel is to set requirements on feed for the compound feed producers (sustainable soy or raw materials which are labelled (e.g. EKO/Milieukeur). This might have a positive impact on work conditions. At this stage it is not sure if applying these standards is possible from an economic point of view. When Rondeel is in production the deployed requirements can be evaluated on work conditions. This sustainability indicator is scored neutral.

1.03 Animal welfare and health

The supply chain of new laying hens does not differ from the baseline scenario this is why this sustainability indicator is scored neutral.

1.04 Human health (other than emissions), 1.05 Animal disease risks and 1.06 Development

The supply chain of Rondeel does not differ from the baseline scenario this is why this sustainability indicator is scored neutral.

1.08 Environmental quality, 1.09 Biodiversity, 1.10 Landscape, 1.11 Emissions ,1.15 Balance sheet, 1.16 Investment, 1.17 Value creation

There is no difference compared to the baseline scenario because we assume that no requirements are set on suppliers of feed and animals. This sustainability indicator is 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 sustainability indicators (land use, greenhouse gasses and fossil energy) are calculated from feed production till farm gate (including breeding of layers). The used method is described in detail in Blonk et al. (2008).

2.01 Land use[5]

The baseline scenario claims 4.3 m^2 per kg egg and Rondeel 4.6 m^2. The main reason for this difference is a higher feed conversion ratio of Rondeel. It is assumed that the package of Rondeel eggs consists of coco fibre and natural rubber latex with a land use of respectively 0.02 and 0.11 m^2 per kg material. Land use for the package for 1 kg eggs with 85% coco fibre and 15% natural rubber latex is calculated at 0,11 m^2. Table 4.6 compares the land use results of the baseline with Rondeel. Land use of Rondeel eggs are

[5] Blonk calculated the land use of 1 kg egg at 3,8 m^2 (Blonk *et al.*, 2008), Dekker calculated 5,0 m^2 per kg egg (Dekker *et al.*, 2008).

expected to be 9% higher because of a higher FCR and the use of natural materials like coco fibre and rubber. This sustainability indicator is scored negative.

Table 4.6. Land use comparison of the baseline and Rondeel

	Baseline	**Rondeel**
	*m^2 *year / kg eggs*	*m^2 *year / kg eggs*
Eggs (1 kg)	4.3	4.5
Package	0.0	0.1
Total	**4.3**	**4.6**

2.02 Greenhouse gas effect [6]

The carbon footprint (CF) of the baseline scenario is calculated at 1.95 kg CO_2-eq. per kg egg at farm gate and Rondeel scored 1.97 kg CO_2-eq. per kg egg at farm gate. The main reason for this small difference is a higher feed conversion ratio of Rondeel. When all fossil energy used in the Rondeel system is replaced by solar energy, produced at Rondeel, the CF will be reduced with 0,11 kg CO_2-eq. per kg egg.

The greenhouse gases of the conventional egg packaging materials polystyrene and recycled paper package are respectively 0,16 and 0,10 kg CO_2-eq. per kg egg. When the package is replaced by the typical Rondeel package, which is made of 85% cocofibre and 15% natural rubber latex, the greenhouse gas emissions are the same as the recycled paper package, thus 0,10 kg CO_2-eq. per kg egg. In appendix A a quick environmental scan is shown of several egg packages.

Differences in transport efficiency is not included in calculations but is expected to be negligible. Differences in failure percentages are not expected but do have an important impact on greenhouse gas emissions. Table 4.7 compares the greenhouse gas effect of the baseline with Rondeel. This sustainability indicator is scored neutral.

Table 4.7. Greenhouse gas effect comparison of the baseline and Rondeel

	Baseline	**Rondeel**
	kg CO_2-eq / kg eggs	*kg CO2-eq / kg eggs*
Eggs (1 kg)	1.95	1.97
Package	0.10	0.10
Total	**2.05**	**2.07**

2.03 Depletion: fossil energy use[7]

The fossil energy use of the baseline scenario is 11.4 MJ per kg egg at farm gate and 11.5 MJ for Rondeel eggs at farm gate. This is an increase of 1%.

The share of fossil energy of the package for 1 kg eggs is approximately 2 MJ when recycled paper is used. The cocofibre package of Rondeel realizes a reduction of fossil energy use of approximately 47% for the egg package. When the package and the eggs are included the reduction is 6%. In appendix A an quick

[6] The Swedish institute for food and biotechnology, SIK, calculated the carbon footprint (CF) of eggs in 2005. The carbon footprint was 1,42 and 1,47 kg CO_2-eq. per kg egg respectively at farm gate and at retail (Cederberg *et al.*, 2009). Blonk calculated the CF of 1 kg egg at retail at 2,0 kg CO_2-eq. (Blonk *et al.*, 2008) and Dekker calculated the total greenhouse gas emissions at 4,24 kg CO_2-eq. per kg egg at farm gate (Dekker *et al.*, 2008).

[7] Blonk calculated the use of fossil energy of 1 kg egg at retail at 13,3 MJ (Blonk et al., 2008) and Dekker calculated 13,4 MJ (Dekker et al., 2008).

environmental scan is shown of several egg packages. Table 4.8 compares the fossil energy use results of the baseline with Rondeel. This sustainability indicator is scored neutral.

Table 4.8. Fossil energy use comparison of the baseline and Rondeel

	Baseline *MJ / kg eggs*	**Rondeel** *MJ / kg eggs*
Eggs (1 kg)	11.4	11.5
Package	2.0	1.1
Total	**13.4**	**12.6**

2.04 Depletion: phosphate rock

This indicator is relevant because phosphate fertilizers are used in the life cycle to produce the product. This indicator is not scored because it is not quantified.

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, are expressed in consumer money results are changing rapidly. Egg prices described in paragraph 4.3 are assumed. So €1,070 and €1,428 per ton eggs is respectively used for the baseline scenario and Rondeel.

3.04 Land use

This sustainability indicator is scored positive because the land use per euro product is 18% lower for Rondeel eggs (see table 4.9).

Table 4.9. Land use comparison of the baseline and Rondeel per euro

	Baseline *m^2 *year / € eggs*	**Rondeel** *m^2 *year / € eggs*
Eggs (1 kg)	4.0	3.2
Package	0.0	0.1
Total	**4.0**	**3.3**

Land use per euro is 4.3m² per € egg when minimum egg prices (€1078,- per ton eggs) are realized with a balance of zero, so costs are the same as revenues.

3.05 Greenhouse gas effect

This sustainability indicator is scored positive because the greenhouse emissions per euro product is 24% lower for Rondeel eggs (see table 4.10).

Table 4.10. Greenhouse gas effect comparison of the baseline and Rondeel per euro

	Baseline *kg CO_2-eq / € eggs*	**Rondeel** *kg CO2-eq / € eggs*
Eggs (1 kg)	1.8	1.4
Package	0.1	0.1
Total	**1.9**	**1.4**

Greenhouse gas emissions per euro are 1.9kg CO_2-eq per € egg of Rondeel when minimum egg prices (€1078,- per ton eggs) are realized with a balance of zero, so costs are the same as revenues.

3.06 Depletion: fossil energy use

This sustainability indicator is scored positive because the greenhouse emissions per euro product is 30% lower for Rondeel eggs (see table 4.11).

Table 4.11. Fossil energy use comparison of the baseline and Rondeel per euro

	Baseline	**Rondeel**
	MJ / € eggs	*MJ / € eggs*
Eggs (1 kg)	10.7	8.1
Package	1.9	0.8
Total	**12.6**	**8.8**

Fossil energy use per euro is 11.7 MJ per € egg when minimum egg prices (€1078,- per ton eggs) are realized with a balance of zero, so costs are the same as revenues.

3.07 Depletion: phosphate rock

This relevant indicator could not be quantified because it needs information of indicator 2.04 which is not being scored.

4.7 Potential

Upscaling potential

Rondeel is a standardized concept that can easily be built on other locations. There are three types of Rondeel housing systems described by Vermeij et al. (2008), all these systems are based on the same type of building and inventory: Marketing Rondeel, Production Rondeel and a basic version excluding certain risks. This multiplier is scored positive.

Knowledge dissemination

The Rondeel concept is patented and cannot easily be copied by other companies. This might economically limit the spreading of knowledge. On the other hand, when Rondeel becomes a success it can also inspire other animal production systems to place housing systems such as Rondeel. This multiplier is not scored because a clear judgement is not possible.

4.8 Critical success factors

Expected product (egg) price

The main stability parameter is the realisation of a stable product price of Rondeel eggs. When this price is not achieved some sustainability indicators will be affected. The effect of different sales estimates and prices on the profit of Rondeel is calculated. The "*Marketing Rondeel*" with a write-off term of 15 years instead of 5 years is examined. Economic data are from the report "*Innovatie tafeleieren*" (Vermeij et al., 2008). The fraction of eggs sold at the industry market is assumed to be remained constant at 10 percent and the prices for hens bought and sold will also remain the same.

How resilient is the Rondeel if more than 10% of the eggs have to be sold as aviary plus eggs instead of premium eggs?

- With current prices if all the premium eggs have to be sold as aviary plus eggs the Rondeel will barely be profitable.

How will the result change if the Rondeel eggs cannot be sold as aviary plus but have to be sold as aviary eggs instead?

- If all the premium eggs have to be sold as aviary eggs the Rondeel will not be profitable. At least 13% of the eggs must be sold at premium prices for the Rondeel to be profitable.

How resilient is the Rondeel if the premium price is lower than the expected € 9.73 per 100 eggs?

- Assuming the egg sales are divided as described above, the minimum price of the premium eggs must be € 7.03 per 100 eggs. This is well above the price for aviary and similar to aviary plus eggs.

If Rondeel can sell its eggs for a premium price it is quite resilient. At this time it is not clear if consumers are willing to pay more for their eggs. At this time prices for eggs are quite high if the prices drop it will be more difficult because of its higher costs.

Fixed RAV code

Rondeel is being assigned with a RAV number of a normal aviary system. It is not known if new Rondeel housing systems will be assigned with the same RAV number in the future because of higher or lower emissions due to measurements at the first Rondeel. When Rondeel is assigned with another RAV number with higher emissions, the authorisations for new Rondeel housing systems could be a problem.

5. Discussion and conclusions

To interpret the conclusions on the sustainability performance of Rondeel in this study the following has to be taken into account. This study evaluates the sustainability performance of the initiative Rondeel 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 Rondeel. 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 Rondeel can distinguish itself in a positive way, in comparison to housing systems of the baseline, are:

- A positive animal health and animal welfare: e.g. variation in environment and no beak trimming.
- A positive contribution of community involvement: A high transparency and accessibility.
- A good financial balance for the farmer.
- Positive environmental scores per euro per egg: A high egg price in relation with the environmental scores.

The potential of Rondeel is seen as positive because of the scalability of the project.

Weaknesses

It can be concluded from the sustainability evaluation that the weak sustainability indicators of Rondeel, in comparison with the egg production systems of the baseline, are:

- More land use per mass of egg: More feed for the same amount of eggs.
- Higher investment costs to realize a Rondeel housing system: New techniques and marketing facilities.

Opportunities

Some opportunities for Rondeel to develop more sustainability are:

- Setting requirements for the supply chain (compound feed producers / rearing of laying hens) such as the inclusion of sustainable produced raw materials (e.g. EKO/Milieukeur/sustainable soy).
- Setting requirements for the sales channel such as maximum distance to the outlet and minimum prices (to ensure a fair price system within the system).
- A fair price system within the whole system (from producer of raw materials towards retail).

Threats

The main critical success factor is when egg prices are below a certain turning point. When this occurs it has the following consequences on sustainability indicators:

- The financial balance will alter from positive to negative.
- The system effects global warming (kg CO_2 per €) and depletion of fossil energy (MJ per €) will alter from positive to a neutral score.
- The system effect land use (m^2 per €) will alter from a positive to a negative score.

Another threat is the assignment, due to measurements at Rondeel, of another RAV number with higher emissions.

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Appendix A: Quick scan: Fossil energy use and Carbon Footprint (CF) from several egg packaging

Functional unit

The functional unit of this quick scan is the package needed for 1 ton eggs.

Results

Egg packaging	Starting-points		Results	
	Eggs per package	Weight	Fossil energy	Carbon footprint
	kg eggs/package	*kg/package*	*MJ / ton egg**	*kg CO_2-eq / ton egg**
Coco fiber (85%) / Natural rubber (15%)	0,44	0,055	1084	97
Flax (70%) / PLA (30%)	0,44	0,055	2027	138
Polystyrene	0,37	0,015	4487	163
Recycled paper	0,37	0,022	2033	98

* Only environmental pressure of the package needed for 1 ton eggs (excl. the production of eggs)

The shaping and pressing of the coco fiber and flax packaging contributes respectively 32% and 17% to the fossil energy use and respectively 30% and 21% to the CF.

Sensitivity

When the share of coco fiber increases from 85% towards 95% the fossil energy use decreases from 1084 MJ towards 977 MJ and the CF decreases from 97 towards 85 kg CO_2-eq / ton egg.
When the share of flax increases from 70% towards 80% the fossil energy use decreases from 2027 MJ towards 1507 MJ and the CF decreases from 138 towards 130 kg CO_2-eq / ton egg.
When the coco fiber and flax packaging contains 8 eggs (0,50kg/package) instead of 7 (0,44 kg/package) the fossil energy use is respectively 948 and 1774 MJ and the CF is respectively 85 and 121 kg CO_2-eq.

Conclusion

The package made of coco fiber and natural rubber is the package with the least fossil energy use and the lowest carbon footprint of all four egg packages.

Sources

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