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Report on the impact of animal key indicators on the value chain

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Smart Farming for Europe



Value creation through *P*recision *L*ivestock *F*arming



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1. Introduction

The size of livestock farms have increased dramatically in recent times which resulted in large number of animals cared for by decreasing number of livestock producers. Thus, farmers are finding it increasingly difficult to take care of the animals in a satisfactory manner. This may result in a decreased technical and economic performance of the farm and lower welfare for the animals (EU-PLF, 2015). “Precision Livestock Farming” (PLF) technologies could assist livestock producers with continuous, automatic and real-time monitoring of animals. The observed data can be translated into key indicators on animal welfare, animal health, productivity and environmental impact. A number of PLF tools have been developed at laboratory levels and as prototypes. The overall objective of the EU-PLF project is to bring some of those tools from the lab to the farm (www.eu-plf.eu). The EU-PLF project is divided in different work packages (WP) in which WP4 has the objective to define the value created by the use of the PLF tools on farms. One of the tasks within this WP4 has the goal to evaluate the value creation potential by the exchange of PLF data along the supply chain. At the same time, with the increased pressure on livestock (e.g., greenhouse gasses produced by dairy, ammonia emission by pigs) and farmers (e.g., increasing legislation concerning the environment), the awareness of the need to produce protein products (e.g., meat) in a sustainable way is increasing for different stakeholders along the supply chain. For example, the Belgian compound feed sector (BEMEFA) called for a global chain approach and for the actors involved in the feed and food chain to choose a common strategy during BEMEFA's Annual General Meeting (2015) for food safety, the environment and sustainability. Moreover, the action plan of the Flemish government for the Belgian pig producers stresses the importance of price transparency with slaughterhouses, as well as sustainable production. Finally, a plan of communication towards consumers is launched, focussing on nutritional value, food safety, and sustainability (Vlaamse Overheid, 2011). Also the president of the European Feed Manufacturers' Federation (FEFAC), Ruud Tijssens, stated that PLF and fair trade could help to achieve a sustainable production along the whole animal production supply chain at the Nuscience Round Table (2014). This shows that different stakeholders are realizing that a sustainable future and transparency are a common goal and extremely important for the licence to produce animal protein products in the future.

However, there is still a diverse interpretation of the term “sustainability” (Silvius et al., 2012). Up to now, a universal agreement has been made to divide sustainability into three dimensions known as the 3P's referring to “People Profit Planet” (Slaper, 2011; FAO, 2013).

To assess the value creation potential for the exchange of information along the supply chain, a tool was created. This tool would help evaluating the value creation potential of using precision livestock farming (= PLF) on-farm along the supply chain. According to the description of task 4.3 it was essential that this tool would be linked to three topics: cost-effectiveness, sustainability and fair & ethical trade. These topics show the link with the 3P's vision which was a possible translation of sustainability. Different actors along the supply chain were identified as being feed provider, farmer, slaughterhouse, processors and retail (Figure 1), using the assumption that the viewpoint of the potential of PLF on-farm as presented by the actor ‘Consumers’ would be reflected through the actor ‘Retail’, since ‘Retail’ are usually very sensitive for the consumer’s opinion. Additionally, retail has a key role in the supply

chain because they often indirectly influence the farmer through their power concerning price decisions at slaughterhouses or quality demands. The actor ‘Farmer’ was included, since farmers are those who implement the PLF technology. However, when collecting on-farm data using PLF technology would be beneficial for other actors along the supply chain, and therefore costs of investment in PLF technology should perhaps not be paid by farmers solely.

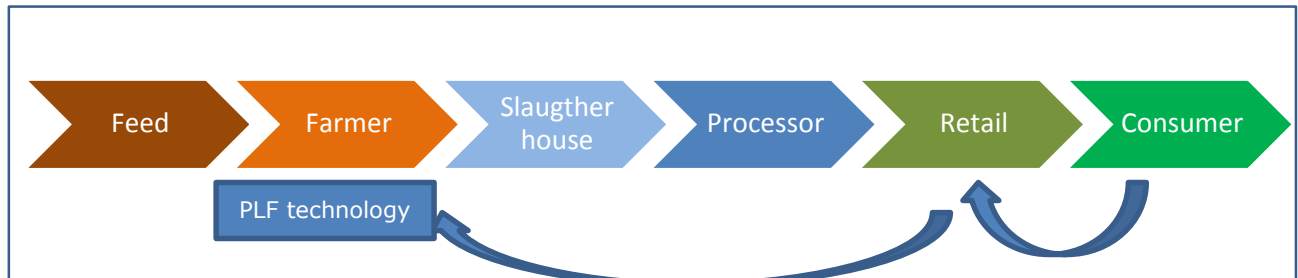


Figure 1: Different actors in the supply chain for producing animal protein products.

2. Methodology

In order to evaluate the potential value of precision livestock farming along the supply chain, different stakeholders had to be contacted. In order to approach the different stakeholders with a concrete idea, the “responsibility index (RI)” was created. This tool was presented to the different stakeholders as a possible way to evaluate the value creation potential of precision livestock farming. The RI can have multiple ways of interpretation. It can act as an umbrella for existing labels on food products. But it can also be seen as a benchmark between stakeholders. For example: if every farmer has an RI, a farmer can have an idea of which parameters he has to improve in, in comparison with other farmers. The RI can also be seen as a way to rank stakeholders (i.e. farmers, processors, etc.). The better the RI the higher those stakeholders are ranked. In order to give a value to this RI an underlying calculation model is generated. In order to validate this model two methods were incorporated. First, a general opinion about PLF and EU-PLF was gathered from different stakeholders. Secondly, a survey was established which was distributed to different stakeholders along the supply chain.

2.1. The responsibility index

The tool which is created has the objective to include different topics relating to cost-effectiveness, sustainability and fair & ethical trade, and is thus called the responsibility index (RI). This RI is partly based on static data collected on-farm and partly on real-time data measured by PLF technology (on-farm). In Section 2.1.1 more information is given about the visualisation of the RI. Section 2.1.2 will give some more information about the content of the RI. Section 2.1.3 will show the possible value of the RI for stakeholders. Section 2.1.4 will show the model which is linked to the RI.

2.1.1 Visualisation of the responsibility index

In order to find a visual way to present the responsibility index (RI), different existing certification methods for food products were analysed (i.e. Global Gap (globalgap.org), British Retail Consortium Standard (www.brcglobalstandards.com), Fair Trade (www.fairtrade.net)). There has not been chosen to follow the visual interpretation of the previous described certification methods because the logo of these certificates was not strong in their visualisation regarding the topics the certificates stand for. Therefore there has been chosen to base the visualisation of the RI on “The Cradle to Cradle certification for non-food products” (Figure 2; McDonough Braungart Design Chemistry, 2012). This

certificate follows the continuous improvement methodology that evaluates products across five categories of human and environmental health. This product certification is awarded at five levels (Basic, Bronze, Silver, Gold, Platinum). In order to achieve certification, a product must meet the requirements for a given level in all five categories. The Cradle to Cradle certification is a very visual certification, making it easy for producers to see where they can improve over time. Because of its visibility and clarity, the Cradle to Cradle certification served as an example for the RI.



Figure 2: The Cradle to Cradle certification for non-food products (McDonough Braungart Design Chemistry, 2012).

The RI has been visualised by combining aspects from the “Cradle to Cradle certification for non-food products” with 3 key indicators: Productivity, Fair and Ethical Trade, and Environment. Figure 3 visualizes how this combination led to a possible way of presenting the responsibility index (RI).



Figure 3: Visualisation of the responsibility index.

2.1.2 Key indicators included in the responsibility index

The responsibility index (Figure 3) consists of three key indicators: Productivity, Fair & ethical trade, and Environment. These key indicators were defined in the description of work (task 4.3) as cost effectiveness, sustainability and fair and ethical trade. The key indicators match the 3Ps (People, Planet, and Profit). Fair and ethical trade reflect both best practices of farmers as well as animal welfare. In this way the RI will distinguish itself from labels where animal welfare is often not included.

In order to quantify these three key indicators, factors and sub factors were created. In Table 1,

Table 2 and Table 3, the different factors and sub factors belonging to the three key indicators (Productivity, Fair & ethical trade and Environment, respectively) are summarized. Factors were defined at the meeting on May 9th, in Drongen (Belgium) among EU-PLF project members. Sub factors would be partly based on static data collected on-farm and partly on real-time data measured by PLF technology (on-farm).

Table 1: Factors and sub factors of "Productivity"

Factor	Sub factor
Animal production efficiency	<ul style="list-style-type: none">• Feed conversion ratio• Mortality rate
Animal production quality	<ul style="list-style-type: none">• Number of rejected animals by slaughterhouse• Number of animals treated with medication• Complete use of the animals into food products

Table 2: Factors and sub factors of "Fair and ethical trade"

Factor	Sub factor
Ethical approach of employees	<ul style="list-style-type: none"> • Humidity and temperature in working area
Fair price for farmer	<ul style="list-style-type: none"> • Price per animal/ price per kg animal product
Good feeding*	<ul style="list-style-type: none"> • Water accessibility for the animal • Feed conversion ratio (consumed feed/kg growth)
Good health*	<ul style="list-style-type: none"> • Cough • Rejected animals by slaughterhouse • Penalties at slaughterhouse • Mortality rate on farm • Number of animals treated with medication
Good housing*	<ul style="list-style-type: none"> • Dust and ammonia concentration in the barn • Stocking density (numbers on animals/m² in de the barn) • Uniform distribution of animals in the barn (distribution index)
Good transportation*	<ul style="list-style-type: none"> • Number of injuries during transport • Mortality rate during transport

* Based on the five freedoms of the Farm Animal Welfare Council (2009)

Table 3: Factors and sub factors of "Environment"

Factor	Sub factor
Water consumption	<ul style="list-style-type: none"> • Responsible use of water resources
GHG emissions (CO ₂ , NH ₃)	<ul style="list-style-type: none"> • Restricting greenhouse gas emissions
Unused nitrogen	<ul style="list-style-type: none"> • Optimisation of nitrogen-containing effluents

2.1.3 Possible value of the RI for stakeholders along the food-supply chain

In this paragraph two possible ways of interpreting an RI will be described. First, the RI as an umbrella for existing labels on food products, will be discussed. There are a number of very well-established labels on non-food products, e.g., the EU energy label on electrical devices like refrigerators). In addition it is known that certain labels on food products, focusing on sustainability, can have a major effect on sales. For example, the Magnum Infinity including sustainable growth of cacao helped Unilever to rise sales up to 8.4% (www.foodmanufacture.co.uk). Unfortunately, labels on food products often lose their objective due to the oversupply of labels presented on these food products. This loss is confirmed by the European Commission (2006) stating that "many consumers find using labels difficult as they contain too much information, much of which is not understood, is confusing and is poorly presented". The implementation of an index could solve this problem since indexes could summarize or estimate the overall 'effect' of multiple labels on one single food product (Figure 4). The index has no narrow focus on Productivity, Fair & ethical trade and Environment, solely (which distinguishes itself from labels), but instead an index focuses on multiple areas simultaneously.

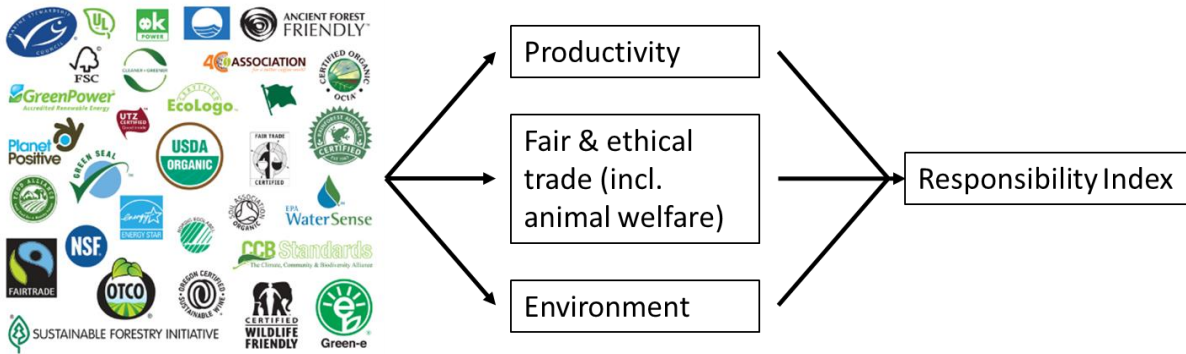


Figure 4: Example of existing labels within food products. The responsibility index could help summarizing the overall 'effect' of these labels on productivity, fair & ethical trade and environment, which is one of the possible ways to use or interpretate the RI

Secondly the RI can act as a tool to benchmark farmers or processors. The idea to rank certain stakeholders was first used by the international Non-Governmental Organisation Oxfam who has the ultimate goal to enable people to exercise their rights and manage their own lives. Therefore Oxfam started the campaign 'Behind the brands' in 2013 (Oxfam 2015). This initiative consists of a scoreboard (Figure 5; Oxfam 2015) which ranks the top-10 food companies (Nestle, PepsiCo , Unilever, Mondelez, Coca-Cola , Mars, Danone , Associated British Foods (ABF), General Mills, Kellogg's) according to their effort in different areas (e.g., sustainable water management, effectuate equal rights between women and men, the way they expect their suppliers to behave on these issues, and what they do to measure and improve their impact on every worker and farmer who makes their ingredients). The ranking is based on publicly available information on company policies. The campaign aims at providing consumers information about the products they buy. The ranking tool stimulates big food companies to perform better because they are benchmarked against other large good companies. Some examples of changes in policies of big food companies due to this campaign (e.g., Nestlé changed its policy related to land use) can be found on the 'Behind the brand' website (<http://www.behindthebrands.org/en-gb/campaign-news>).

Company	Score	Land	Women	Farmers	Workers	Climate	Transparency	Water	Total
1	1 (71%)	7	5	8	8	9	7	6	50/70
2	2 (69%)	8	5	7	6	8	7	7	48/70
3	3 (54%)	8	6	2	6	6	5	5	38/70
4	4 (43%)	7	2	2	3	6	5	5	30/70
5	5 (40%)	2	5	4	4	6	4	3	28/70

Figure 5: Ranking of big food companies by Oxfam in the campaign 'Behind the brands' (Oxfam, 2015)

A similar approach as the ranking tool made by Oxfam (Figure 5) could be useful for different stakeholders. Retail or integrators could rank their farmers according to their score on the RI. They could have a clear view in which key indicators (Productivity, Fair & Ethical Trade, and Environment) farmers must/can improve. The RI will also have advantages for farmers because the RI makes it possible for them to benchmark themselves with other farmers and in this way identify in which key indicators they could improve.

2.1.4 From draft to final model linked to the RI

Validation by the EU-PLF consortium during the EAAP conference in Copenhagen, Denmark (2014)

The RI model was presented at the EU-PLF consortium in Copenhagen (2014). There, the model was explained in detail and it was shown how the model summarized the different factors and sub factors to assess one value for each of the three key indicators. The model suggested was judged by the consortium as too complex, and thus, a simplification was carried out leading to a new model whereby some sub factors were grouped or deleted.

At this meeting also farmers were present who confirmed the importance of animal welfare. The opinion of the farmers was followed and animal welfare was included in the final RI. The final model as seen in Table 4 was established by processing the consortium's comments. Additionally, fine-tuning about terminology and the importance of certain sub factors were discussed with the members of the value creation group within the EU-PLF project, as well as with Compassion In World Farming (CIWF) and the Belgian retailer Colruyt.



Table 4: Final RI with key indicators and their associated factors and sub factors. Measurements linked to sub factors are based on static data from the farm, manual entries (i.e. notes in log books) and real-time measurements obtained by PLF technology on-farm.

				Key indicators			Measurements
Factors		Sub factors: measured with PLF		Productivity*	Fair and ethical trade*	Environment*	obtained by PLF technology/farm data/manual entries
	Good health	Animal health problems			x		# alarming coughs /herd size
	Good housing	Stocking density (number of animals in the barn)			x		Activity index
	Good housing	Uniform distribution of the animals (i.e. not all-in one corner)			x		Distribution index
Good feeding		Guaranteed water accessibility			x		Length of water interruption x affected living animals / total living animals
Good feeding	Animal production efficiency	Feed conversion ratio		x	x		Consumed feed / kg growth
Ethical approach of employees	Good housing	Impact of humidity and temperature on animals/worker well-being (on-farm)			x		Threshold for optimal animal humidity and T
Good health	Animal production quality	Number of rejected animals by slaughterhouse		x	x		Rejected / delivered animals
Good health	Animal production quality	Off-spec animals (= penalties at slaughterhouse after inspection of the carcass)		x	x		# Penalties / total slaughtered
Good health/transport	Animal production efficiency	Mortality rate		x	x		Number of dead animals on-farm/transport
Good transport		Injuries during transport		x	x		Incidences / delivery
Good health	Animal production quality	Number of animals treated with medication		x	x		# treated animals / herd size
	Fair price for farmer	Profitability		x			EBITA
	Water consumption	Responsible use of water resources			x	x	Consumption / living animals
	GHG emissions (CO ₂ , NH ₃)	Restricting greenhouse gas emissions				x	CO ₂ equivalent = electricity consumption per month + NH ₃ + CO ₂ + “unused nitrogen”
	“unused nitrogen”	Optimisation of nitrogen-containing effluents				x	N in feed minus N converted into weight
	Animal production quality	Complete use of the animals into food products		x			kg waste/animal



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Good housing	Ethical approach of employees	Impact of dust and ammonia on animals/worker well-being (on-farm)	x	Threshold for maximum dust and ammonia concentration
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2.2. General opinion of the different stakeholders on the EU-PLF project and value creation along the supply chain.

After the responsibility index (RI) and the final model were validated for the first time by the EU-PLF consortium and the farmers present at the EAAP conference in Copenhagen it was time to hear the opinion of different stakeholders on PLF technology, the EU-PLF project and task 4.3. It was decided to interview stakeholders about various topics concerning task 4.3. The interview was also performed when the stakeholder could not fill in the survey (see section 2.3) due to various reasons (e.g., no time, or a bit reluctant to fill in an entire survey) or when the opportunity was there to ask some extra questions to the stakeholder. The interview often started with one main question: What do you know about PLF technology? In this way a discussion started about the possibilities of PLF technology. If the stakeholder was comfortable on the topic PLF, questions about animal welfare and transparency along the supply chain, were asked.

2.3 Survey

An online survey was conducted to assess the importance of the three key indicators that form the RI, and their factors and sub factors for stakeholders along the supply chain (Annex B).

2.3.1 Distribution of the on-line survey

To contact different stakeholders, and especially retail, numerous communication channels were addressed. The first channel to distribute the online survey was via email (end of April 2014), where the majority of contact details were provided by EU-PLF partners (i.e. 13 email addresses of retail and 10 of farmers). The survey was accompanied with a letter (Annex A) which gave an introduction to PLF and explained the purpose of the survey. Unfortunately, the response rate was low (retail: 23%, farmers: 30%). Therefore, a more personal approach was established by trying to make in-person meetings through email with different stakeholders. The integrator Dalehead foods and the slaughterhouse Westvlees were contacted using this latter approach.

Although some retailers had filled in the survey by email (3 complete, 1 uncomplete) it was preferable to have some more information. Reaching retail was difficult due to the lack of relevant telephone numbers. Retail is very protective in sharing information on the internet. Often only general phone numbers concerning 'customer service support' could be found online. Still, one survey could be filled in by phone by reaching one retailer. An additional two retailers were willing to meet after a conversation on the phone explaining the project. In order to reach some more actors in retail, Colruyt (a retailer which was willing to fill in the survey) advised us to visit the "World of Private Label International Trade Show (PLMA)" in Amsterdam, The Netherlands (May 19th/20th 2015). Therefore, the fair was visited with hand-outs of the survey with the intention to speak with different actors in retail. However, this fair focused on processors and not on retail, and no valuable responses were collected.

Research has been done to visit other interesting fairs. Compassion In World Farming (CIWF) proposed the 'Good farm animal welfare awards' in Milan, Italy. However, this fair would result in a bias since the majority of attendees in such fair are in favour of efforts towards animal welfare. Another

interesting fair was the Sustainable Foods Summit Europe 2015. Due to practical reasons it was not possible to attend the fair. Eventually, a total of 23 respondents filled in the survey.

2.3.2 Analysing the data

According to McLeod S. A. (2008) a variety of rating scales have been developed to measure the attitudes of a person whereby the most widely used is the Likert scale. Measuring attitudes by asking people to respond to a series of statements about a topic, in terms of the extent to which they agree with them was developed by Likert (1932). “Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions” (Bowling, 1997; Burns, & Grove, 1997). The Likert Scale is a five (or more) point scale which is used to allow the individual to express how much they agree or disagree with a particular statement. The traditional way to report on a Likert scale is to give numeric values to each fixed choice response (McLeod S. A., 2008).

The methodology of the Likert Scale was used to analyse the answers of the survey. The 23 respondents were asked to fill in their preference on a 6 point scale whereby numeric values were assigned to each fixed response (Not important = 1, Less important = 2, Neutral =3, Important=4, Very Important=5, Not relevant =0). An example is given in Figure 6.

Please indicate how important the following topics are to you:

Example of a sub factor	Not important	Less important	Neutral	Important	Very important	Not relevant
Low feed conversion ratio (consumed feed/ kg growth)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Low mortality rate (number of dead animals on-farm)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Not important = value 1

Figure 6: Example of a question out of the survey whereby the 6 point Likert Scale can be seen whereby values are addressed to each fixed answer: Not important = 1, Less important = 2, Neutral =3, Important=4, Very Important=5, Not relevant =0).

In order to rank the importance of each sub factor for each stakeholder the Likert scale weights for each question were multiplied by the number of respondents of the stakeholder (Figure 7). In this way a ranking of sub factors could be obtained (Table 5).

#	Question	Not important	Less important	Neutral	Important	Very important	Not relevant	Total Responses
1	Low feed conversion ratio (consumed feed/ kg growth)	0	1	2	1	2	0	6
2	Low mortality rate (number of dead animals on-farm)	0	1	0	3	2	0	6

Figure 7: Answers given by the respondents of the stakeholder on each sub factor.

Table 5: Example how ranking of two factors is done using the methodology of the Likert scale (calculation). The higher the Likert scale, the higher the ranking is

Factor	Calculation	Ranking
Low feed conversion ratio (consumed feed/kg growth)	$1 \times 2 + 2 \times 3 + 1 \times 4 + 2 \times 5 = 22$	2
Low mortality rate (number of dead animals on-farm)	$1 \times 2 + 3 \times 4 + 2 \times 5 = 24$	1

Asking the importance of all key indicators, factors and sub factors to different stakeholders by means of the survey had a lead interview time of more than ten minutes. It was decided at the Value Creation Work Group meeting at Paestum (March 9-11th 2015) that this lead interview time was too long. Therefore the survey had to be shortened and it was decided to exclude the factors of the survey. Due to this decision, it was not possible to make a direct ranking of these factors. On the other hand the importance of different sub factors for the different stakeholders was represented in the survey and thus these sub factors could be ranked. The sub factors are linked to factors and key indicators and therefore it was possible to give the opinion of the stakeholders about factors and key factors as well.

3. Results

3.1 General opinion of the different stakeholders on the EU-PLF project and value creation along the supply chain.

Table 6 lists the different stakeholders that were approached and summarizes the main outcome of the assessment of the general opinion on the EU-PLF project and value creation along the chain. It should be noted that the outcome of the interview depended on the willingness to share information of the stakeholder's representative. Therefore, the topics discussed in the column 'main outcome' in Table 6 may differ between stakeholders. The main outcomes are summarized per stakeholder in the paragraphs below.

Table 6: Different stakeholders which gave their opinion about PLF and the EU-PLF project.

Stakeholder	Company*	Species ¹	Data	Name questioner ²	Main outcome
Feed companies	Nuscience (Drongen, BE)	P	February 13 th , 2015	HvH	<ul style="list-style-type: none"> Interested in PLF as a tool to improve transparency with farmers concerning data about feed trials.
Farmers	Farm 1 (Aalter, BE)	P	August 12 th , 2014	NB	<ul style="list-style-type: none"> Concerned about the cost price of PLF systems. Positive towards PLF concerning measuring animal welfare leading to more respect.
	Farm 2 (Nevele, BE)	B	August 13 th , 2014	NB	<ul style="list-style-type: none"> Concerned about the possible monopoly of retailers Return of investment for small farmers?
	Farm 3 (Zottegem, BE)	D	August 18 th , 2014	NB	<ul style="list-style-type: none"> Concerned about the possible monopoly of retailers Reluctant towards the industrialisation of the farm
Slaughter houses	Westvlees (Westrozebeke, BE)	P	May 13 th , 2015	HvH	<ul style="list-style-type: none"> Opportunities to increase transparency with farmers (e.g., Feed conversion ratio or animal live weight) and retail (e.g., logistics and automate stock management) Interested in measuring animal welfare (goal: reduce stress)
Processors	Lactalis (Laval, FR)	D	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Positive attitude towards PLF technology. Ranking farmers with the help of the RI looks at this moment impossible due to millions of farmers they are connected to (big investment). Ranking farmers could lead to a negative relationship with farmers.
	Friesland Campina (Amersfoort, NL)	D	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Impossible to monitor all farmers with PLF technology (big investment) At the moment, farmers have to meet high already high standards in terms of quality, animal welfare and environment. Friesland Campina formulated the route2020 strategy (period 2010-2020). The key words are sustainable growth and value creation: sustainable growth of the Company and maximising the value of all the milk produced by the Cooperative's member dairy farmers. The consumer has a lot of influence on retail and processors. Making campaigns directed to consumers about PLF technology and the possibilities towards animal welfare can have a positive effect on the supply chain.
	Ekomilk (Frydek-Mistek, CZ)	D	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Was not that interested in PLF technology. Animal welfare and environmental issues were not a hot topic for this processor.
	Eco-mes (Pazardzhik, BG)	P	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> No great interest in sustainability or animal welfare. Traceability and quality certificates are more important.
	Elburg Foods (Elburg, NL)	B	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Interested in an index which could act as an umbrella for all the labels in the EU. EU standards for quality are sufficient in terms of animal welfare and environment



Processors (part 2)					<ul style="list-style-type: none"> Although the retailers are very powerful in respect to other stakeholders of the supply chain, retail are very sensitive for the opinion of the consumers. The only way to make any changes or improvements in the supply chain is by public campaigns. Consumers are willing to pay a few cents more for sustainable produced meat but often the price difference between sustainable meat and not sustainable meat is too high.
	Salmuficio (Casaccio, IT)	P	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> A good traceability system and quality certificates are more important than animal welfare. Price is very important for the retail. In the future animal welfare can become more important and then the company will anticipate on that. Quote "I make all my decision based on what the consumer wants".
	Guina (Machelen, BE)	P	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Retail is a very closed stakeholder Price is still very important. UK is ahead in terms of animal welfare. Only one of his customers has forced him to do an internal audit about sustainability.
	Detry (Aubel, BE)	P	May 19 th -20 th , 2015	HvH	<ul style="list-style-type: none"> Intrest in one index instead of different labels In favour of one legal basis in the EU for slaughterhouses and farmers in terms of animal welfare. Retail is very powerful along the supply chain and only campaigns addressed to the consumer might change the way the retailer act.
Integrators	Dalehead Foods (Suffolk, UK)	P	Sept 2 nd , 2015	HvH	<ul style="list-style-type: none"> PLF could be potentially very useful (i.e. overview of farmers). First of all PLF should measure economically important parameters because every business is still economically driven. When the business is economically healthy more efforts can be addressed to animal welfare. Already rank 2300 farmers' as much as possible based on different parameters including sustainability and welfare. Insight in these indicators was asked by their customer, which is the retailer Waitrose. Waitrose can use these information to distinguish itself from competitors. At this moment ranking is done by experienced representatives of Dalehead. This is a low cost because periodic quality checks have to be conducted anyway. Less positive is the subjective method of assessing these farms due to human assessments. The more automated, the more reliable a measurement can be and it would be more consistent. The challenge is that it is sometimes difficult to motivate certain farmers to improve their production result or to increase efforts in animal welfare since the farmers are not the owners of the animals and they consider extra efforts as an extra workload. Concerning labels, especially for pork a European legislation or code of practice would be helpful in terms of definitions and terminology. Dalehead believes that in



					<p>the current market there is an overload of different labels addressed to the consumer. An RI could be a possibility but it should be very clear and simple and not include too many details.</p> <ul style="list-style-type: none"> • Is in favour of asking the opinion of the consumer about the RI. It can be a risk to develop something without knowing if there would be an additional value/or market for it.
	KFC (Milton Keynes, UK)	B	February 26th, 2015	SL	<ul style="list-style-type: none"> • KFC had a very positive attitude towards PLF in terms of the possibility to improve production and gather evidence for “a licence to produce”. • It also could be seen as a tool to help the assessments of farms and how they can improve.
Retail	Colruyt (Brussels, BE)	Ns	January 7 th , 2015	HvH	<ul style="list-style-type: none"> • In favour of reducing the numbers of labels. The consumer is overwhelmed and is often ignorant about the meaning of labels. • Had a positive feeling about the Responsibility Index. • Liked to have the opinion of the consumer included in the project. • PLF technology is very important and could be a way of having more transparency in the supply chain. Especially topics in animal welfare but also Feed conversion rate were very interesting for them to know.
	Metro (Düsseldorf, DE)	Ns	February 3 rd , 2015	HvH	<ul style="list-style-type: none"> • Metro Group joined the Dow Jones Sustainability Indices in September 2014. But it should be mentioned that this independently examined companies only represent environmental, social and economic topics. No animal welfare is included. • Too many labels are currently on the market. • Responsibility index should be very simple, not only for the consumer but as well for the whole supply chain. • Finding a gold standard to quantify what is ‘good’ and what is ‘wrong’ is very difficult. This is due to the fact that different countries focus on different aspects. A standardisation of ‘rules’ is difficult but should be made on the level of Europe. • Ranking farmers by using the Responsibility Index was impossible according Metro because they have more than 200.000 suppliers and millions of connected farmers. • Metro stressed that the farmer should innovate to survive. PLF will become even more important when demand of meat in the future rises and farmers will have more power. Metro remarked that sustainable use of meat (= use the complete animal) should be included in the value creation model. This remark has been translated as a sub factor in the model.



EU-PLF

Smart Farming for Europe

Value creation through *P*recision *L*ivestock *F*arming



Non-governmental organisation	Compassion In World Farming (Surrey, UK)	Ns	March 23 rd , 2015	HvH	<ul style="list-style-type: none"> Was pleased that the value creation model included the topic of animal welfare.
Other stakeholders	Covap & Elanco (Cordoba, SP); (Greenfield, USA)	Ns	March 4 th , 2015	GB	<ul style="list-style-type: none"> The opinion of Elanco (=Pharma/vet – business) and Covap (=Spanish Integrator i.e., milk industry) can be summarised as “money is no longer the only goal for farmers”. Especially recognition for the job (i.e. Animal welfare) and the possibility to invest more in social life (i.e., social dimension) gain a lot of importance.
	WWF (Gland, CH)	Ns	November 20 th , 2014	GB	<ul style="list-style-type: none"> WWF did not take up our offer to take part in a meeting in order for us to present the EU-PLF project and the value creation model. The reason for that was that precision farming on livestock had not their priority. They do not expect that this will change in the near future. The strategy that WWF wants to follow is a focus on fisheries and farming in third world countries.

¹abbreviations stand for broilers (B), fattening pigs (P), Dairy cows (D), or no specific animal species (NS)

² abbreviations stand for Helena van Hyfte (HvH), Nora Benremidja (NB), Simon Lague (SL) and Geert Bruggeman (GB)

3.1.1 The opinion of feed companies

As a premix and concentrate producing enterprise, Nuscience (Table 6) sees a lot of opportunities in PLF technology. Especially in terms of transparency with farmers concerning data about feed trials. The set-up of a trial at the farm facilities is often done by the feed company. Afterwards the trial is in the hands of the participating animals and the farmer. The feed company has to rely on the farmer to measure all different parameters manually (e.g., weight of animals, amount of consumed feed, mortality). Therefore, Nuscience is interested in automated real time systems, those that PLF can offer, provide the option to measure parameters constantly and to respond immediately in case certain parameters are not giving the required output.

3.1.2 The opinion of farmers

One of the 3 interviewed farmers was reluctant towards PLF technology because he associated PLF technology to industrialisation which had a negative connotation for him. Still 2 out of 3 farmers found that PLF technology can be seen as a warning tool and decision support tool. However, they indicated that they did not want to pay for all the costs (e.g., investment and installation costs) themselves. They also hope that PLF and the responsibility index will not lead to a monopoly of the retail but that it can lead to create more transparency along the supply chain. In this way retail will have less power. Respect towards the farmer concerning animal welfare was very important for the pig farmer.

3.1.3 The opinion of slaughterhouses

Westvlees (Table 6) sees a lot of opportunities in PLF technology due to lack of transparency in the supply chain. At this moment, farmers receive information on e.g., slaughter weight, lean meat percentage and health parameters. But the return of information is rather low. Farmers do not easily provide information (e.g., production figures as feed conversion ratio (FCR), mortality) about the farming process. For Westvlees, having more insight in Feed Conversion Ratio (FCR) and the animals live weight would be of great interest. At the moment Westvlees buys a certain batch of animals from a farmer without any information regarding the animals' live weight. With the help of PLF technology, Westvlees could estimate the weight of the animals on farms. In this way Westvlees could in the future anticipate more easily on which and how many animals they need and communicate with the farmers when the transport companies will pick up the pigs and deliver them to the slaughterhouse.

Measuring animal welfare in terms of transport would also be of great interest. Reduce or avoid stress is very important for meat quality. Currently, a limited number of trucks have sensors that monitor transport conditions. Transport companies could use this as a differentiation tool.

Also an increased transparency between retail and slaughterhouses would be interesting for Westvlees. For example, if Westvlees could have access to the retail's stocking data, they could optimise their logistics and automate stock management.

3.1.4 The opinion of processors

Processors (n = 8, Table 6) are in close contact with retail and according to them, retail has a very strong influence on the way processors should act in terms of for example pricing or qualifications for certain quality certificates. According to processors, price is still the most important issue for retail, particularly in the meat-processing area. Animal welfare and environment are not that important for the retail industry according to the opinion of the processors as long as the local quality system (e.g.,

the German QS code, www.q-s.de) has been followed. Only one fattening pig processor had to perform an internal audit concerning sustainability for a customer in the retail business. Often, milk processors are more closely in contact with the farmers than broiler or pig processors because they collect milk on the farms and have no intermediate step of the slaughterhouse. Therefore, milk processors are more aware of what's happening on farms in terms of animal welfare and environment and they value these key indicators as more important than a fattening pig or broiler processor does. Three out of 8 processors (one of each animal species; Table 6) had the opinion that the way the supply chain act, and especially the retail, can only be influenced by public campaigns focused on the consumer.

3.1.5 The opinion of integrators

Although the definition of an integrator can vary, it can be considered as an enterprise which works in close contact with farmers (i.e. contract based production) and controls logistics and production processes in its own slaughterhouses and the processing plant. Both integrators which were interviewed had a positive attitude towards PLF technology and the RI. Especially the possibility to rank farmers on a more objective and consistent way, was promising. Dalehead Foods believes that the current market overloads consumers with different labels but it's not always clear what the content of the labels is. The RI could be a solution in lowering the numbers of labels by acting as an umbrella but the RI should be visually very simple. Dalehead Foods thinks it could be of interest to listen to the opinion of the consumer about the RI.

3.1.6. The opinion of retail

Overall, there was a very positive feedback of the retail sector about the implementation of PLF at farm level, especially when this could lead to more transparency along the supply chain. Another conclusion is the interest in an RI instead of labels, despite the fact that the interviewed retail was unaware as to how this could be executed in practice. Metro had the opinion that including consumers in the project would be very complex. Colruyt would like to hear the opinion of the consumer about the EU-PLF project and especially about the RI.

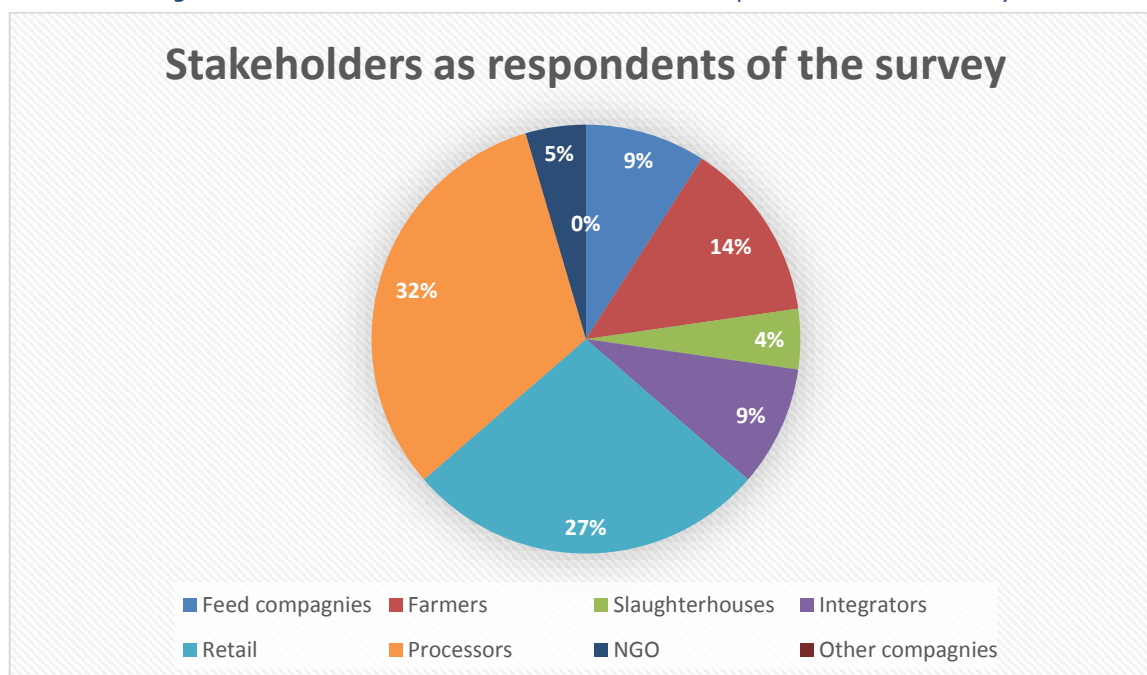
3.1.7 The opinion of an NGO and input by other stakeholders

CIWF was pleased that the value creation model included the topic of animal welfare. WWF did not want to give their opinion on the EU-PLF project because they have different priorities (i.e. fisheries and farming in third world countries). The opinion of Elanco and Covap was positive towards PLF technology especially in terms of measuring animal welfare and the social dimension (i.e. social life for farmer).

3.2. Survey

Below, more information regarding the 23 anonymous respondents can be found. These respondents are grouped according to the different groups of stakeholders along the supply chain (Table 9).

Figure 8: Deviation between stakeholders as respondents of the survey



3.2.1 Survey analysis of feed companies

A total of 3 representatives of the feed sector have filled in the survey. One had not completed the survey and therefore those answers were excluded from further analyses. Both remaining respondents were registered in the Benelux and had a different gender whereby aged ranged between 18-30 (1x) and 31-40 (1x) years old. They both had a university degree and 1 of the 2 had never heard about PLF technology before. The interest to be involved in future discussions was rather low (2/10, 5/10). The same could be seen in the willingness to pay as a consumer for product consumed in an ethical way (3/10 and 5/10). Concerning a single indication of responsible farming on food products (= responsibility index) both answered neutral.

Below, the importance of the sub factors (= translated in a ranking) for the feed companies can be seen for each of the factors: environment (Table 7), Fair and ethical trade (Table 8) and productivity (Table 9).

Table 7: Ranking of the sub factors related to the factor "environment" by feed companies.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	2
Unused nitrogen	Optimisation of nitrogen containing effluents	1

The sub factors a responsible use of water resources and optimisation of nitrogen containing effluents are equally important for feed companies (rank 1). Restricting greenhouse gas emissions was less important.

Table 8: Ranking of the sub factors related to the factor "Fair and ethical trade" by feed companies.

Factor	Sub factor	Ranking
Good health	Less animal health problems	1
	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	3
	Low mortality rate	2
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	2
	High uniform distribution of the animals (i.e. not all in one corner)	1
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	1
Good transport	Low number of injuries during transport	1
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	1
	Low feed conversion ratio (consumed feed/kg growth)	2
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	2
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

According to Table 8 'less animal health problems' and 'lower number of animals treated with medication' are the most important sub factors for the factor 'Good health'. For the factor 'Good housing' all sub factors were equally important except for 'low stocking density' which was less important. For the factor 'Good transport' no distinction is made in importance between 'Low number of injuries during transport' and 'Low mortality rate during transport'. In the factor 'Good feeding' the sub factor 'Guaranteed water accessibility' is more important than 'low feed conversion ratio'. For the factor 'Ethical approach of employees' the sub factor 'Low impact of humidity and temperature improving worker well-being (on farm)' was less important than 'Low impact of dust and ammonia concentration improving worker well-being (on farm)'.

Table 9: Ranking of the sub factors related to the factor "Productivity" by feed companies.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	3
	Lower number of animals treated with medication	1
	Complete use of the animal into food products	1
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	1
	Low mortality rate (number of dead animals on-farm)	1

According to Table 9, for the factor 'Animal production quality' the sub factors a 'Lower number of animals treated with medication' and the 'Complete use of the animal into food products' were the most important followed by 'Less rejected animals by slaughterhouse' and 'Less penalties at slaughterhouse after inspection of the carcass' respectively. For the factor 'Animal production efficiency' both sub factors were equally important ('Low feed conversion ratio (consumed feed/kg growth)' and 'Low mortality rate (number of dead animal's on-farm)').

In Table 10 Sub factors (linked to factors and key indicator) are ranked according to the score given by the feed companies. It can be seen that the most important sub factors (rank 1) were linked to Fair & ethical trade (less animal health problems, lower number of animals treated with medication, guaranteed water accessibility), environment (high responsible use of water resources, optimisation of nitrogen containing effluents) and productivity (lower number of animals treated with medication and the complete use of the animal into food products). The least important sub factor (low stocking density) for the feed sector was related to the factor 'good housing' of the key indicator Fair & ethical trade.



Table 10: Sub factors (linked to factors and key indicator) are ranked according to the score given by the feed companies

Sub factor	Factor	Key indicator	Score	Rank
High responsible use of water resources	Water consumption	Environment	10	1
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	10	1
Less animal health problems	Good health	Fair & ethical trade	10	1
Lower number of animals treated with medication	Good health	Fair & ethical trade	10	1
Guaranteed water accessibility	Good feeding	Fair & ethical trade	10	1
Lower number of animals treated with medication	Animal production quality	Productivity	10	1
Complete use of the animal into food products	Animal production quality	Productivity	10	1
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	9	8
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	9	8
Low number of injuries during transport	Good transport	Fair & ethical trade	9	8
Low mortality rate during transport	Good transport	Fair & ethical trade	9	8
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	9	8
Less rejected animals by slaughterhouse	Animal production quality	Productivity	9	8
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	9	8
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	9	8
Restricting greenhouse gas emissions	GHG emissions	Environment	8	16
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	8	16
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	8	16
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	8	16
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	8	16
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	8	16
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	7	22
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	7	22
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	4	24

3.2.2 Survey analysis of farmers

All three farmers come from the Benelux, are male (older than 41) and have passed high school or higher education. Two out of three farmers never heard about PLF technology before. Especially the two farmers who never heard about PLF were in favour of the slogan ‘keep it safe and simple’ and transparency in terms of animal welfare. All farmers find training and support important when new technology would be implemented. No conclusive answer was given on the importance of recognition for the hard work on the farm. Very different answers were given concerning the wish to future involvement in discussions ranging from 3 to 8 on a scale of 10. All three farmers were in favour of a single indication of responsible farming on food products.

On the question: “How much are you willing to pay as a consumer for ethical trade that takes into account the welfare of animals and farmers?” high scores were filled in by two farmers (7 and 8 out of 10), while one farmer thinks this is not important (score 2/10). The latter was given by the farmer who never heard about PLF technology and was not very interested (score 3) to be involved in further PLF discussions. As expected all farmers indicated that finding a fair price for the farmer is very important.

Below, the importance of the sub factors (= translated in a ranking) for the farmers can be found for each factor: environment (Table 11), Fair and ethical trade (Table 12) and productivity (Table 13).

Table 11: Ranking of the sub factors related to the factor "environment" by farmers.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	1
Unused nitrogen	Optimisation of nitrogen containing effluents	2

Restricting greenhouse gas emissions was considered as the most important sub factor together with responsible use of water resources. Optimisation of nitrogen containing effluents was less important for the farmers (Table 11).

Table 12: Ranking of the sub factors related to the factor "Fair and ethical trade" by farmers.

Factor	Sub factor	Ranking
Good health	Less animal health problems	1
	Less rejected animals by slaughterhouse	3
	Less penalties at slaughterhouse after inspection of the carcass	3
	Low mortality rate	2
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	2
	High uniform distribution of the animals (i.e. not all in one corner)	3
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	1

Good transport	Low number of injuries during transport	1
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	2
	Low feed conversion ratio (consumed feed/kg growth)	1
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	2
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

The most important sub factors in terms of good health were ‘less animal health problems’ and ‘lowering the number of animals treated with medication’. In terms of good housing the most important factors for farmers are a low impact concerning humidity and temperature and dust and ammonia concentration on animals. The least important sub factor was the uniformity of the distribution. In terms of transport is low number of injuries during transport equally important as mortality rate. In terms of good feeding a low feed conversion ratio is the most important sub factor. According to farmers a low impact of dust and ammonia is more important than impact of humidity and temperature on the worker well-being (Table 12).

Table 13: Ranking of the sub factors related to the factor "Productivity" by farmers.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	3
	Lower number of animals treated with medication	1
	Complete use of the animal into food products	2
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	2
	Low mortality rate (number of dead animals on-farm)	1

Especially a lower number of animals treated with medication was very important for the farmers (Table 13). This was followed by less rejected animals at the slaughterhouse and complete use of the animal in food products. Least important was the possibility to receive penalties at slaughterhouse. In terms of the factor ‘Animal production efficiency’ the sub factor ‘a low mortality rate’ is more important than ‘a low feed conversion rate’ (Table 13).

In Table 14 sub factors (linked to factors and key indicator) are ranked according to the score given by farmers. It can be seen that the most important sub factors (rank 1) were linked to the key indicators fair and ethical trade (Less animal health problems; Lower number of animals treated with medication) and productivity (Lower number of animals treated with medication). The least important sub factors were low stocking density (rank 22) and a low impact of humidity and temperature on the worker well-being on farm (rank 22) followed by uniform distribution of animals in the barn (rank 24).

Table 14: Sub factors (linked to factors and key indicator) are ranked according to the score given by farmers.

Sub factor	Factor	Key indicator	Score	Rank
Less animal health problems	Good health	Fair & ethical trade	15	1
Lower number of animals treated with medication	Good health	Fair & ethical trade	15	1
Lower number of animals treated with medication	Animal production quality	Productivity	15	1
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	14	4
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	14	4
high responsible use of water resources	Water consumption	Environment	13	6
Restricting greenhouse gas emissions	GHG emissions	Environment	13	6
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	13	6
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	13	6
Low number of injuries during transport	Good transport	Fair & ethical trade	13	6
Low mortality rate during transport	Good transport	Fair & ethical trade	13	6
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	13	6
Less rejected animals by slaughterhouse	Animal production quality	Productivity	13	6
Complete use of the animal into food products	Animal production quality	Productivity	13	6
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	13	6
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	12	16
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	12	16
Guaranteed water accessibility	Good feeding	Fair & ethical trade	12	16
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	12	16
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	12	16
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	11	21
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	10	22
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	10	22
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	9	24

3.2.3 Survey analysis of slaughterhouses

Although it was decided to focus more on the opinion of the retail, it is still important to take a look at the opinion of a slaughterhouse. Therefore Westvlees (Benelux) was asked to fill in the survey.

Westvlees knew PLF and is interested in further PLF discussions (8/10). A responsibility index would be of value because the respondent was interested in 'to see a single indication of responsible farming on food products'.

Below, the importance of the sub factors (= translated in a ranking) for the slaughterhouse can be found for each factor: environment (Table 15), Fair and ethical trade (Table 16) and productivity (Table 17).

Table 15: Ranking of the sub factors related to the factor "environment" by slaughterhouses.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	3
Unused nitrogen	Optimisation of nitrogen containing effluents	2

According to (Table 15) the responsible use of water resources was considered as the most important sub factor followed by 'optimisation of nitrogen containing effluents' and restricting greenhouse gas emissions respectively (Table 15).

Table 16: Ranking of the sub factors related to the factor "Fair and ethical trade" by slaughterhouses.

Factor	Sub factor	Ranking
Good health	Less animal health problems	1
	Less rejected animals by slaughterhouse	1
	Less penalties at slaughterhouse after inspection of the carcass	1
	Low mortality rate	1
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	2
	High uniform distribution of the animals (i.e. not all in one corner)	1
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	1
Good transport	Low number of injuries during transport	1
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	2
	Low feed conversion ratio (consumed feed/kg growth)	1
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	1
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

According to (Table 16) all sub factors in terms of good health were equally important. In terms of good housing low stocking density was less important than the other mentioned sub factors. In terms of transport both sub factors are equally important (Low number of injuries during transport; Low mortality rate during transport). In terms of good feeding a low feed conversion ratio is more important than 'guaranteed water accessibility). According to the slaughterhouse a 'low impact of dust and ammonia' is equally important as 'impact of humidity and temperature on the worker well-being' (Table 16).

Table 17: Ranking of the sub factors related to the factor "Productivity" by slaughterhouses.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	1
	Less penalties at slaughterhouse after inspection of the carcass	1
	Lower number of animals treated with medication	2
	Complete use of the animal into food products	1
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	1
	Low mortality rate (number of dead animals on-farm)	1

According to (Table 17) concerning the factor 'Animal production quality' the least important factor is 'Lower number of animals treated with medication'. In terms of 'Animal production efficiency' all sub factors were equally important (Table 17).

In Table 18 sub factors (linked to factors and key indicator) are ranked according to the score given by the slaughterhouse. It can be seen that the most important sub factors (rank 1) were linked to the key indicators environment, fair and ethical trade and productivity. Within 'fair and ethical trade' especially the factor good health was well established. The least important factor was 'Ethical approach of employees' as both sub factors linked with this factor received the lowest ranking.



Table 18: Sub factors (linked to factors and key indicator) are ranked according to the score given by slaughterhouse

Sub factor	Factor	Key indicator	Score	Rank
high responsible use of water resources	Water consumption	Environment	5	1
Less animal health problems	Good health	Fair & ethical trade	5	1
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	5	1
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	5	1
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	5	1
Lower number of animals treated with medication	Good health	Fair & ethical trade	5	1
Low number of injuries during transport	Good transport	Fair & ethical trade	5	1
Low mortality rate during transport	Good transport	Fair & ethical trade	5	1
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	5	1
Less rejected animals by slaughterhouse	Animal production quality	Productivity	5	1
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	5	1
Complete use of the animal into food products	Animal production quality	Productivity	5	1
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	5	1
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	5	1
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	4	15
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	4	15
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	4	15
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	4	15
Guaranteed water accessibility	Good feeding	Fair & ethical trade	4	15
Lower number of animals treated with medication	Animal production quality	Productivity	4	15
Restricting greenhouse gas emissions	GHG emissions	Environment	3	21
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	3	21
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	2	23
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	2	23

3.2.4 Survey analysis of processor

As mentioned in section 2.2.1, processors were met at the PLMA fair. This group was at first not foreseen as an actor in the supply chain and therefore processors were at first not mentioned in the survey as a stakeholder but due to their importance they were added eventually. A total of 7 processors have filled in the survey on handouts. These were analysed after manual insertion in the survey program.

The correspondents' age was well distributed (18-30 (1x), 31-40 (2x) 41-50 (2x) and 50+ (2x)). Five males and 2 females originating from the Benelux (3x), Germany (2x), France (1x) and other (1x) had minimum a high school degree. Three out of 7 persons had heard about PLF technology before and most of them were interested to be involved in future discussions (5/10 (1x), 6/10 (2x), 8/10 (3x), 10/10). Four were interested in a responsibility index followed by one neutral answer and two not interested. The willingness to pay for ethical produced food was very divers (6/10 (3x), 7/10 (2x), 8/10 and 10/10). A fair price for a farmer was also quite important (neutral (1x), important (2x), Very important (4x). The Seven processors could be identified as Lactalis, Friesland Campina, ZMI (Zurmüller International), Eipro, Ekomilk, Belgomilk and Elburg.

Below, the importance of the sub factors (= translated in a ranking) for processors can be found for each factor: environment (Table 19), Fair and ethical trade (Table 20) and productivity (Table 21).

Table 19: Ranking of the sub factors related to the factor "environment" by processors.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	2
Unused nitrogen	Optimisation of nitrogen containing effluents	3

In the factor environment (Table 19), the most important sub factor is 'high responsible use of water resources'. This is followed by 'Restricting greenhouse gas emissions'. The least important sub factor was 'Optimisation of nitrogen containing effluents' (Table 19).

Table 20: Ranking of the sub factors related to the factor "Fair and ethical trade" by processors.

Factor	Sub factor	Ranking
Good health	Less animal health problems	2
	Less rejected animals by slaughterhouse	4
	Less penalties at slaughterhouse after inspection of the carcass	4
	Low mortality rate	3
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	2
	High uniform distribution of the animals (i.e. not all in one corner)	3
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	2
Good transport	Low number of injuries during transport	1

	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	1
	Low feed conversion ratio (consumed feed/kg growth)	2
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	1
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	2

For the factor 'Good health' (Table 20) the most important sub factor could be identified as 'Lower number of animals treated with medication'. For the factor 'Good housing' the most important sub factor could be identified as 'Low impact of humidity and temperature on animals'. The least important factor was 'high uniform distribution of the animals'. For the factor 'Good transport' both sub factors were equally important. For the factor 'Good Feeding' the sub factor 'Guaranteed water accessibility' was the most important. For the factor 'Ethical approach of employees' the sub factor which relates to humidity and temperature was more important than the one relating to dust and ammonia (Table 20).

Table 21: Ranking of the sub factors related to the factor "Productivity" by processors.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	2
	Lower number of animals treated with medication	1
	Complete use of the animal into food products	2
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	1
	Low mortality rate (number of dead animals on-farm)	2

For the factor 'Animal production quality' (Table 21) the sub factor 'Lower number of animals treated with medication' was the most important. For the factor 'Animal production efficiency' the sub factor 'Low feed conversion ratio' was more important than mortality. It should be mentioned that often the answers vary a lot within a factor (i.e. animal production efficiency, good housing, and environment). This can be assigned to the fact that within the stakeholder 'processor' a lot of variety can be seen. Some could be identified as meat or milk processors which leads to possible other opinions about the importance of transport, welfare at slaughterhouse etc. About other factors the response was almost unanimously the same (i.e. animal production quality) (Table 21).

In Table 22 sub factors (linked to factors and key indicator) are ranked according to the score given by the slaughterhouse. It can be seen that the most important sub factors (rank 1) was linked to the key fair and ethical trade and the factor 'good health'. Also the following ranked sub factors (rank 2 and 3) are linked to the key indicator fair and ethical trade. The least important sub factors were linked with the factor 'Ethical approach of employees' (linked to key indicator: Fair and ethical trade).



Table 22: Sub factors (linked to factors and key indicator) are ranked according to the score given by processors.

Sub factor	Factor	Key indicator	Score	Rank
Lower number of animals treated with medication	Good health	Fair & ethical trade	29	1
Guaranteed water accessibility	Good feeding	Fair & ethical trade	28	2
Less animal health problems	Good health	Fair & ethical trade	27	3
Low mortality rate during transport	Good transport	Fair & ethical trade	27	3
Lower number of animals treated with medication	Animal production quality	Productivity	27	3
Low number of injuries during transport	Good transport	Fair & ethical trade	26	6
high responsible use of water resources	Water consumption	Environment	25	7
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	25	7
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	25	7
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	25	7
Restricting greenhouse gas emissions	GHG emissions	Environment	24	11
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	24	11
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	24	11
Complete use of the animal into food products	Animal production quality	Productivity	24	11
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	24	11
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	23	16
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	22	17
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	22	17
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	22	17
Less rejected animals by slaughterhouse	Animal production quality	Productivity	20	20
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	20	20
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	19	22
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	19	22
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	19	22

3.2.5 Survey analysis of integrators

It was decided to discuss the data received from processors and integrators separately. The two integrators which filled in the survey are both originating from the UK (age between 18-30 and 41 -50 years old). Both followed higher education, and one had not heard about PLF technology. Fair price for a farmer ranged from neutral to important. The willingness to pay for a product produced with attention to ethical trade was 3/10 and 6/10. The interest for a responsibility index ranged from neutral to interested.

Below, the importance of the sub factors (= translated in a ranking) for integrators can be found for each factor: environment (Table 23), Fair and ethical trade (Table 24) and productivity (Table 25).

Table 23: Ranking of the sub factors related to the factor "environment" by integrators.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	3
Unused nitrogen	Optimisation of nitrogen containing effluents	2

In the factor environment (Table 23), the most important sub factor is 'high responsible use of water resources'. This is followed by 'Optimisation of nitrogen containing effluents' and Restricting greenhouse gas emissions' respectively (Table 23).

Table 24: Ranking of the sub factors related to the factor "Fair and ethical trade" by integrators.

Factor	Sub factor	Ranking
Good health	Less animal health problems	2
	Less rejected animals by slaughterhouse	3
	Less penalties at slaughterhouse after inspection of the carcass	4
	Low mortality rate	1
	Lower number of animals treated with medication	2
Good housing	Low stocking density (number of animals in the barn)	3
	High uniform distribution of the animals (i.e. not all in one corner)	2
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	2
Good transport	Low number of injuries during transport	1
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	2
	Low feed conversion ratio (consumed feed/kg growth)	1
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	1
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

For the factor ‘Good health’ (Table 24) the most important sub factor could be identified as ‘Low mortality rate’. For the factor ‘Good housing’ the most important sub factor could be identified as ‘Low impact of humidity and temperature on animals’. For the factor ‘Good transport’ both sub factors were equally important. For the factor ‘Good Feeding’ the sub factor ‘Low feed conversion ratio’ was the most important. For the factor ‘Ethical approach of employees’ both sub factors were equally important (Table 24).

Table 25: Ranking of the sub factors related to the factor "Productivity" by integrators.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	3
	Less penalties at slaughterhouse after inspection of the carcass	2
	Lower number of animals treated with medication	2
	Complete use of the animal into food products	1
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	1
	Low mortality rate (number of dead animals on-farm)	1

For the factor ‘Animal production quality’ (Table 25) the sub factor ‘Complete use of the animal into food products’ was the most important. For the factor ‘Animal production efficiency’ both the sub factors were equally important (Table 25).

In Table 26 sub factors (linked to factors and key indicator) are ranked according to the score given by integrators. It can be seen that the most important sub factors (rank 1) were linked to the key indicators fair and ethical trade (Low mortality rate (2x); Low number of injuries during transport; Low feed conversion ratio) and productivity. Complete use of the animal into food products; Low feed conversion ratio; Low mortality rate). The least important sub factor is low stocking density (rank 24) (Table 26).



Table 26: Sub factors (linked to factors and key indicator) are ranked according to the score given by integrators.

Sub factor	Factor	Key indicator	Score	Rank
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	10	1
Low number of injuries during transport	Good transport	Fair & ethical trade	10	1
Low mortality rate during transport	Good transport	Fair & ethical trade	10	1
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	10	1
Complete use of the animal into food products	Animal production quality	Productivity	10	1
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	10	1
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	10	1
high responsible use of water resources	Water consumption	Environment	9	8
Less animal health problems	Good health	Fair & ethical trade	9	8
Lower number of animals treated with medication	Good health	Fair & ethical trade	9	8
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	9	8
Guaranteed water accessibility	Good feeding	Fair & ethical trade	9	8
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	9	8
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	9	8
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	9	8
Lower number of animals treated with medication	Animal production quality	Productivity	9	8
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	8	17
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	8	17
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	7	19
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	7	19
Less rejected animals by slaughterhouse	Animal production quality	Productivity	7	19
Restricting greenhouse gas emissions	GHG emissions	Environment	6	22
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	6	22
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	5	24

3.2.6 Survey analysis of retail

A total of 7 representatives of retailers have filled in the survey completely. One retailer from the UK (unknown) has only filled in the survey partly and was deleted. The female representatives were greater in number and the age of all representatives ranged between 18-30 (1x), 31-40 (1x) 41-50 (1x) and 50+ (3x) years old. The majority had a minimum education at university level. Retail from Benelux, Germany and UK were represented and could be identified as Ahold, Asda, Metro, Colruyt, Tesco and 1 unknown. Only one retailer never heard about PLF technology. Two out of three were rather not interested to be involved in further PLF discussion (score of 2/10 and 3/10) whereby for the other retailers their interest ranged between 6 and 9/10.

Concerning a single indication of responsible farming on food products (= responsibility index) the majority of retailers were neutral (4x), one interested and one not interested. The answers concerning the willingness to pay as a consumer was very divers ranging from 3, 5 (2x), 7 (2x) and 10. Also a fair price for the farmer was ranging between less important, neutral, important (2x) and very important (2x).

Below you can find the importance of the sub factors (= translated in a ranking) for retail for each factor: environment (Table 27), Fair and ethical trade (Table 28) and productivity (Table 29).

Table 27: Ranking of the sub factors related to the factor "environment" by retail.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	2
Unused nitrogen	Optimisation of nitrogen containing effluents	2

In the factor environment (Table 27), the most important sub factor is 'high responsible use of water resources'. This is followed by 'Optimisation of nitrogen containing effluents' and restricting greenhouse gas emissions' which both have the same ranking (Table 27).

Table 28: Ranking of the sub factors related to the factor "Fair and ethical trade" by retail.

Factor	Sub factor	Ranking
Good health	Less animal health problems	2
	Less rejected animals by slaughterhouse	4
	Less penalties at slaughterhouse after inspection of the carcass	4
	Low mortality rate	3
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	2
	High uniform distribution of the animals (i.e. not all in one corner)	3
	Low impact of humidity and temperature on animals	1
	Low impact of dust and ammonia on animals	1
Good transport	Low number of injuries during transport	2
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	1

	Low feed conversion ratio (consumed feed/kg growth)	2
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	1
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

For the factor ‘Good health’ (Table 28) the most important sub factor could be identified as ‘Lower number of animals treated with medication’. For the factor ‘Good housing’ the most important sub factors could be identified as ‘Low impact of humidity and temperature on animals’ and ‘Low impact of dust and ammonia on animals’. For the factor ‘Good transport’ low mortality rate during transport was the most important sub factor. For the factor ‘Good Feeding’ the sub factor ‘Guaranteed water accessibility’ was the most important. For the factor ‘Ethical approach of employees’ both sub factors were equally important (Table 28).

Table 29: Ranking of the sub factors related to the factor "Productivity" by retail.

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	1
	Less penalties at slaughterhouse after inspection of the carcass	1
	Lower number of animals treated with medication	3
	Complete use of the animal into food products	2
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	2
	Low mortality rate (number of dead animals on-farm)	1

In case of the factor ‘Animal production quality’ (Table 29) two factors were equally important (‘less rejected animals by slaughterhouse’ and ‘less penalties at slaughterhouse after inspection of the carcasses’). In case of the factor ‘Animal production efficiency’ the most important factor is ‘Low mortality rate’ (Table 29).

In Table 30 sub factors (linked to factors and key indicator) are ranked according to the score given by retail. It can be seen that the most important sub factor (rank 1) was linked to the key indicator fair and ethical trade (Lower number of animals treated with medication). Also the following ranked sub factors (rank 2 and 3) are linked to the key indicator ‘fair and ethical trade’.

The least important sub factors were ‘High uniform distribution of the animals’, ‘Low impact of humidity and temperature improving worker well-being’ and ‘Low impact of dust and ammonia concentration improving worker well-being’. Little importance was given to the well-being of workers on the farm.

Table 30: Sub factors (linked to factors and key indicator) are ranked according to the score given by retail.

Sub factor	Factor	Key indicator	Score	Rank
Lower number of animals treated with medication	Good health	Fair & ethical trade	29	1
Guaranteed water accessibility	Good feeding	Fair & ethical trade	28	2
Less animal health problems	Good health	Fair & ethical trade	27	3
Low mortality rate during transport	Good transport	Fair & ethical trade	27	3
Lower number of animals treated with medication	Animal production quality	Productivity	27	3
Low number of injuries during transport	Good transport	Fair & ethical trade	26	6
high responsible use of water resources	Water consumption	Environment	25	7
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	25	7
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	25	7
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	25	7
Restricting greenhouse gas emissions	GHG emissions	Environment	24	11
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	24	11
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	24	11
Complete use of the animal into food products	Animal production quality	Productivity	24	11
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	24	11
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	23	16
Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	22	17
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	22	17
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	22	17
Less rejected animals by slaughterhouse	Animal production quality	Productivity	20	20
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	20	20
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	19	22
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	19	22
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	19	22

3.2.7 Survey analysis by an NGO

The Non-governmental organisation (NGO), Compassion in World Farming (CIWF) who helped in the validation of the survey has also given their opinion.

Below, the importance of the sub factors (= translated in a ranking) for the NGO can be found for each factor: environment (Table 31), Fair and ethical trade (Table 32) and productivity (Table 33).

Table 31: Ranking of the sub factors related to the factor "environment" by NGO.

Factor	Sub factor	Ranking
Water consumption	High responsible use of water resources	1
GHG emissions	Restricting greenhouse gas emissions	2
Unused nitrogen	Optimisation of nitrogen containing effluents	2

In the factor environment (Table 31), the most important sub factor is 'high responsible use of water resources'. This is followed by 'Optimisation of nitrogen containing effluents' and restricting greenhouse gas emissions' which both have the same ranking (Table 31).

Table 32: Ranking of the sub factors related to the factor "Fair and ethical trade" by NGO.

Factor	Sub factor	Ranking
Good health	Less animal health problems	1
	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	3
	Low mortality rate	1
	Lower number of animals treated with medication	1
Good housing	Low stocking density (number of animals in the barn)	1
	High uniform distribution of the animals (i.e. not all in one corner)	2
	Low impact of humidity and temperature on animals	2
	Low impact of dust and ammonia on animals	2
Good transport	Low number of injuries during transport	1
	Low mortality rate during transport	1
Good feeding	Guaranteed water accessibility	1
	Low feed conversion ratio (consumed feed/kg growth)	2
Ethical approach of employees	Low impact of humidity and temperature improving worker well-being (on farm)	2
	Low impact of dust and ammonia concentration improving worker well-being (on farm)	1

For the factor 'Good health' (Table 32) the most important sub factors (rank 1) could be identified as 'Less animal health problems', 'Low mortality rate' and 'Lower number of animals treated with medication'. For the factor 'Good housing' the most important sub factor could be identified as 'Low stocking density'. For the factor 'Good transport' both sub factors were equally important. For the

factor ‘Good Feeding’ the sub factor ‘Guaranteed water accessibility’ was the most important. Concerning the factor ‘Ethical approach of employees’ the sub factor ‘Low impact of dust and ammonia concentration improving worker well-being (on farm)’ was more important than ‘Low impact of humidity and temperature improving worker well-being (on farm)’ (Table 32).

Table 33: Ranking of the sub factors related to the factor "Productivity" by NGO...

Factor	Sub factor	Ranking
Animal production quality	Less rejected animals by slaughterhouse	2
	Less penalties at slaughterhouse after inspection of the carcass	2
	Lower number of animals treated with medication	1
	Complete use of the animal into food products	1
Animal production efficiency	Low feed conversion ratio (consumed feed/kg growth)	2
	Low mortality rate (number of dead animals on-farm)	1

In case of the factor ‘Animal production quality’ (Table 33) the sub factor ‘Lower number of animals treated with medication’ is most important for the NGO. In case of the factor ‘Animal production efficiency’ the most important factor is ‘Low mortality rate’ (Table 33).

In Table 34 sub factors (linked to factors and key indicator) are ranked according to the score given by the NGO: Compassion in World Farming (CIWF). It can be seen that most of the sub factors with ‘rank 1’ were linked to the key indicator fair and ethical trade. The least important sub factor was ‘Less penalties at slaughterhouse after inspection of the carcass’ (rank 24).

Table 34: Sub factors ranked according their score given by the NGO: Compassion in World Farming (CIWF)

Sub factor	Factor	Key indicator	Score	Rank
High responsible use of water resources	Water consumption	Environment	5	1
Less animal health problems	Good health	Fair & ethical trade	5	1
Low mortality rate (number of dead animals on-farm)	Good health	Fair & ethical trade	5	1
Lower number of animals treated with medication	Good health	Fair & ethical trade	5	1
Low stocking density (number of animals in the barn)	Good housing	Fair & ethical trade	5	1
Low number of injuries during transport	Good transport	Fair & ethical trade	5	1
Low mortality rate during transport	Good transport	Fair & ethical trade	5	1
Guaranteed water accessibility	Good feeding	Fair & ethical trade	5	1
Low impact of dust & ammonia concentration improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	5	1
Lower number of animals treated with medication	Animal production quality	Productivity	5	1
Complete use of the animal into food products	Animal production quality	Productivity	5	1
Low mortality rate (number of dead animals on-farm)	Animal production efficiency	Productivity	5	1
Restricting greenhouse gas emissions	GHG emissions	Environment	4	13
Optimisation of nitrogen containing effluents	Unused nitrogen	Environment	4	13
High uniform distribution of the animals (ex. not all in one corner)	Good housing	Fair & ethical trade	4	13
Low impact of humidity & temperature on animals	Good housing	Fair & ethical trade	4	13
Low impact of dust & ammonia on animals	Good housing	Fair & ethical trade	4	13
Low impact of humidity & temperature improving worker well-being (on farm)	Ethical approach of employees	Fair & ethical trade	4	13



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Less rejected animals by slaughterhouse	Good health	Fair & ethical trade	3	19
Low feed conversion ratio (consumed feed/kg growth)	Good feeding	Fair & ethical trade	3	19
Less rejected animals by slaughterhouse	Animal production quality	Productivity	3	19
Less penalties at slaughterhouse after inspection of the carcass	Animal production quality	Productivity	3	19
Low feed conversion ratio (consumed feed/kg growth)	Animal production efficiency	Productivity	3	19
Less penalties at slaughterhouse after inspection of the carcass	Good health	Fair & ethical trade	2	24

4. Summary and conclusions

4.1 Supply chain

It was decided that involvement of the consumer in this project would be too complex. Due to the importance and power of retail in the supply chain and the reflection of the consumer's point of view in the strategy of retail, it was decided to focus on the latter. During the development of task 4.3 it became clear that processors and integrators have a valuable opinion especially due to the close relationship with retail (Figure 8).

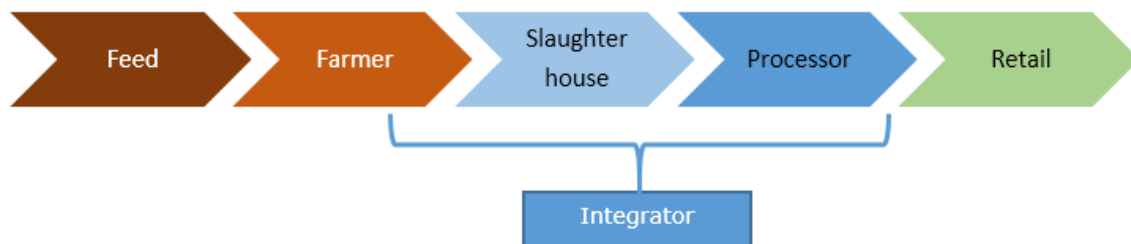


Figure 8: Final setup of the discussed stakeholders along the supply chain

4.2 The responsibility index (RI) and the linked model

In order to evaluate the potential value of precision livestock farming along the supply chain, different stakeholders had to be contacted. In order to approach the different stakeholders with a concrete idea the "responsibility index (RI)" was created. This tool was presented to the different stakeholders as a possible way to evaluate the value creation potential of precision livestock farming. The RI can have multiple ways of interpretation. It can act as an umbrella for existing labels on food products. In this case the RI (Figure 5) could be displayed on food products and is comparable with the existing "Cradle to Cradle certification for non-food products". In order to give a certain value to this tool the different key indicators (Productivity, fair and ethical trade and environment) were linked to this RI and the 3P vision whereby animal welfare was strongly represented. The key indicators were divided in factors and sub factors and were summarised in a model (Table 4). The RI can also be seen as a benchmark between stakeholders. Retail or integrators could rank their farmers according to their score on the RI. They could have a clear view in which key indicators (Productivity, Fair and Ethical Trade, and Environment) farmers must/can improve. The RI will also have advantages for farmers because the RI makes it possible for them to benchmark themselves with other farmers and in this way identify in which key indicators they could improve.

4.3 Value of PLF technology for different stakeholders

The feed industry sees opportunities in PLF technology on farm. Especially in terms of transparency with farmers concerning data about feed trials. About the RI opinions were quite neutral. This can be explained by the fact that the feed industry will have no immediate profit of such an RI on food

products. **Farmers** which were interviewed had a positive attitude towards PLF (especially as a warning tool and decision tool). But they indicate that they could not bear the costs of all the installations themselves. With PLF technology and the RI, they hope that there is an evolution towards a supply chain with more transparency because they are afraid that retail will gain even more power in the future. Respect concerning the work they do is also very important. Especially concerning animal welfare. Farmers want to be rewarded for the efforts they make. On the level of **slaughterhouse** also here an increase of transparency along the supply chain is mentioned as a possible positive effect of PLF technology. This transparency would be on the level of the farmer (e.g. logistics) and of retail (e.g. responding on demand). Other parameters in which they would like to have more insight with PLF technology is Feed Conversion Rate (FCR), weight of the animals, antibiotic use, measuring animal welfare and mortality during transport. **Processors** are in close contact with the retail and according to them, retail has a very strong influence on the way processors act. According to processors, price is still the most important issue. Especially in the meat business. Animal welfare and environment are not that important for the retail industry according to the opinion of the processors as long as the quality system is assured. In section 3.4 a detailed description of the opinion of different processors about PLF, labels and animal welfare was given. According to the **integrator** we interviewed, the implementation of PLF on farms can be potentially very useful, especially in order to have an overview of farmers. Also, the more automated, the more reliable a measurement can be. Concerning labels, at this moment there is possibly an overload of variation for the consumer. The integrator is not sure if a responsibility index would work because it wants to tell too much information at once and for consumers in the decision making process, price is often still the most important factor. First of all PLF should measure economically important parameters. Because every business is still economically driven. First this has to be successful and secondly other parameters (such as animal welfare) can be addressed. **Retail** which was interviewed personally was in favour in reducing the numbers of labels. They had a positive attitude about the Responsibility Index but it should be simple to understand. A remark was the fact that they would have liked to have the opinion of the consumer included in the project. According to retail, PLF technology is important and could be a way of having more transparency in the supply chain. Especially topics in animal welfare but also feed conversion rate would be very interesting for them to know.

4.4 Value of different sub factors which can be measured by PLF technology for different stakeholders

Some sub factors of the final model linked with the RI and mentioned in the survey were clearly more important than others. In Table 35 an overview is given regarding the most important key indicators and sub factors for different stakeholders along the supply chain. The sub factor 'lower number of animals treated with medication' can be considered as the most important one due to the fact that it received a 'rank 1' by Feed, Farmer, Slaughterhouse, Processor, Retail and the NGO. The sub factor 'Less animal health problems' was also scored high. Only the slaughterhouse did not give rank 1 to this parameter. Table 35 can be seen as the final output of task 4.3. This output can be considered as a leading guidance to start task 4.4.

Table 35: Importance of key indicators and sub factors for different actors along the supply chain.

Stakeholder	Key indicator		Most important sub factor*
Feed companies	Productivity	1	Less animal health problems , lower number of animals treated with medication (2x), Guaranteed water accessibility, high responsible use of water resources, optimisation of nitrogen containing effluents
	Fair and ethical trade	3	
	Environment	2	
Farmers	Productivity	1	Less animal health problems , Lower number of animals treated with medication (2x)
	Fair and ethical trade	1	
	Environment	1	
Slaughterhouses	Productivity	1	High responsible use of water resources, less animal health problems, less rejected animals by slaughterhouse (2x), less penalties at slaughterhouse (2x), low mortality rate, lower number of animals treated with medication, low number of injuries/mortality during transport, low feed conversion ratio, complete use of the animal into food product.
	Fair and ethical trade	1	
	Environment	2	
Processors	Productivity	1	Lower number of animals treated with medication (rank 1 and 3), Less animal health problems (rank 2)
	Fair and ethical trade	3	
	Environment	2	
Integrators	Productivity	1	Low mortality rate (2x), low feed conversion ratio (2x), low number of injuries/mortality during transport, complete use of the animal into food products
	Fair and ethical trade	3	
	Environment	2	
Retail	Productivity	2	lower number of animals treated with medication (rank 1), Guaranteed water accessibility (rank 2), Less animal health problems (rank 3)
	Fair and ethical trade	1	
	Environment	2	
NGO	Productivity	2	High responsible use of water resources, Less animal health problems , Low mortality rate (2x), Low stocking density (number of animals in the barn), Low number of injuries during transport, Guaranteed water accessibility, Low impact of dust & ammonia concentration improving worker well-being (on farm), Lower number of animals treated with medication (2x), Complete use of the animal into food products
	Fair and ethical trade	1	
	Environment	1	

*When no rank is mentioned the sub factor can be identified as rank 1.

5. Acknowledgments

The Value Creation Group greatly acknowledge all those that were involved in the development of the RI and in the writing of this Deliverable. Also greatly acknowledged are the stakeholders that participated in this project and did efforts by giving their opinion and valuable answers in the survey (Colruyt, Metro, Ahold, Tesco, Asda, CIWF, Dalehead Foods, Golden Foods Siam, Covap, Elanco, Ra-Se genetics, Agrifirm, Nuscience, Lactalis, Friesland Campina, ZMI (Zurmüller International), Eipro, Ekomilk, Belgomilk, Elburg, Westvlees.)

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7. Annex

Annex A: letter which accompanied the online survey in order to correctly inform the actor which received the survey.

Smart farming for Europe: EU PLF project *Survey*

Dear Madam/Sir,

This survey is

On behalf of the **European project EU PLF** (<http://www.eu-plf.eu>). One of the objectives of this project is to determine the **social and economic value** for different "**Precision livestock farming**" (**PLF**) applications used **on-farm** and in the **supply chain**. PLF is the continuous automated real-time monitoring of production and reproduction, health and welfare of livestock and environmental impact. In order to reach **the opinion** of the whole supply chain about indicators and the **profitability of mature PLF technology** we address this assessment to you.

In this stage of the project the goal is to determine the degree of importance of certain topics for you as a stakeholder. We very much appreciate your opinion and feedback and would like to thank you in advance for it.

This survey will take **only 5-10 minutes** of your time and can be filled in **anonymously**. The information will be used **within the European research project** and **conclusions from this survey** will be published.

Should you have any concerns or questions regarding this survey, please feel free to contact us at info@eu-plf.eu.

Thank you in advance!

Link to the survey:

https://az1.qualtrics.com/SE/?SID=SV_doRHJN2VIz4iMrH&Preview=Survey&BrandID=qtrial2015az1





Annex B: Online survey which is distributed among different actors in the supply chain

English ▼

EU-PLF

Dear Madam/Sir,

This survey is established on behalf of the **European project EU PLF** (<http://www.eu-plf.eu>). One of the objectives of this project is to determine the **social and economic value** for different **"Precision livestock farming" (PLF)** applications used **on-farm** (sound and/or visual detection, automatic weighing, etc.) and in the **supply chain**. "Precision livestock farming" is the continuous automated real-time monitoring of production and reproduction, health and welfare of livestock and environmental impact. A model applicable for pigs is established and pre-validated by the retail. In order to reach **the opinion** of the whole supply chain about indicators and the **profitability of mature "Precision livestock farming" technology** we address this assessment to you.

This survey will take **only 5-10 minutes** of your time and can be filled in **anonymously**. The information will be used **within the European research project** and **conclusions form this survey** will be published.

Should you have any concerns or questions regarding this survey, please feel free to contact us at **info@eu-plf.eu**.

Thank you in advance!



Smart Farming for Europe

Value creation through *P*recision *L*ivestock *F*arming



What is your age?

- Under 18 years old
 - 18-30 years old
 - 31-40 years old
 - 41-50 years old
 - + 50 years old
-

What is the highest degree or level of school you have completed?

- Some high school, no diploma
 - High school graduate
 - College
 - University
 - Doctorate Degree
-

Please select your gender:

- Male
 - Female
-

In which country are you registered?

- Benelux
- Denmark
- Germany
- UK
- Spain
- France
- Other (Please define)



Smart Farming for Europe



Value creation through *P*recision *L*ivestock *F*arming

Please indicate to **which sector** you belong. *(Only one answer is possible)*

- Feed
 - Breeder
 - Farmer
 - Slaughterhouse
 - Processor
 - Integrator
 - Retail
 - Consumer
 - Veterinarian
 - Technology Provider
 - NGO
 - Academics
-

Have you ever heard about "**Precision Livestock Farming**"?

Yes

No

How important is it to you to be involved in future "**Precision Livestock Farming**" discussions?

Not at all important

0 1 2 3 4 5 6 7 8 9 10

Very important

In case you are interested in the conclusions of this survey, please enter your email address. (No personal data will be distributed.)

Would you like to see a single indication of responsible farming on food products?

Such an indication would be derived from certification and real-time observations and act as an umbrella for other labels.

Not interested
Neutral
Interested

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
High efficiency and quality of animal production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High welfare of farmers and animals; Fair & ethical trade	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High environmentally sound production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
High responsible use of water resources	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restricting greenhouse gas emissions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Optimisation of nitrogen-containing effluents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Low feed conversion ratio (consumed feed/ kg growth)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low mortality rate (number of dead animals on-farm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Less rejected animals by slaughterhouse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less penalties at slaughterhouse after inspection of carcass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower number of animals treated with medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complete use of the animal into food products	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Low impact of humidity & temperature improving worker well-being (on-farm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low impact of dust & ammonia concentration improving worker well-being (on-farm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Less animal health problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less rejected animals by slaughterhouse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Less penalties at slaughterhouse after inspection of carcass	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low mortality rate (number of dead animals on-farm)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower number of animals treated with medication	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Guaranteed water accessibility for the animal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low feed conversion ratio (consumed feed / kg growth)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Low stocking density (number of animals in the barn)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
High uniform distribution of animals in the barn (ex. not all in one corner)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low impact of humidity & temperature on animals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low impact of dust & ammonia on animals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Complete use of the animal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please indicate how important the following topics are to you:

	Not important	Less important	Neutral	Important	Very important	Not relevant
Low number of injuries during transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Low mortality rate during transport	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How much are you willing to pay as a consumer for ethical trade that takes into account the welfare of animals and farmers?

Very little Very much

0 1 2 3 4 5 6 7 8 9 10

Please answer the questions below:

	Not important	Less important	Neutral	Important	Very important	Not relevant
How important to you is a "fair price for the farmer" ?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Are there any other parameters/measures of importance from your point of view? If yes, please mention it in the following box.

Thanks a lot for your participation!

This information is of great value and will be used in the EU PLF project.

Annex C: Presentation given at the EU-PLF meeting in Paestum (Italy) for the VCG.

Task 4.3
 'Estimate value creation potential for the exchange of information along the supply chain'

Ir. Helena Van Hyfte
 Norah Benmerdja
 Dr. ir. Geert Bruggeman

Bright Farm by Precision Livestock Farming
 Aimed to precision livestock farming in Europe

Our goal

Incorporating the 3 P-vision into a tool to create value along the supply chain with implementation of PLF technology

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Value creation

"Responsibility Index" as a basis for an investment tool (Idea Metro)

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First step..

Prototype to calculate "Responsibility Index"

Shape

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Prototype "Responsibility Index"

Draft presented at Copenhagen

Key indicator
 • Productivity

Factors
 • Animal production efficiency
 • Animal production quality
 • Labor & energy efficiency
 • Feed efficiency

How to quantify these factors?
 Introducing **subfactors** with certain value (weight, answer, score)
 → Will define final score

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Table 1: Key Performance Indicators

Code	Indicator	golden standard	PLF technology	weight	answer	ranking	score
P1.2	reproduction numbers		direct	33,33%			83%
P1.2.1	weight (kg) / pig	120-205	weighting	5,56%	130	3	0,167
P1.2.2	throw (kg) / pig	1,8-2,4	register	5,56%	1,8	3	0,167
P1.2.3		0-10	register	5,56%	0	3	0,167

Table 2: Summary of Indicators

Code	Indicator	weight	answer	score
P1	Animal Production (Efficiency)			87/100
P1.1	Production numbers		90%	36/40
P1.2	Reproduction numbers		83%	37/20
P1.3	Death		40	85%

Table 3: Certification Summary

Certification	Productivity	Fair & Ethical trade	Animal Health & Welfare	Environment
	5,56%			

Final Score: BRONS

Annotation: Draft presented at Copenhagen → Not feasible → To complicated

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7 Prototype "Responsibility Index"

First draft of scoreboard: Presented in Copenhagen (EU_PLF Conference August)

- + very detailed
- not feasible/To complicated

→ FEEDBACK →

→ simplify →

- less factors, less subfactors
- work with 3 level ranking (A,B or C) for each factor

→ Ease of use = high priority →

Second draft of scoreboard: - Not all subfactors linked to PLF technology

Third draft of scoreboard:

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8 Prototype "Responsibility Index"

Factors	Subfactors: measure with PLF	Dimension: key indicators			Values obtained by PLF technology	Reference value Assigned in later stadium
		Profitability	People	Planet		
Good health	Medication	x	x	x	# warning coughs / herd size	A, B and C
Good housing	Stocking density	x	x	x	# Undisturbed sleep / day / herd size	A, B and C
Good housing	Occupation	x	x	x	# occupation	A, B and C
Good feeding	Animal production consumption	x	x	x	Length of feed interruptions affected living animals / total living animals	A, B and C
Good feeding	Animal production efficiency	x	x	x	Average feed conversion	A, B and C
Ethical approach of employees	Good housing	x	x	x	Threshold for optimal animal humidity and T	A, B and C
Good health	Animal production quality	x	x	x	Rejected / delivered animals	A, B and C
Good health	Animal production quality	x	x	x	# Parasites / total slaughtered	A, B and C
Good health	Animal production efficiency	x	x	x	Average mortality per herdsize	A, B and C
Good transportation	Animal production quality	x	x	x	Incidence / delivery	A, B and C
Good health	Animal production quality	x	x	x	# treated animals / herd size	A, B and C
Fair price for farmer	Cost effectiveness	x	x	x	BSFA	A+B
	Water consumption	x	x	x	Consumption / living animals	B+B
	CO2 emissions (CO2)	x	x	x	CO2 equivalent = electricity consumption per month + NH3	B+B
	NH3	x	x	x	+ CO2 + "ammonia nitrogen"	C+C
	"ammonia nitrogen"	x	x	x	# of feed in each converted into weight	C+C
Good housing	Ethical approach of employees	x	x	x	Threshold for maximum dust and ammonia concentration	

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9 Second Step..

Validation of the model "dialogue with actors in the supply chain"

Polish "Responsibility Index" Shape

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10 "Responsibility Index" ...Why interesting for Retailer?

BEHIND THE BRANDS: FOOD COMPANIES SCORECARD

RI = Marketable tool?
Ranking farmers?
What does the retailer think about the RI model?

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11 ...Why interesting for farmer ?

- ✓ Willingness to pay Economic profit ↔ 'Soft values'
- ✓ Willingness to accept 'to be part of it'
- ✓ Changing attitude & behaviour of farmer Early warning Prediction => Due to PLF

Social Benefits > Economic Benefits

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12 Dialogue - Farmer

The opinion of farmers in pig, dairy and poultry!

Positive	Dangers
Soft values: <ul style="list-style-type: none"> • more respect • time 	Low prices continue? → EU PLF to expensive
Rewarded for efforts in animal welfare	Big investment, Return of investment for small farmer? Monopoly

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Validation by Metro

- too much labels on the market
- RI model should be **very simple**
- Ranking farmers? → impossible
- Make farmer aware that **innovation is needed to survive** (instead of pushing them)
- Due to high demand of meat in the future **farmers will have more power** → PLF will be more **important**
- Standardised → Impossible due to different systems/approaches (German, Dutch or Australian)

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Validation by Metro

- Need to use meat of the whole animal = **avoid waste!**

less animals should be raised which would lead to lower stocking density, etc.

Improving animal welfare

Translated as a factor in the RI Model

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Note: Dow Jones Sustainability Index (world & Europe)

- Goal: include those companies that represent the best **environmental, social and economic** performers in their particular industry (ex. Retailer)
→ **no animal welfare is included**
- The basis for inclusion in these indices is an analysis of companies' sustainability strategies and programmes that is conducted by the **independent agency** RobecoSAM
- **Annual assessment** based on an **online questionnaire + company documentation**
- Companies that participate receive a **Company Benchmarking Scorecard** comparing their sustainability performance to that of their industry peers
- **METRO GROUP rejoined the Dow Jones Sustainability Indices World and Europe (sept 2014)**

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Validation by Colruyt

- Active policy in sustainable production:
*Remark: until now (too) much focus lays on environmental impact → Colruyt would like to include more **Animal welfare issues** in their policy*
- Too much labels on the market
- Dangerous to not involve the consumer
- 2nd meeting: 1 April 2015

Validation by WWF

- No interest in the project
- Focus at this moment lays on sustainability in fisheries not on farm animals

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Validation by KFC

- Positive attitude towards PLF in terms of the possibility to improve production and gather evidence for "a licence to produce".
- benefit to help farm assessment improve

"If only I had these tools when I was managing 200 farms".

- having dialogue with growers → using the evidence for marketing purposes

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Validation by retailers

Overall very positive feedback of the retail sector:

- Interest in index instead of labels
- Interest in PLF which can measure/include animal welfare
- Appreciation that the validation model is already well developed → leads to acceptance

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2 April 2015 Distribution online survey

Feed → Farmer → Slaughter → Retailer → Consumer ?

agrifirm
Monopoly of retailers????

COMPASSION in world farming
cifw.org

Need for consumer organisation?

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Food for thought..

Grouped by labels

"Responsibility Index"

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Discussion

- Involving consumer organisation?
- PLF technology to measure waste?
- ...

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"A green world is in *our hands*.."

The End ...Let's start now

Ir. Helena Van Hyfte
Narah Benmeridja

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