Barriers and levers for innovations

Deliverable 4.2

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This research was made possible by funding from **SusAn**, an ERA-Net co-funded under European Union's Horizon 2020 research and innovation programme (www.era-SusAn.eu) under Grant

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1 Introduction

The report at hand presents the stakeholders' perception about innovations to reduce feed food competition identified thanks to task 4.1. It focuses on the factors, at farm, territorial or value chain scales, limiting or promoting the uptake of the innovations. This report serves as a foundation for the definition of scenarios and the innovations modelling (WP4).

2 Methods

The opinions of the beef sector stakeholders were collected through focus groups. By "stakeholders", we mean: breeders, farm advisors and value chain actors as feed companies, veterinarians, genetic breeders, slaughterhouses, retailers,… (see below for the list of participants). These stakeholders were mobilized separately, to avoid risk of self-censorship. Therefore, two kinds of focus groups were organized: with breeders and farm advisors on one hand, with value chain actors on the other hand[1]. However, this recommendation has not been followed in every focus group (see below).

The groups were artificial groups (i.e. created by us for the period of our research), except in Ireland where they were natural groups (i.e. already existing groups). The recruitment of breeders used snowball sampling technique. Farm advisory structures and other advisory actors were involved as relay-actors (see appendix 7.1 for the list of relay-actors). Farm advisors were mobilized through partnership of each institution involved. The recruitment of the value chain actors was conducted directly by us, after identifying the main actors for each activity within the value chain. Indeed, if breeders and farm advisors came "in their own name", value chain actors were selected specifically as "representative actors".

The purpose of the focus groups was to gather the opinions of breeders, farm advisors and value chain actors on feed-food competition in general, and on the innovations identified through task 4.1 in particular, in order to identify and characterize the barriers and levers to their implementation at farm, territorial and value chain scales. Breeders and farm advisors were also invited to identify innovations by themselves.

The report at hands also include results of focus groups organized in Ireland. The purpose of these focus groups was quite similar, i.e. gather opinions of breeders on ideas for more sustainable beef production.

The Walloon focus groups were recorded and fully transcribed[2]. The analysis of the French, Italian and Irish focus groups is based on the reports.

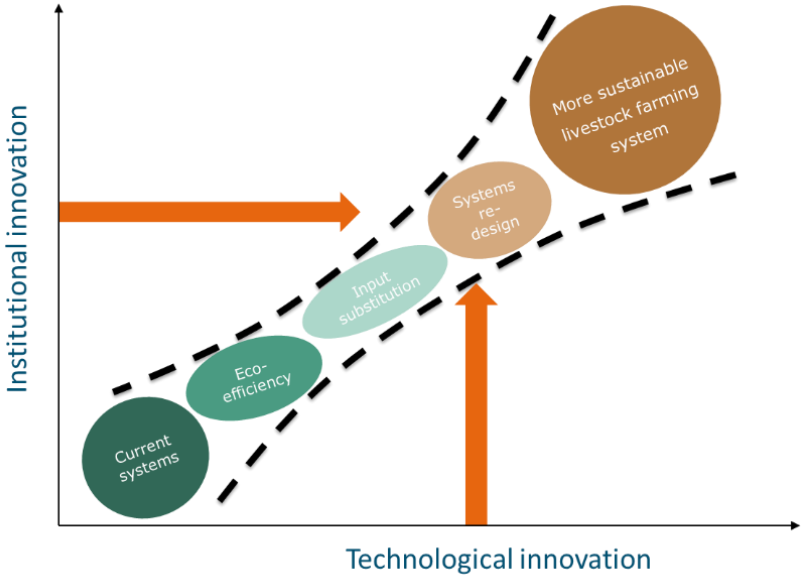
We classified the innovations according to the "Efficiency, Substitution and Re-design" (ESR) framework [2] and the type of practice. This conceptual framework is designed to characterize farmers' transition towards sustainable agriculture following three stages: eco-efficiency, substitution and redesign [3]. In our case, efficiency refers to innovations that improve the effectiveness of fodder production or animal feeding practices and limit waste. Substitution refers to the replacement of the part of the feed

[1] Indeed, focus groups require both sufficient social homogeneity but also diversity within the group in order to encourage interactions [1].

[2] However, the recording of the FG7 is partial because of a technical issue. The transcription is thereupon based on recording and notes.

competing with human food by less competitive feeds. Finally, the re-design stage occurs when the causes of the problem are recognized, allowing to develop solutions at farm or regional level to modify the system and make it more self-sufficient.

Figure 1 – Steps towards a more sustainable livestock farming system using the ESR approach, [4] adapted from [2].



Despite the criticisms that can be made of it [5], we decided to use the ESR approach because it seemed interesting to us to distinguish the transition strategy(ies) mobilized by each innovation and to differentiate between innovations that are closer to business as usual and those that are more disruptive. Indeed, the latter are potentially the ones for which support (advice, policies, research) will be most crucial. However, it should be kept in mind that the boundaries between each "step" are rather blurred and therefore each innovation can mobilize several transition strategies. In addition, it is not necessary to go through the three steps in the pathway towards more sustainable systems.

3 Clarifications

Some deviations occurred compared to the methods initially planned. They are listed below.

3.1 Participants

In Wallonia, we met some difficulties in the mobilization of breeders leading to deviations compared to the selection matrix initially planned (see appendix 7.2). We can identify the lack of time, the lack of interest and moody conditions (low prices) in beef farming among reasons explaining these difficulties. We also met some difficulties in the mobilization of some value chain actors, also due to a lack of time and interest. Therefore, some links of the value chain lack.

In France and in Italy, some breeders involved were not only breeders, but also representative actors. Moreover, some focus groups mixed breeders and value chain actors. In both cases, this mix between participants speaking “in their own name” and participants speaking “in the name of” could introduce some bias. Indeed, it is generally advised to pay attention to the symmetry in the relations between participants – or in other words homogeneity within the group in terms of “status” – in order to avoid risk of self-censorship [1], [6], [7]. We considered these focus groups as “breeders and advisors focus group” for the analysis. No focus group with only value chain actors was organized nor in France neither in Italy. Indeed, French partners prefer to mobilize them in a second step, i.e. to debate the scenarios).

Irish partners organized only focus groups with breeders.

3.2 Interview guide

French and Walloon focus groups followed the version of the interview guide initially planned (see appendix 7.3). Italian partners asked for a shorter version, for practical reasons (time and staff availability) (see appendix 7.4). Irish partners did not use interview guide.

French, Italian and Walloon partners organized differently the sequence of the voting. First, the list of innovations put to the vote was not exactly the same in each country. Second, the way in which the vote was organised in France differs from the method initially planned (see below). Irish partners did not carry out any voting sequence.

These variations led to disparities in the results obtained, some aspects were not documented in the same way in each country.

4 Results

4.1 Participants Description

In total, 10 focus groups were organized: 3 in France, 2 in Italy, 2 in Ireland and 3 in Wallonia, involving the participation of 108 stakeholders: 75 breeders, 19 advisors and 14 up and downstream value chain actors (see Table below). The focus groups were organized between September 2018 and February 2019.

Table 1 – Description of the sample

	Date	Location	Type and number of participants	Case study
Focus Group 1	20th September 2018	Vouziers (Ardennes) (FR)	5 breeders 3 advisors 1 experimental farm 1 slaughterhouse (only PM)	FR.LOR-BF
Focus Group 2	27th October 2018	Aulon (Creuse) (FR)	6 breeders 2 advisors 1 school of agriculture representative	FR.LIM-CC
Focus Group 3	18th December 2018	Vic-sur-Sère (Cantal) (FR)	6 breeders 2 advisors 1 agricultural high school representative	FR.CANT-CC FR.CANT-DCC
Focus group 4	9th October 2018	Verona (Veneto) (IT)	3 breeders 1 farmer and feed trader 1 breeders union 2 nutrition advisors 1 veterinarian nutritionist 1 advisor 1 expert in quality control	IT.F900 IT.F226
Focus group 5	7th February 2019	Carmagnola (Piemonte) (IT)	3 breeders 3 advisors	Not related to a case study. Breeders-Fatteners, suckler to beef system
Focus Group 6	29th November 2018	Ciney (Wallonia) (BE)	5 breeders 2 advisors	2 BE-CC2 3 BE-BF
Focus group 7	4th December 2018	Ciney (Wallonia) (BE)	6 breeders 2 advisors	3 BE-CC1 3 BE-BF
Focus Group 8	18th December 2018	Ciney (Wallonia) (BE)	Representative actors: 2 for feed manufacturers 1 for rural veterinarians 1 for cattle traders 3 for transformation (1	

			for the long supply chain, 2 for the short supply chain)	
Focus group 9	6th November 2018	Grange (co. Meath) (IR)	Beef Discussion Group members 20 beef farmers some in suckler beef production and others in beef finishing 1 Advisor	IR-CC IR-F
Focus group 10	27th November 2018	Portlaoise (co. Laois) (IR)	20 beef farmers in suckler beef production and in beef finishing 1 Advisor	IR-CC IR-F
Total			108	

As we pointed out above, FG 1, 2, 3, and 4 mix breeders and advisors with value chain actors. We decided to process the data coming from these focus groups as "breeders and advisors" focus groups.

In France, the focus groups gathered breeders from each French case study (i.e. FR.LOR-BF, FR.LIM-CC, FR.CANT-CC, FR.CANT-DCC). Thanks to a partnership, the chambers of Agriculture of the Ardennes, Creuse and Cantal mobilized the breeders and advisors.

In Italy, the focus group at Verona gathered breeders related to the two Italian case studies (IT.F-900, IT.F-226) (FG4), while the focus group at Carmagnola gathered breeders who are not related to a specific case study, but are still fatteners (suckler to beef system) (FG5). The Piedmont Meat Producers Organization (ASPROCARNE) was in charge to mobilize the breeders.

In Wallonia, the focus groups with breeders gathered on one hand "intensive" holdings (breeders as well as fatteners) (FG 6), and on the other hand "extensive" holdings, including conventional and organic farms (breeders as well as fatteners too) (FG 7). In this way, three of the four case studies defined in WP2 were represented (BE-CC1, BE-CC2 et BE-BF)[3]. The advisors were mobilized through the partnership with the Walloon Livestock Association (AWE - Elevéo).

As we pointed out above, we encountered some difficulties in mobilizing Walloon farmers, and even some relay-actors. We then multiplied the number of relay actors to help us in this task. In total, 14 breeders agreed to participate in each focus group, but less than half (respectively 5 and 6 breeders) really participated. Indeed, they cancelled their participation when we recall them, a few days before the focus group, or even the D-day. The selection matrix initially planned could therefore not be respected (see Appendix 7.2).

The Walloon focus group with value chain actors gathered representatives for the followed activities: feed manufactories (2), rural veterinarians (1), cattle trade (1) and transformation (short and long supply chain) (3). The representative actors for the genetic selection and the retailers (short supply chain) cancelled their participation the D-Day for personal reasons. We also failed to mobilize retailers (long supply chain) (not interested, lack of time) and consumers association (no answer despite many reminders).

[3] We have deliberately excluded the BE-D case study (dairy farm).

In Ireland, the focus groups gathered breeders from each case study (IR-CC, IR-F). Teagasc mobilized these breeders.

4.2 Their opinion about feed-food competition

In French and Walloon focus groups (i.e. focus groups using the full version of the interview guide), we introduced the day by asking participants their opinion on the feed-food competition, using the technique of "moving debate".

Most participants agree with the objective to increase the share of resources inedible by human in cattle feeding, but at different degrees (from simply agree to totally agree). However, some questions raised:

- Why focus on beef production? Some participants pointed out that feed-food competition is much more problematic in other types of farming (especially pig). Therefore, they do not really understand why the project focus on beef farming, which, from their point of view, is not really in competition with food (FG3, 6, 8). Some feel this as an additional attack on beef farming (FG6, 8).
- Many participants highlighted the competition with energy production (especially biofuel) which is much more problematic for them (FG1, 2, 3, 5, 6)[4]. One focus group also mentioned the competition with road network (FG2).
- What resources are inedible by human? Not all the participants shared the same definition of what an inedible resource is. Some of them think the feed-food competition in terms of products other in terms of area (FG2, 6, 8). One participant mentioned also the possible progress in the agri-food sector: an inedible resource today could be edible tomorrow (FG1).

Moreover, if most of participants share the objective of reducing feed-food competition for the breeding phase, some of them are sceptical for the fattening phase (FG2, 3, 6, 7), as explain in the following excerpt:

> *"I think we have to differentiate between breeding and fattening. For the breeding part, we are at about 90 if not 100% of feed not consumed by humans. On the other hand, for the fattening part, we need richer feed: there we need a minimum of cereals, or at least grain corn, to concentrate the ration. We can't escape it!" (BE-BF, FG6).*

The need to concentrate the ration is not the only explanation participants mentioned to justify their use of cereals as feed. They also mention the too low selling price and the too stringent production standards associated with bread-making cereals, as explain in the following excerpt:

> *"We are not asking for anything better than to produce milling grain. It's just that they [editor's note: the value chain] don't want to buy it from us or they don't want to pay us [editor's note: at a fair price]. So we produce feed [grain] because it produces a little more." (BE-BF, FG6)*

The opinions differ on this point, some participants believing in other ways to fattening, such as grass fattening or use of by-products (FG6, 7, 8) (see below).

Two participants radically disagree with the general objective. The first one totally disagrees with the use of by-products, because it involves industries dependency[5] (BE-BF in organic farming, FG7). The second one disagrees with grass fattening, which is incompatible from his point of view with a high level of performance, as explained in the following excerpt:

[4] Some participants of the FG8 also mentioned biofuel, but not in a negative way.
[5] This breeder-fattener (BE-BF) has an organic holding and is engaged in a process of feed autonomy.

"With the price of land, we are obliged to have results: it imposes breeds that make performances, and to finish the animals with something other than grass" (BE-BCC1 in conversion to organic farming, FG7).

Grass fattening and use of by-products were often mentioned by participants as ways to decrease feed-food competition. However, many barriers (but also levers) rose during discussion (see details below).

Participants also mentioned elements as barrier to change the current beef production, such as:

- The globalization and in particular the imports: *"the meat market is a globalized market".* Some participants also pointed out the *"lack of control"* for the imported products (FG6, 7, 8);
- The recurrent "attacks" and "misinformation" against beef farming leading to hasty generalizations: *"In fact, we are compared, I believe far too often to our agriculture here in Europe, to that of there [editor's note: South America]: we make an amalgam, and in fact, it [editor's note: the agriculture in Belgium] has nothing to do with it [editor's note: the agriculture in South America]."* (BE-BF, FG6) (FG1, 6, 8);
- The lack of incentives for less feed-food competition (political incentives, value chain incentives, consumers incentives) (FG1, 3);
- The type of system (easier in extensive than in intensive systems, in breeding than in fattening systems) (FG 2)
- The pedo-climatic conditions and the area: in some agricultural regions, livestock farming is the only option given the soil and climate conditions (FG2)

Finally, if most participants agree with the objective to increase the share of resources non edible by human in cattle feeding, reduce the feed food competition is not a "matter of concern" for all of them. The farmers most concerned by this topic were farmers engaged in processes such as search of autonomy, forage efficiency, decrease of the herd or diversification of crops rotation which may result in a reduction in feed-food competition from their point of view, even if this is not the initial objective (FG 1, 6, 7). They were all engaged in organic farming production excepted for two of them: an "intensive" fattener (BE-BF, FG6), using many by-products, and an extensive breeder, basing all his system on grass (BE-CC2, FG6).

4.3 Their representation of the innovation

In French and Walloon focus groups (i.e. focus groups using the full version of the interview guide), we also questioned participants about what "innovation" means to them. Indeed, experts we met for interviews during the task 4.1 often asked us what we mean when we spoke about "innovation". Here is the definition retained in the frame of the project:

"Innovation is the introduction of something new or improved into something that has a well-established character, such as products, processes, marketing or organizational methods. In other words, it means applying ideas, knowledge or practices that are new to a particular context with the purpose of creating positive change that will provide a way to meet needs, take on challenges or seize opportunities. Innovation is generally synonymous with risk-taking."

For most participants, innovation means "novelty" (FG1, 2, 3, 6). Only one focus group mentions that innovation can also be the update of an old or forgotten practice/thing (FG6).

Innovation is also understood in terms of "breakthrough" or "revolution" (FG1, 2) or, by contrast, in terms of evolution, progress or improvement of something already existing (FG1, 2, 6, 7).

Innovation can also lie in alternatives (FG6) or is associated with change (FG2). Indeed, innovation is for some participants a tool/path towards adaptation to change (FG7), resilience (FG1), but also autonomy (FG2) and independence (FG7) ("*taking back the keys to one's home*").

Finally, innovation is necessary associated with technology for some participants (FG1, 2, 6).

Innovation also implies a certain posture, i.e. the ability of questioning oneself (FG7).

Participants also highlight that innovation can be thought at many scales (not only farm scale) (FG1, 3). One group especially pointed out that it must focus on the value chain scale (FG3).

For some participants, innovation must have certain characteristics, such as creativity (FG1), usefulness (FG1) progressiveness (FG7), necessarily risky (FG7) and long-term thinking (avoid temporary innovation) (FG3, 7).

In addition, innovation should necessarily aim at economic profitability or viability (FG1, 2, 3, 6, 7), and to a lesser extent, improvement of quality of life (FG6), efficiency (FG1, 2), simplification (FG1, 6) and quality (FG2).

Finally, one group (FG7) highlights brakes to innovation adoption: the investments, the inherent risk associated to innovation adoption, the time required for their implementation, the time before their effects can be measured, the peer pressure (mockery) and the lack of guidance in innovative situation.

4.4 The innovation reducing feed-food competition identified by breeders and advisors

In the FG 1, 2, 3, 6 and 7, participants had to identify innovations that could reduce competition between feed and food. In the Irish focus groups (FG9, 10), participants had to identify ideas for more sustainable beef production.

To summarize these ideas, we classified them into categories depending on what they focus on (e.g. grass and fodder, by-products, animal selection, precision livestock farming, downstream value chain,…). Thus, to the initial categories defined in task 4.1, i.e. "use and management of grass and fodders", "replacing concentrates", "animal selection and breeds", "precision livestock farming", "optimization of existing agro-systems" and "limiting meat production to non-competitive feed", we add new categories. Some of the innovations suggested by the participants were similar to those identified in literature (in red), while others are new. Several focus groups sometimes suggested the same innovation. The suggestions could be very realistic or more theoretical.

Table 2 – Innovations aiming to reduce feed-food competition identified by the breeders and advisors

Category	**Innovation**			**FG**	**Case-study**
Use and management of grass and fodders[6]	Improve fodders' area management	Decision making-tools to help fodder resources management	Multi-function GPS collar*	1	FR.LOR-BF
		Improve/change grazing practices	Dynamic rotational grazing	2	FR.LIM-CC
			Ease grazing by the way of land consolidation*	2	FR.LIM-CC
			Longer grazing season (earlier and later grazing) to increase production from pasture	9, 10	IR.F IR.CC
			Improve the management of refusals	7	BE-CC1 BE-BF

[6] Fodders are « Plant or part of a plant other than grain that has not undergone industrial processing, that can be fed to animals either grazed or harvested and that is self-sufficient in itself to keep an animal alive ».

		Improve productivity of forage areas*	Improve the composition of grasslands	7	BE-CC1 BE-BF
			Choose adapted varieties (i.e. adpated to local conditions)	1, 2	FR.LOR-BF FR.LIM-CC
			Use of alfalfa	7	BE-CC1 BE-BF
	Improve fodders techniques*	Hay instead of silage		7	BE-CC1 BE-BF
		Improve fodders preservation		1, 7	FR.LOR-BF BE-CC1 BE-BF
	Diversify fodders' sources	Use of fodder beets		3	FR.CANT-CC FR.CANT-DCC
	Grass fattening thanks to :	Rotational grazing		3	FR.CANT-CC FR.CANT-DCC
		Hay dried in barn			
		Downstream value chain valorisation			
Replacing concentrates with by-products of the agro-industry	Increase the use of by-products*			2, 3	FR.LIM-CC FR.CANT-CC FR.CANT-DCC
	Facilitate the use of by-products	Joint purchasing group for by-products for livestock		1	FR.LOR-BF
		Mixed ration to ease the use of by-products		7	BE-CC1 BE-BF
	New by-products	Milk powder given to young bulls*		6	BE-CC2 BE-BF
		New technics to allow the use of meat and bone meal		3	FR.CANT-CC FR.CANT-DCC

Animal and breeds selection	Improve efficiency by the way of	Breed and genetic selection	Rustic breeds	1, 2, 3	FR.LOR-BF FR.LIM-CC FR.CANT-CC FR.CANT-DCC
			Breed with improved consumption index		
			Breed that better valorise grass and fodders	1, 2, 3, 7	FR.LOR-BF FR.LIM-CC FR.CANT-CC FR.CANT-DCC BE-CC1 BE-BF
			Calving ease	7	BE-CC1 BE-BF
			Milk capacity		
			Daily growth		
			Ability to suck		
		Crossbreeding		3	FR.CANT-CC FR.CANT-DCC
	Decrease age at slaughter but maintaining carcass weight thanks to	Better lifetime performance	Better lifetime growth	9, 10	IR.F IR.CC
			Genetics and health		
	Improve suckler cows productivity	Better fertility, lower maintenance cost, better weaning weights, better progeny carcass weights	Genetics and data recording	9, 10	IR.F IR.CC
Precision Livestock farming	Precision feeding	Reduce waste by better matching inputs to needs		1, 9, 10	FR.LOR-BF IR-F IR-CC
			Ultra-modern automatic dispenser for concentrates	3	FR.CANT-CC FR.CANT-DCC
		Improve distribution : the way feed is given to cattle		2	FR.LIM-CC
		Use of enzymes (ease cellulose digestion)		1	FR.LOR-BF

Optimization of the agro-systems	Agroforestry	Trees, hedges as fodders' sources*		3, 7	FR.CANT-CC FR.CANT-DCC BE-CC1 BE-BF
	Optimize land use*	Produce fodders on area of ecological interest, cover crops		6, 7	BE-CC1 BE-CC2 BE-BF
	Include temporary grasslands in the rotation			7	BE-CC1 BE-BF
Use and management of areas allocated to feed	Develop alternative concentrates*			6	BE-CC2 BE-BF
	Improve productivity thanks to*	Plant breeding		1	FR.LOR-BF
		Fertilization			
		Area management			
		Use of GMO			
Autonomy	Feed autonomy	New crops/pasture mixtures*		3, 6	FR.CANT-CC FR.CANT-DCC BE-CC2 BE-BF
		New species of fodder that cover all needs*		2	FR.LIM-CC
	Diversification	Market gardening		3	FR.CANT-CC FR.CANT-DCC
Downstream value chain	Valorisation of products with less FFC* including grass fattening	Added-value		1, 3	FR.LOR-BF FR.CANT-CC FR.CANT-DCC
		Incentives			
				3	FR.CANT-CC FR.CANT-DCC
	Improve transparency within the value chain			3	FR.CANT-CC FR.CANT-DCC

	New prices system - Innovations require investments. Better incomes open the door to innovation			3	FR.CANT-CC FR.CANT-DCC
Guidance	System modelling	Help breeders to know whole farm consequences of changes		9, 10	IR-F IR-CC
Society	Improve communication about livestock farming*			2, 3	FR.LIM-CC FR.CANT-CC FR.CANT-DCC

*Innovations labelled with * are deepen in Appendix 7.5*.

As identified through literature and experts' interviews, participants suggested grass fattening, dynamic rotational grazing, use of by-products, precision livestock farming, production of fodder through cover crops or agroforestry and genetic selection for improving feed efficiency as potential ways aiming to decrease feed-food competition. All these suggestions belong to the categories initially defined in task 4.1.

Synergies between innovations are also highlighted. Thus, hay dried in barn as well as rotational grazing are ways to achieve grass fattening. Participants however add the differentiate valorisation of such a meat within the value chain (through added-value, incentives) as another prerequisite.

We decided to add the category "use and management of areas allocated to feed" in addition to the category "use and management of grass and fodder" as participants sometimes suggested innovations related to concentrates, more than grass and fodders, even if grasslands and fodder's area are of course "areas allocated to feed".

More than innovations, participants also suggest "strategies" or "logic of action" as the feed autonomy or diversification through market gardening as ways to reduce feed-food competition. Indeed, as feed autonomy relies on fodders' autonomy, it could lead indirectly to the decrease of feed-food competition.

As we can see, some innovations are more levers for the uptake of innovations, than innovations per se. This is the case of the suggestions sorted in the categories "downstream value chain" and "guidance".

Finally, part of the suggestions is not actual innovations or are not tackling feed-food competition, such as "the improvement of communication about livestock farming". It could suggest that the concepts used were not totally clear to the participants (such as in the FG6 when participants suggested "alternative crops" as innovation reducing feed-food competition, before to abandone this idea, aware that it does not reduce the issue), or were not totally accepted by the participants. It may also refer to a lack of framing on the part of the facilitator.

Some of these innovations (labelled with asterisk in the Table 2) were then deepened in sub-group before being discussed in plenary session (see Appendix 7.5 for the details).

Remark: During the voting sequence, participants often voted for the suggestions they made (see Appendix 7.6).

4.5 The innovations identified through literature and experts interviews: the opinion of the breeders, advisors and value chain actors

4.5.1 The results of the votes

4.5.1.1 Breeders' and advisors' vote

In the FG 1, 2, 3, 4, 5, 6 and 7, breeders and advisors voted in two times: first, they had to choose the most relevant innovations. Then, they had to choose the most feasible innovations. In that way, we can identify the most relevant but less feasible innovations. However, in France, the instruction for the vote was different: participants had to choose the most relevant, as in Belgium and Italy, but then, they had to choose the less feasible (and not the most feasible). N.B.: The participants could vote for as many innovations as they wanted.

In the French and Walloon focus group (FG 1, 2, 3, 6, and 7) the vote focused on both: the innovations identified through the literature and expert interviews and the innovations proposed by the participants. In Italy, other innovations identified by Italian experts were added to the list. As a result, the vote did not focus on the same list in each focus group. Moreover, as already mentioned above, the list of innovations identified through literature and experts' interviews was not exactly the same between countries. The innovations not examined in all focus groups are in grey in the Table 3. Now, when participants proposed innovations similar to innovations identified through literature, we decided to count the votes allocated to these innovations in those identified during the task 4.1.

Finally, the method used in Ireland differs from those used by the other partners (no list of innovations proposed by the experts, no voting sequence). However, Irish breeders suggested innovations quite similar to some innovations identified in the task 4.1. We have therefore counted one vote per similar innovation.

For all these reasons, the compilation of the votes was not easy. That's why we decided to present only the result of the votes concerning the innovations identified through the task 4.1. The full results are however available in appendix 7.6.

The results are presented in two stages: first the overall results, then the results innovation by innovation.

Table 3 – Result of the voting sequences in the focus groups with breeders and advisors: relevance of the innovations identified through task 4.1

Innovation	Cat.	ESR	FG1	FG2	FG3	FG4	FG5	FG6	FG7	FG9	FG10	Nb FG	Total	Case study
Grass fattening	Use and management of grass and fodders	R	0	0	6	0	1	2	4	1	1	6	15	FR.CANTCC, FR.CANTDCC, IT.BF, BE.CC1, BE.BF, BE.CC2, IR.F, IR.CC
Dynamic rotational grazing	Use and management of grass and fodders	E,R	0	1	6	0	0	1	4	1	1	6	14	FR.LIMCC,FR.CANTCC, FR.CANTDCC, BE.BF, BE.CC1, BE.CC2, IR.F, IR.CC
Genomic selection for food efficiency	Breed and selection	E		7	6	2	0			1	1	5	17	FR.LIMCC, FR.CANTCC, FR.CANTDCC, IT.F900, IT.F226, IR.F, IR.CC
Use of by-products	Replacing concentrates	S	0	1	2	1	1	3	0			5	8	FR.LIMCC, FR.CANTCC, FR.CANTDCC, IT.F900, IT.F226, IT.BF, BE.BF, BE.CC2
Crossbreeding (continental breed x breed with an early maturity, more adapted to be fattened under grazing) (e.g. Salers X Angus)	Breed and selection	E,S	1	0	0	1	0	0	2	1	1	5	6	FR.LORBF, IT.F900, IT.F226,BE.CC1, BE.BF, IR.F, IR.CC
Production of fodder through cover crops	Use and management of grass and fodders	E				2	1	5	2			4	10	IT.F900, IT.F226, IT.BF, BE.BF, BE.CC1, BE.CC2
Precision Livestock Farming	Precision livestock farming	E	4	0	1	3	1	0	0			4	9	FR.LORBF, FR.CANTCC, FR.CANTDCC, IT.F900, IT.F226, IT.BF
Terminal crossbreeding (beef breed on dairy herd)	Breed and selection	E,R				0	1	0	1	1	1	4	4	IT.BF, BE.BF, BE.CC2, IR.F, IR.CC

Innovation	Cat.	ESR	FG1	FG2	FG3	FG4	FG5	FG6	FG7	FG9	FG10	Nb FG	Total	Case study
Alfalfa and red clover as protein supplements in rations for young beef cattle	Use and management of grass and fodders	S	3	0	0	0	0	1	6			3	10	FR.LORBF, BE.BF, BE.CC1, BE.CC2
Genomic selection: favouring the milk production of suckler cows	Breed and selection	E,R	4	0	0	1	0	0	1			3	6	FR.LORBF,IT.F900, IT.F226, BE.BF, BE.CC1
New sources of proteins: Insects, Algae	Replacing concentrates	S	1	0	0	3	0	2	0			3	6	FR.LORBF, IT.F900, IT.F226, BE.BF, BE.CC2
Integrated crop-livestock systems	Optimize existing agro-systems	R						2	3			2	5	BE.BF, BE.CC1, BE.CC2
Spring calving	Breed and selection	R	0	0	0			1	1			2	2	BE.BF, BE.CC1, BE.CC2
Agroforestry to produce fodder	Optimize existing agro-systems	S,R	0	1	0	0	0	1	0			2	2	FR.LIMCC, BE.BF, BE.CC1
Hay dried in barn	Use and management of grass and fodders	E	1	0	0	0	0	0	0			1	1	FR.LORBF
Preservation of the by-products in a single silo	Replacing concentrates	E				0	0	1	0			1	1	BE.BF, BE.CC2

Innovation	Cat.	ESR	FG1	FG2	FG3	FG4	FG5	FG6	FG7	FG9	FG10	Nb FG	Total	Case study
Limiting meat production to non-competitive available feed	Limiting meat production to non-competitive available feed	R				0	0	0	0			0	0	

The innovations are ranking from those which were selected by the most to the less number of focus groups. This leads to a ranking a little different that the ranking we can obtain if it relies on the total number of votes.

Grass fattening and rotational grazing are selected by the largest number of focus groups (6/9). Only the focus groups 1, 2 and 4 did not select them as relevant innovation, i.e. focus groups gathering participants related to the case studies FR.LOR-BF, FR.LIM-CC, IT.F-900, IT.F-226. Except for the case study FR.LIM-CC, this refers to the remark made by some participants: if grass valorisation is possible for the breeding phase, it is more complicated for the fattening phase.

However, these two innovations do not reach the consensus within each group that select them as relevant innovation. The consensus is only reached in the focus groups 3 and 7, i.e. focus groups gathering participants related to the case studies FR.CANT-CC, FR.CANT-DCC, BE-CC1 and BE-BF (organic and/or extensive BF), i.e. quite extensive systems.

The genomic selection for feed efficiency, the use of by-products and the crossbreeding of continental breed and breed with an early maturity, more adapted to be fattened under grazing, are the second group of innovations considered relevant by the largest number of focus groups (5/9), although not all these innovations were examined in each group.

However, the opinions of the participants within each group is highly variable. The consensus is seldom reached, except for the genomic selection for feed efficiency in the focus groups 2 and 3, i.e. focus groups gathering participants related to the case-studies FR.LIM-CC, FR.CANT-CC and FR.CANT-DCC, so cow-calf systems. To a lesser extent, the use of by-products is also shared by several participants in the focus group 6, i.e. participants related to the case studies BE-CC2 and BE-BF, so quite intensive systems. The crossbreeding approach receives only limited support in each focus group.

The production of fodders through cover crops, the precision livestock farming and the terminal crossbreeding are selected as relevant innovations by less than the half of the focus groups (4/9). However, not all these innovations were examined in each group.

Once again, the opinions of the participants within each group is highly variable. The consensus is only reached in the focus group 6 (BE-CC2, BE-BF) concerning the production of fodders through cover crops and the focus groups 1 and 4 (FR.LOR-BF, IT.F-900, IT-F226) concerning the precision livestock farming. The terminal crossbreeding (beef breed on dairy breed) receives only limited support within each focus group.

The use of alfalfa and red clover in the ration of young bulls, the genomic selection in favour of the milk production of suckler cows and the use of new sources of proteins (i.e. insects and algae) are selected by three focus groups.

The use of alfalfa and red clover reaches consensus in the focus group 7 (BE-CC1, BE-BF) and to a lesser extent in the focus group 1 (FR.LOR-BF). The genomic selection for milk production of suckler cows is only well shared in the focus group 1 (FR.LOR-BF). Finally, the use of new sources of proteins receives a mixed support in the focus group 4 (IT.F-900, IT.F-226). It should be noted that the support goes more to algae than to insects (see below).

Finally, the last innovations, i.e. integrated crop-livestock systems, spring calving, agroforestry, hay dried in barn, preservation of the by-products in a single silo and limiting meat production to non-competitive available feed, are supported by few groups and few participants or are not supported at all, except for the integrated crop-livestock system that receives a mixed support in the focus group 7 (BE-CC1, BE-BF). It should be noted however that some of these innovations were not examined in all groups.

Innovations considered as the most relevant by participants come under efficiency increase as well as substitution or re-design stages [2]. The need for re-design does not seem to be an obstacle at first sight.

These results are compared with the result of the voting sequence in the focus group with the value chain actors in section 4.5.1.2. The section 4.5.2 develops the barriers and levers identified in connection with the implementation of each innovation.

4.5.1.2 Value chain actors' vote

The way we organized the vote with the value chain actors was different from the method used with the breeders. Indeed, the participants had to choose the innovations they could support in the frame of their activity within the value chain.

We used the principle of the technique of Régnier Abaccus [8] (that we adapted) to ease the discussion. Participants had to choose for each innovation the degree of their support, ranking from total support to radically opposed, as followed:

	Total support
	Support
	Mixed
	No support
	Radically opposed
	Do not know
	No answer

The list of innovations used is almost similar to that used with breeders and advisors. Some innovations are presented separately (by-products, precision livestock farming tools, news sources of proteins).

The Table 4 and the Table 5 show the results of the vote.

Table 4 – Result of the voting sequence in the focus group with value chain actors: degree of support per innovation and per participant

	Trader	Transformer (long supply chain)	Transformer (short supply chain)	Feed Manufacturer	Veterinarian	Feed Manufacturer	Transformer (short supply chain)
Grass fattening							
Dynamic rotational grazing							
Hay dried in barn							
Alfalfa and red clover as protein supplements							
New by-products: process waters							
New by-products: whey							
New by-products: breweries dregs							
New by-products: downgraded products (vegetable, milk powder)							
By-products: preservation in a single silo							
Insects							
Algae							
Crossbreeding (continental breed and breed with an early maturity)							
Spring calving							
Genomic selection: favouring the milk production of suckler cows							
Terminal crossbreeding with beef breed on dairy herd							
Genomic selection for feed efficiency							
Precision livestock: infra-red analysis of fodder							
Precision livestock: connected herbometer							
Integrated crop-livestock systems							
Agroforestry							
Limiting meat production to non-competitive feed							

Differences of opinions appear between value chain actors. The representative for the veterinarians is the participant who agrees with the most innovations. By contrast, the representative for the transformation in long supply chain seldom took position and when he did, he had systematically a mixed view or was radically opposed.

The two representative actors for the transformation in short supply chain did not always share the same opinions. Indeed, they radically disagree on agroforestry, crossbreeding between continental breed and breed with an early maturity, grass fattening and integrated crop-livestock system. To a lesser extent, they disagree too on dynamic rotational grazing, hay dried in barn, use of whey, use of a single silo, use of algae, spring calving and precision livestock farming. By contrast, they agree (as well pros as cons) on alfalfa and red clover in the ration of young bulls, use of process waters, breweries dregs, downgraded products and insects, favour the milk production of suckler cows, terminal crossbreeding, forage efficiency and limiting meat production to non-competitive feed. It should be noted that their main disagreement often concerns the innovations related to the grass and fodder, except for the use of alfalfa and red clover, and the improvement of the forage efficiency. It could be explained by the fact that one of them is also a breeder-fattener.

The two representative actors for the feed manufacturers also disagree on several innovations, such as the use of process waters, terminal crossbreeding, forage efficiency and limiting meat production to non-competitive feed. They also disagree to a lesser extent with grass fattening, hay dried in barn, spring calving and integrated crop-livestock system. By contrast, they agree with dynamic rotational grazing, use of alfalfa and red clover, whey, breweries dregs, downgraded products, single silo, insects, algae, crossbreeding between continental breed and breed with an early maturity, favouring the milk production of suckler cows, precision livestock farming and agroforestry.

Finally, the representative for the traders is the participant who has the most mixed view. This actor is also active in genetic selection.

Table 5 – Result of the voting sequence in the focus group with value chain actors: ranking of the innovations according to their degree of support

New by-products: breweries dregs	
Alfalfa and red clover as protein supplements	
Genomic selection: favouring the milk production of suckler cows	
Genomic selection for feed efficiency	
Terminal crossbreeding with beef breed on dairy herd	
Integrated crop-livestock systems	
Crossbreeding (continental breed and breed with an early maturity)	
Grass fattening	
Precision livestock: infra-red analysis of fodder	
Precision livestock: connected herbometer	
Dynamic rotational grazing	
New by-products: downgraded products (vegetable, milk powder)	
Hay dried in barn	
New by-products: whey	
Spring calving	
Algae	
Agroforestry	
By-products: preservation in a single silo	
New by-products: process waters	
Limiting meat production to non-competitive feed	
Insects	

If the innovations at the bottom of the ranking are relatively similar to the results obtained in focus groups with breeders and advisors, the middle and top of the ranking show more variations.

Thus, the use of breweries dregs, the use of alfalfa and red clover in the ration of young beef cattle and the genomic selection in favour of the milk production of suckler cows are the innovations the most supported by the Walloon value chain actors (6/7). These innovations have a lower position in the ranking of the breeders.

The genomic selection for feed efficiency and the terminal crossbreeding (beef breed on dairy herd) are the second group of innovations the most supported per the value chain actors (5/7). If feed efficiency is also very relevant for the breeders, this is not the case for the terminal crossbreeding.

The integrated crop-livestock system, the grass fattening, the dynamic rotational grazing, the precision livestock farming and the crossbreeding (meat breed x breed adapted to grazing) come just after (4/7). Grass fattening and dynamic rotational grazing have the highest positions in the ranking of the breeders. The crossbreeding and the precision livestock farming have a high position too.

Only three participants support the use of downgraded products (vegetables, milk powder). These specific by-products were not examined in the focus groups with breeders and advisors.

The hay dried in barn, the use of whey, the spring calving, the use of algae and the agroforestry receive little support (2/7), as well as the use of a single silo and the use of process waters, just like in the ranking of the breeders.

Finally, limiting meat production to non-competitive available feed and the use of insects are not supported at all. Most participants are even totally opposed to these innovations. This is in line with breeders' opinion.

The innovations the most supported by the value chain actors refer to the efficiency increase and substitution stages, except for the genomic selection in favour of the milk production of suckler cows which can lead to a re-design of the system.

4.5.2 The barriers and levers for innovations

The participants expressed their opinions about each innovation. Some of them have been widely commented on, while others have not. The tables below summarize the barriers and levers for each innovation. The barriers gather not only barriers per se, but also disadvantages and threats together, while the levers gather levers, but also advantages and opportunities together. These barriers and levers are sorted according to the scale they occur, i.e. farm scale (F), value chain scale (VC) or territorial scale (T).

4.5.2.1 Alfalfa and red clover as protein supplements in rations for young beef cattle

The barriers and levers identified by the participants refer to the farm and territorial scales. Only one barrier refers to the value chain scale (seeds availability).

Table 6 – Alfalfa and red clover as protein supplements: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		Scale
Cost and access to land: requires available areas, but the UAA is limited (FG6)	F, T	**Feed autonomy/savings:** reduces the feed purchases (FG6)	F
Climate and soils conditions: soil's PH for the alfalfa (FG6)	T	**Improve the appetency (FG6)**	F
Availability of the seeds: if everybody does it, it could be a problem (FG6)	VC	**Optimize land use**: improve the valorisation of the UAA (FG6)	F, T
Equipment required: cost of specific equipment or of the service of an agricultural work company (FG6)	F	**Improve the feed efficiency of the ration (FG6)**	F
Cost of the wrapping of the alfalfa (FG1)	F		
Globalization: this innovation must be implemented all over the world in order to reduce feed-food competition (FG2)	T		

Remark: Barriers and levers are almost identified by only one focus group (FG6: BE-CC2, BE-BF).

4.5.2.2 Grass fattening

The barriers and levers identified by the participants refer to farm, as well as value chain and territorial scales.

Table 7 – Grass fattening: barriers and levers identified by breeders, advisors and value chain actors

Barriers	Scale	Levers	Scale
Standards production (linked to downstream value chain) (FG6): (1) **Slaughter age**: grass fattening implies to extend the fattening phase → Incompatible with the current standards in Wallonia (young bulls production, less than 24 months old) (FG6, 7, 8) (2) **Colour of fat**: grass fattening changes the colour of the fat (whiter or greyer vs yellow if maize-fed) (FG6) (3) **Fat firmness**: carcasses of cattle fed with maize are firmer than those fed with grass (FG6) (4) **Maturation period** (FG3): some participants linked grass fattening with a longer maturation period than the one currently practiced (5) **Fattening score (FG7, 8): currently, the selling price is low, what will it be for cattle with lower fattening score? (FG7)** (6) **Meat quality and consumers acceptance**: grass fattening can impact the meat (organoleptic changes). Do the consumers like this kind of meat? (FG6, 7, 8)	VC	**Valorisation in short supply chain**: it can help to avoid standards production brakes (FG6, 7). However, the consumers' acceptance for this kind of meat still remains a concern (FG6). Short supply chain can also lead to workload increase (FG7)	VC
Over-linking beef production to grassland could lead to the elimination of suckler farming in entire regions (FG8). ← →	T	**Ecosystemic services delivered by grassland in connection with ruminants**: it could be a response to criticisms towards beef farming (FG1, 3, 6, 7, 8).	T
Selling price: grass fattening must lead to an economic added-value, which does not exist currently (FG5, 7)	VC	**Social acceptance**: it could be an argument in terms of **image** (it corresponds to the idealized image of "a cow eating grass") (response to criticisms towards beef farming) (FG6, 7, 8)	VC
Workload: for some participants, grass fattening involves additional workload (e.g. valorisation in short supply chain). All the participants do not share this point of view. Indeed, some of them think that grass fattening can reduce workload and free up time (FG6, 7)	F	Improve **animal welfare** (FG5, 6, 7): *"Cows are made to spend time outdoor eating grass". "They will be better than locked in a barn".* This opinion is not shared by all participants (FG7).	F, VC
Breed: grass fattening can require herd change towards specific breeds: breeds	F	**With steers:** to avoid breed issue. But → extends the slaughter age and decreases	F

Barriers	Scale	Levers	Scale
having early fattening capacity, lighter breeds (FG6, 7). All the participants do not share this opinion. Indeed, some of them highlight that the barrier comes more from the value chain (standards production mentioned above) than from the breed (FG6).		animal welfare (FG7)	
Lack of agricultural interest for grassland (in Wallonia): this poor interest for grassland can lead to a **lack of technical references and guidance related to grassland management and grazing practices** (FG6, 7)	F, T	**Improve animal health (FG6):** vitamin D supply (FG7)	F
Seasonality of products: as the production of meat is linked to grass growth, all the production come at the same time on market (FG3)	VC	**Breeder's pride** (FG6)	F
Access to land: availability and cost of land (FG6, 7)	T	Organization of exchanges between forerunners farmers (FG7)	T
Quality variability of the grass: the feed value of the grass depends on several elements: climatic conditions, management, storage and conservation conditions, … (FG6)	F, T		
Management of young bulls in plots: risk of injury (dominant/dominated competition), proximity to heifers (FG6)	F	**With cows rather than bulls:** participants pointed out thereupon the requirement of valorisation in short supply chain (FG6) **With steers rather than bulls:** participants again pointed out the requirement of valorisation in short supply chain. The question of animal welfare also raised (FG6)	F
Climatic conditions: e.g. risk, in case of drought period, to have to supplement the animals on pasture (the Walloon case of the year 2018 is evoked) (FG6, 8)	T	**Reduction of equipment** (manure management, barn)	F
Must remain a niche market: in order to be able to sell it at a price that will offset the cost in terms of surface area, in particular. Not all participants share this opinion (FG7)	VC		
Environmental cost: what about the impact of such a system on environment? (FG8)	T		

Barriers and levers are mainly identified by the Walloon focus groups (FG6, 7, 8) and to a lesser extent by one French focus group (FG3). Indeed, this innovation particularly provoked debate in Wallonia.

Walloon focus groups especially highlight the barriers at the value chain scale: they mainly refer to socio-technical lock-in linked with standards of production and consumption habits due to the "conventional referential of lean and tender meat" characterizing the Walloon beef production sector [9], [10]. By

contrast, the levers identified by the participants mainly refer to “unlocking” pathways [9] that break with this “referential” and the beef sector.

4.5.2.3 Dynamic rotational grazing

The barriers and levers identified by participants refer to the farm and territorial scales.

Table 8 – Dynamic rotational grazing: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Increase the number of water points needed (smaller plots) (FG3)	F	**Savings:** reduction of operational and structural costs (fuel) (FG3)	F
Increase the workload: for the fences (FG3, 8), time consuming for the change of plots (FG8)	F	**Health benefit:** • **less stressful** for cows because they have enough to eat all the time (FG7) • **reduction of parasitism** (FG7, 8): this aspect could even be improved if associated with mixed species grazing system (FG8)	F
Skills: estimate the "good" stocking rate, the grazing time → need for guidance (FG3), need for skills (FG7)	F, T	**Feed intake:** increases the appetency (FG7)	F
Fragmented area (FG3, 7)	T	**Animal performance:** increases milk production if cows have a permanent access to high quality grass in quantity → benefit for calves too (FG7)	F
Equipment: adapted fences, mower for the refusals (FG7)	F	**Feed efficiency:** better valorisation thanks to constant grass feeding value (FG7)	F
Health risk: risk of enterotoxemia for the calves (FG8)	F	**Management tools:** grazing calendar (FG7)	F
Land price and inputs costs (FG8)	F, T	**Facilitate the management of refusals:** even more if it is associated with mixed species grazing system (FG8)	F
		Ecosystemic services: opens the landscape, increases biodiversity (FG8)	T
		Organization of exchanges between farmers, advisers (FG3)	T

Barriers and levers are identified by the focus groups that support the most this innovation (i.e. FG3, 7, 8).

4.5.2.4 Hay dried in barn

The barriers and levers refer to the farm, as well as the value chain and territorial scales.

Table 9 – Hay dried in barn: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Economical cost: the investment is very high (FG2, 6, 7, 8)	F	**Health benefit:** hay is better for rumen activity than grass silage (FG7)	F
Environmental cost: what about the energy needed? (FG2, 6, 8)	T		
Risk to drift to zero grazing: which would be bad in terms of image and animal health (FG7, 8)	F, VC, T		
Valorisation: if there is no additional value compared to "traditional" meat, there is no point (FG7, 8) → Need for studies about the added value of meat: is it like milk? Need for a quality label and involve the whole value chain (FG8)	VC		
Feed value of the hay dried in barn: what about the feed value of such a hay compared to "classic" hay? (FG8)			
Workload: involves more handling (FG7)	F		

Barriers and levers are identified by focus groups that do not support this innovation (FG2, 6, 7 and 8).

4.5.2.5 Use of by-products

The barriers and levers identified by participants refer to the farm, value chain and territorial scales.

Table 10 – Use of by-products: barriers and levers identified by breeders, advisors and value chain actors

Barriers	Scale	Levers	Scale
Potential drift: several participants are afraid by the use of by-products of "poor quality" *("cows are not garbage")*. By-products are perceived as feed of low quality, but all participants did not share this opinion (FG1, 8).	F, VC	**Image:** can help to give a positive image to consumers (reduces waste) (FG2, 3, 8)	VC, T
Health risk: some participants evoked the "mad cow crisis" (speaking about milk powder, giving animal protein to cattle is risky and not accepted by politicians and society) (FG8)	VC, T	**Savings:** decrease the cost of the feed purchases (FG2, 3, 5) → The biggest lever for some participant, even a prerequisite for some of them. However, not all participants think that use of by-products leads to savings (FG5, 8).	F
Meat quality: what about the meat of a cow fed with many by-products (organoleptic changes) (FG2, 3, 8)?	VC	**Improvement of animal health:** reduction of acidosis thanks to reduction of starch in the ration (FG5)	F
Competition with other uses (e.g. energy production, food, other types of farming) that threatens supply: *"the by-product must first pass through the animals' mouths"* → need to secure supply (at reasonable cost) (FG1, 2, 6, 8) + need to organize supply (FG3, 4)	T	**Collective organization for the supply (structuring of the sector):** allow group purchases (FG1)	T
Animal's performance: what about the performances if they eat differently? (FG2, 3)	F, VC	**Preservation in a single silo:** allow to avoid storage problem, facilitate the distribution (FG6)	F
Regularity of supply: in case of irregular supply, a frequent adaptation of the rations will be needed (and the help of an adviser to do so) (FG2, 5, 8). The regularity of supply is a prerequisite for some participants, who pointed out that permanent adaptation of the ration can lead to stress for cattle and reduced performances (FG6) or can impact the quality of the meat (FG8).	T	**Proximity of industries (FG2):** Only interesting if there are local industries (avoid the economic and environmental costs of transport)	T
Lack of information: need to have information about the feed value of each by-product to adapt and balance the ration (FG2)	T		
Storage: what about the storage, the preservation, the equipment needed? (e.g. wet by-products) (FG2, 3, 5, 6, 8)	F		
Distribution: what about the distribution of feed to cattle? Are new equipment or management needed? (e.g. wet by-	F		

Barriers	Scale	Levers	Scale
products) (FG2, 3, 6)			
Dependence on the industry: the biggest barrier for some participant, even an exclusion criterion for some of them (FG2, 7, 8)	F		
Skills: increases the need for/dependency to advisers (to adapt the ration) (FG2, 8)	F		
Compatibility with quality labels, specifications: what about labelled productions and the respect of particular specifications? Risk of refusal (FG2, 3, 5)	VC		
Humidity level: when by-products have high humidity level, that increases the cost of the supply ("we carry a lot of water") (FG2) and complicates transportation (FG1)	F		
Quality variability (FG4, 6): requires adaptability (FG6)	F		
Animals acceptance: by-products could change the taste of the ration that can cause reduction of the feed intake (FG5)	F		
Increase workload: • In case of wet by-products: need time to make silo (FG6) • Administrative work: every feedstuff must be recorded (FG6)	F		

All the focus groups expressed barriers and levers about this innovation. The barriers at farm scale mainly refer to storage and distribution issues. One focus group highlights however the synergy between this innovation and the use of a single silo as a response to barriers due to these issues (FG6). Indeed, one participant in this focus group employs both, and is satisfied.

4.5.2.6 Preservation of the by-products in a single silo

The barriers and levers identified by breeders, advisors and value chain actors refer to the farm and territorial scales.

Table 11 – Preservation of the by-products in a single silo: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Increase workload: need time to make the silo (FG6)	F	**Allow to avoid barriers linked to the use of by-products**, especially (FG6, 8): • barriers linked to the availability and the regularity of the supply of by-products, • barriers linked to storage of wet by-products, • barriers linked to the distribution of by-products (especially wet by-products and gain of time)	F, T
Need for equipment (FG6): • Silo • Mixer	F		
Difficult to have all the by-products at the same time (FG8)	T		
Health risk: what about the health of the rumen due to the humidity level of the by-products? (FG8)	F		
Lack of control about the components (FG8)			
Economical risk: in case of preservation issue (FG8)	F		

Two focus groups identify barriers and levers (FG6, 8). As the only lever, they highlight the utility of this innovation to response to the main barriers identified for the use of by-products (i.e. regularity of the supply, storage and distribution).

4.5.2.7 New sources of proteins: insects, algae

The barriers and levers refer to the farm as well as the value chain and territorial scales.

Table 12 - New sources of proteins (insects, algae): barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
INSECTS			
	Scale		**Scale**
Consumers acceptance (FG4)	VC		
Legal aspects: not allowed currently (FG4)	T		
Contradiction: insects are food → do not reduce the feed food competition (FG6, 7, 8)	T		
Health risk: several participants referred to the "mad cow crisis" (FG1, 7, 8)			
Breeders acceptance (FG7)	F		
Shortage of by-products necessary for insect breeding (FG8)	T		
ALGAE			
Cost of the harvest (FG6)	F	**Proximity of the sea** (FG6, 8)	T
Drying process: energy cost (FG6, 7)	T		

Except for insects, these innovations did not lead to many reactions. The participants' opinion was quite different between insects and algae: most of them were totally opposed to the use of insects. Indeed, this innovation often provoked ironic laugh or sarcastic comments. By the way, participants did not identify lever for it (see below). Walloon focus groups also highlighted that the use of insects is not an innovation that reduces feed-food competition, as insects are food (FG6, 7, 8).

4.5.2.8 Precision livestock farming

Almost all barriers and levers refer to the farm scale.

Table 13 – Precision livestock: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
PRECISION LIVESTOCK (IN GENERAL)			
	Scale		**Scale**
Cost: too expensive for beef farming which have narrow economic margins (FG2, 4)	F		
PRECISION FEEDING/AUTOMATIC DISTRIBUTION OF FEED/CONCENTRATES ACCORDING TO INDIVIDUAL NEEDS (ULTRA-MODERN DAC)			
Cost: investment (automatic dispenser, mechanized distribution, chip) (FG2,3)	F	**Savings:** reduction of waste through individualized feeding (FG3)	F
Skills: use of the tool, analysis of the data (FG3)	F	**Animal health:** reduction of acidosis thanks to fractionation (FG3)	F
Proximity of a repair man/woman (FG3)	T		
Can be incompatible with grazing (FG2)	F		
Change in the management of the herd: from a herd management to an individual management (FG2)			F
CONNECTED HERBOMETER			
Use for beef farming: is it interesting? It has more interest in dairy farms (FG8)	F	**Facilitate the management of the fertilization** of the area (adapt fertilization depending on the grass growth) (FG8)	F
IR ANALYSIS OF FODDERS			
Cost of the tools: not adapted to all systems of production (FG8)	F	**Reduces waste** (FG8)	F
		Increases animal performances (FG8)	F

Except for the connected herbometer, participants systematically highlight the cost as a barrier. By contrast, they twice highlight the reduction of waste as a lever.

4.5.2.9 Spring calving

The barriers and levers refer mostly to the farm scale.

Table 14 – Spring calving: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Fertility: spring calving might imply synchronization of cows' cycles by the use of hormones, which can impact fertility (decrease) (it takes times (2 years) to re-cycle a cow) It is mainly a problem in breeds characterized by low-fertility rates (increase unproductive periods) (FG6)	F	Requires incentives (bonus) (FG6)	T

Health risk due to:
• the high number of calves born at the same time increases the risk of disease spreading (FG6)
• the period:
  ○ cows' vitamin A reserves are low in spring (FG6)
  ○ low immunity (end of winter) (FG8)
	F	**Health benefit due to:**
		• the quality and the feed value of grass (FG6,7)
		• the period: reduces disease and health problems (FG8) linked with temperature particularly (FG6)
			F

Workload: intensive period of workload as calvings are grouped on 3 months (FG6, 7)	F	**Quality of life:** offers the possibility to go in vacation (FG6, 7)	F
		Ease the organisation of the work: in the case of farms with multiple speculations (frees up time for other agricultural works) (FG6)	F
← **Stable space** → **Increases the need for stable space** **Frees stable space:** participants pointed out that it is more problematic for autumn calving than spring calving (calves are smaller in this last case) (FG6, 7)			F
Cost related to the need for hormones to modify the reproductive cycle (FG6)	F	**Savings?** (reduces feed purchases) (FG8)	F
Must remain a niche market: "this system will crash if every breeders adopt it" (FG6, 8)	VC		
Use in beef farming: is it interesting in beef farming? It has more sense in dairy farms (for the cheese processing in particular) (FG8)	F		

This innovation provoked many discussions within the Walloon focus groups (FG6, 7, 8). Indeed, participants did not agree with the period covered by spring calving – for some of them, spring calving refers to calving between April and June, for other, spring calving refers to calving between February and March – and their opinions about this innovation were clearly divergent (pros and cons in each group). By the way, barriers and levers come all from Walloon focus groups. The differences of opinion expressed

during the debates are reflected in the table, the same element often being found on both sides, i.e. barrier and lever.

Walloon value chain actors especially highlight the valorisation issue. Indeed, this innovation supposes a re-design of the downstream value chain.

4.5.2.10 Crossbreeding (continental breed x breed with an early maturity)

The barriers and levers refer to the three levels, but in particular the value chain scale.

Table 15 – Crossbreeding (continental breed x breed with an early maturity): barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Farmers/actors in genetic selection: attachment to traditional breeds. Cross Belgian Blue or French breed with one that have lower carcass yield (e.g. Angus) results in the loss of all the benefits of the Belgian Blue/French breed for some participants. Indeed, one French participant opposed “pure breeds” to "composite breeds” (FG1), while one Walloon participant speak about a “loss of the specificity of the breed and the identity linked with this specificity” (FG8) [7] . The same participants however pointed out the interest for crossing, but keeping the specificity of the breed (i.e. double-muscled type) (e.g. double-muscled Charolais x Belgian Blue) (FG1,8).	VC, T	**Avoid degeneration** (FG8)	F, VC
Consumers’ acceptance: need for a validation. Not all participants share this opinion. Some of them evoked the Irish beef as an example (FG8)	VC		
Potential drift: meat as a by-product of milk (FG8)	F, VC, T		

Only two focus groups identify barriers and levers for this innovation (FG1, 8).

[7] This participant was the representative for cattle trader. However, he is also breeder and actor in the selection of Belgian Blue.

4.5.2.11 Terminal crossbreeding (meat breed x dairy breed)

Few barriers and levers were identified. They refer to the farm and value chain scales.

Table 16 – Terminal crossbreeding (meat breed x dairy breed): barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Need to increase the fertility of the herd (FG4)	F	**Increase the income** (better valorisation of the calves) (FG4)	F, VC
Selling age: dairy farmers prefers to sell the calves very quickly (avoid time spent to take care of them, cost of feed), while beef farmers prefers to buy not too young calves (avoid diseases) (FG4)	F		

This innovation did not provoke many debates. Only the focus group 4 identify barriers and lever. N.B.: As the opinions of the Walloon value chain actors were quite consensual (pros), this innovation was not discussed within this group.

4.5.2.12 Genomic selection for feed efficiency

Table 17 – Genomic selection for feed efficiency: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		Scale
Current genetic selection in Belgian Blue and French breeds: forage efficiency is not a current priority (FG7, 1)	VC	**Consumers**: select animals (from current breed or not) that would better meet consumers expectations (FG2,7)	VC
Animal welfare: improving the efficiency of the breed could lead to a decrease in animal welfare (more fragile animals) (analogy with formula 1: a very efficient car, but one that "breaks" all the time) (FG1)		**Value chain acceptation:** potential for keeping the current breed (e.g. BB) and select animals to reach better feed efficiency (FG7)	VC
		Value chain implication: Act at different levels of the VC (insemination centres, farms, slaughter house) (FG7)	F, VC

4.5.2.13 Genomic selection: favouring the milk production of suckler cows

The barriers and levers refer to the farm as well as the value chain scales.

Table 18 – Favouring the milk production of suckler cows: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Breed orientations: will the selection associations change their selection scheme? (FG1)	VC	**Tools allowing to measure the milk production on farm:** PAT120 (Weigh at a standardized age of 120 days) [11] (FG1)	F
Morphological change: *"a good dairy is not a big cow" (FG1)*	F, VC	**Health benefit**: increases immunity of the calves (FG7)	F
		Savings: reduces the cost for feeding and veterinary expenses for the calves (FG7)	F
← **Insemination** → (-) More costly than natural reproduction (FG7) (-) Increases workload compared to natural reproduction (FG7) (-) Need for equipment (FG7) (+) Less risky than natural reproduction (FG7)			F
Skills: need for skills to calculate a balance index between milk and meat performances. Not all participants share this opinion. For some of them, the choice is simply based on the information on the animals given in the semen catalogues (FG7)	F	Include this criterion in the selection scheme of the Belgian Blue could be a huge lever (FG7)	VC
Way selection is organized: Better to make the selection on the lineage (French system) than the progeny (Belgian system) (FG7)			VC
		Grass fattening: udder- and grass-fed calves are more suitable for grass fattening because their rumen will be better developed than that of calves fed with concentrates (FG7)	F

Only two focus groups identify barriers and levers for the implementation of this innovation (FG1, 7). They both highlight barriers and levers linked with the selection. The focus group 7 highlight the synergy between this innovation and grass fattening and spring calving.

4.5.2.14 Integrated crop-livestock system

Barriers and levers mainly refer to the farm and territorial scales.

Table 19 – Integrated crop-livestock system: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Equipment: need equipment for the two purposes (crop and livestock) or cost of an agricultural contractor (FG7)	F	**Diversify sources of forage**: by the way of cover crops (FG7)	F, T
Increase workload: • less "off-season" (FG7) • Increase administrative work (FG7)	F	Possibility to **valorise crops' by-products**(FG7)	F, T
Skills: need for skills for the two purposes ("You have to do two jobs") (FG7)	F	**Increases the serenity (FG7)**	F
Land price (FG7)	T	**Incentives:** in organic farming, incentives for crops are higher than for grasslands *("when you till a grassland, you have got a bonus, it is so absurd!")* (FG7)	T
Commercial consultants' pressure (FG7)	VC, T ⟷	**Neutral guidance** (i.e. non commercial) (FG7)	T
Regulation: destruction of permanent grassland is only allowed from February to May in Wallonia (FG7)	T		
Pedo-climatic conditions: crops are not possible in every region (FG7)	T		

Remark: Only focus group 7 identify barriers and levers.

4.5.2.15 Production of fodder through cover crops

The barriers and levers refer to the farm and territorial scales.

Table 20 – Production of fodder through cover crops: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		Scale
Pedo-climatic conditions: • only for crops area (FG6, 7) • not all soils can be tilled for two crops a year (e.g. clayey soils); adverse climatic conditions (FG4)	T	Crop-livestock contract (FG6, 7)	T
Equipment: • The more crops are grown the more machines are required (FG4) • Change in irrigation system required (FG4) • Need equipment for both purposes (crop and livestock) or cost of an agricultural contractor (FG7)	F		
Increase workload: • less "off-season" periods (FG7) • There is more load for growing the winter crop (FG4)	F		
Skills: need for skills for both specializations ("*You have to do two jobs*") (FG7)	F		
Increase administrative work (FG7)	F		
Risk of competition with other uses of biomass (energy production) (FG6)	T	**Cover crops obligation (FG6):** will be there anyways	T
Legal aspect: mandatory destruction (FG7)	T	**Avoids leaching of fertilizers:** cover crops using excess of fertilizers (FG6)	F, T
Land price (FG7)	T	**Increases soils quality** (FG7): especially humus level (FG6)	F, T
Commercial advisors' pressure (FG7)	F	**Neutral guidance** (i.e. non commercial) (FG7)	F, T
	T	**Savings:** reduction of feed purchases thanks to an increase of forage production (FG4)	F
CAP: Some concerns arise in considering some constrains in the Common Agriculture Policy (~~FG4~~FG5)	T	**Secures forage supply:** diversify sources of forage (FG6, 7)	F
		Incentives: in organic farming, incentives for crops are higher than for grasslands *("when you till a grassland, you receive a bonus, it is so absurd!")* (FG7)	T

4.5.2.16 Agroforestry

The barriers and levers refer to the farm as well as the value chain and territorial scales.

Table 21 – Agroforestry: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Quantity: is it realistic to feed cattle on it? (FG2)	F, T	**Multiple uses of the resources (economical add-value):** feed, food, litter, firewood,… (FG1, 2, 7, 8) from different products (leaves, branches, fruits) (FG2, 7)	F
Regular watering (at the plantation and at the beginning) (FG2)	F	**Benefit for the soil**: avoid erosion (FG2, 8)	F, T
Breed: breeding organisms not always ready to adapt the animals to tree grazing (FG2).	VC	**Animal welfare:** shade and windbreak effect (FG1, 2, 8)	F, VC
Health risk: in particular risk linked to orchard ("drunk cows", choking), scab (FG8)	F	**Health benefit:** deworming, anti-parasitic, homeopathic action (FG7)	F
Increased workload: in case of daily harvest (of fodder, fruits) and its distribution (FG2)	F	**Decreased workload:** in case of cattle picking directly fodder from the trees/shrubs (FG2)	F
Increase in the use of fuel: for the daily harvest (FG2)	F	**Decrease in the use of fuel:** in case of direct "picking" if it replaces complementation on pasture (FG2)	F
Economical cost: at the plantation (cost of the trees, of the plantation if subcontracted)	F	**Existing incentives** for the planting of hedgerows, orchards, … (FG7)	T
Peer pressure: according to some participants, agroforestry suffers from negative perception within the profession (FG2)	F	**Positive impact in terms of image**, communication concerning society (FG7)	VC
Equipment: cost for the harvesting in case of fruit trees (FG2)	F	**Complementary fodder**: when grass is no more available (e.g. dry summer) (FG2, 7)	F
Renter: if the farmer does not own his land, the add-value goes to the owner (FG7)	F		
Acceptance by the breeders: some participants are sceptic while regarding cattle eating leaves and branches (FG6, 8)	F	**Appetence:** cattle appreciate it (FG7), this is an old technique (FG2, 6, 7)	F
		Pedoclimatic conditions: choose adapted species, providing fodder during period with low ressources (FG2)	F, T
		Knowledge (FG2): • look at what is done in other countries/regions • trials in experimental farms	T
← **Meat quality (organoleptic change)** → Specific flavour that can be valorised downstream? What about consumers' acceptance? (FG2)			VC

Several focus groups identify barriers and levers (FG1, 2, 6, 7, 8). The barriers refer almost all to the farm scale. The differences of opinion expressed during the debates are reflected in the table, the same element often being found on both sides, i.e. as barrier and lever.

4.5.2.17 Limiting meat production to available non-competitive feed

The barriers and levers refer to the value chain and the territorial scales.

Table 22 – Limiting meat production to non-competitive available feed: barriers and levers identified by breeders, advisors and value chain actors

Barriers		Levers	
	Scale		**Scale**
Beef sector acceptance: many participants immediately refused this innovation (FG6, 8)	VC	**Increase the price of meat** (FG7)	F
Need for manure: participants highlighted that soils allocated to crops need sufficiently manure (FG7)	T		
Globalization: this innovation has no sense if it is done locally (FG8)	T		

As participants had almost the same opinion on this innovation, it did not provoke many debates. However, more than limiting meat production to non-competitive available feed, some participants evoked the reduction of the herd in order to improve economical sustainability of beef farming, as highlighted in the following excerpt:

> *"Does everyone have to breed so many cattle?" "It's still something that comes up regularly on the farm: why do you keep so many animals? It's space, structures, hectares, manpower and finally, you don't earn more than anyone else!" (FG7)*

One participant however pointed out that *"famers don't always have the choice* [editors' note: because of the investments they made]*"* (FG7).

Among the barriers identified, participants expressed the service rendered by livestock in terms of soils' fertilization, and the globalization (if it is done locally, there is no point because their efforts would be undermined by imports).

5 Conclusion

The analysis does not show any obvious difference of opinion according to the case-studies, but inter-category analysis is made difficult by the inconsistency of the lists of innovations used between countries.

The results presented above should help to guide the choice of scenarios (to say, to identify the innovations to be implemented in the different case-studies in order to reduce feed-food competition) to be implemented in FarmDyn. They provide an overview of the innovations considered most relevant in each case-study. They also provide information on the degree of acceptance of innovations by the actors in the value chain (even if we are limited here to Walloon actors). The brakes and levers give us a better understanding of the participants' position in relation to innovations.

The simulations carried out within the framework of WP3 will certainly make it possible to provide an answer to some of the questions asked for, that are currently obstacles and/or levers to be scientifically validated.

6 Bibliography

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7 Appendices

7.1 Appendix1: List of relay actors

7.1.1 Wallonia

- Service Public de Wallonie – Direction Générale opérationnelle Agriculture, Ressources naturelles et Environnement – Département de l'Etude du Milieu Naturel et Agricole – Direction de l'Analyse Economique Agricole
- Service Public de Wallonie – Direction Générale opérationnelle Agriculture, Ressources naturelles et Environnement – Direction de la Recherche et du Développement
- Association Wallonne de l'Elevage asbl (AWE asbl)
- Centre Provincial Liégeois de Promotion et Gestion en Agriculture asbl (CPL-Promogest)
- Service Provincial d'Information, de Gestion et de Vulgarisation agricole asbl (SPIGVA)
- Office Provincial Agricole Ciney (OPA Ciney)
- Centre de Michamps asbl
- Fédération Unie de Groupements d'Eleveurs et d'Agriculteurs (FUGEA)
- Union Nationale des Agrobiologistes Belges (UNAB)
- Fédération Wallonne d'Agriculture (FWA)
- Collège des Producteurs (SOCOPRO)
- Réseau wallon de Développement Rural (RWDR)
- Parc Naturel de Gaume
- GAL Nov'Ardenne
- GAL Condroz et Famenne
- GAL Romana
- GAL Tiges et Chavées
- GAL Haute Sûre et Forêt d'Anlier
- GAL Ardenne méridionale
- GAL Entre Sambre et Meuse
- Comice agricole d'Arlon
- Comice agricole d'Etalle
- Comice agricole de Virton
- Comice agricole de La Roche
- Comice agricole de Bastogne
- Comice agricole de Neufchâteau
- Comice agricole de la Semois ardennaise
- Comice agricole de Marche
- Comice agricole de Soignies
- Comice agricole du Roeulx
- Comice agricole de Lens
- Comice agricole de Perwez
- Comice agricole de Jodoigne
- Comice agricole de Seneffe
- Comice agricole de Braine-le-Comte
- Comice agricole de Lessines
- Association Régionale des Eleveurs et Détenteurs de Bétail (AREDB) d'Ath

7.1.2 France

- Chamber of agriculture of Ardennes
- Chamber of agriculture of Creuse
- Chamber of agriculture of Cantal

7.1.3 Italy

- Piedmont Meat Producers Association (ASPROCARNE)
- Veneto Meat Producers Association (UNICARVE)

7.1.4 Ireland

- Teagasc Grange for Meath and Portlaoise

7.2 Appendix2: Selection matrix for the recruitment of the breeders (Wallonia)

7.2.1 Focus group 6 ("intensive holdings")

a) Selection matrix initially planned:

	Agricultural areas					
	Ardenne	Famenne	Jurassique	Condroz	Région limoneuse	Total
BE-CC2	1	1	1	2	1	6
BE-BF	1	1	1	1	1	5
Total	2	2	2	3	2	11

b) Breeders finally involved:

	Agricultural areas					
	Ardenne	Famenne	Jurassique	Condroz	Région limoneuse	Total
BE-CC2	1			1		2
BE-BF	1	1			1	3
Total	2	1	0	1	1	5

7.2.2 Focus group 7 ("extensive holdings including organic farms")

a) Selection matrix initially planned:

	Agricultural areas					
	Ardenne	Famenne	Jurassique	Condroz	Région limoneuse	Total
BE-CC1	1 (conv.) + 1 (organic)	1 (conv.)	1 (organic)	1 (conv.)	1 (organic)	6
BE -F	1 (organic)	1 (organic)	1 (conv.)	1 (organic)	1 (conv.)	5
	3	2	2	2	2	11

b) Breeders finally involved:

	Agricultural areas					
	Ardenne	Famenne	Jurassique	Condroz	Région limoneuse	Total
BE-CC1	1 (organic)	1 (organic)		1 (in conversion to organic farming)		3
BE-BF	1 (organic)	1 (organic)		1 (conv.)		3
	2	2	0	2	0	6

As explained in the report, some deviations occurred compared to the selection matrix initially planned, due to difficulties encountered during the mobilisation of the breeders.

In France and in Italy, partners did not used matrix for the selection. Relay actors were simply informed of which profiles they had to find, related to the case studies.

Finally, in Ireland, partners mobilized natural groups (i.e. pre-existing groups).

7.3 Appendix3: Interview guides (used for French and Walloon focus groups)

7.3.1 Interview guide and proceedings for focus groups with breeders and advisors

Sequences	Time	Accumulated Time	Description	Techniques	Material
	5’	5’	Welcome Consent for the recording (reminder) Program of the day		
1. Introduction **10:15 to 10:40**	5’	10’	Rules of the group : • There is no bad or good opinion: every opinions are welcome (no judgement) • Positive and constructive attitude • Mutual listening in a respectful way • Voluntary participation: no obligation of anything • Shared responsibility in the success of the meeting • Switch off or mute phone • Respect of the agenda to finish on time • … Anything else?	To be written previously and posted on a flipchart sheet visible for all at all times	Flipchart, marker, buddies or sticky tape or magnets
	15’	25’	Presentation (1’ per person) based on the following model: first name, their farm in a few words (region, surface area (grasslands and cereals), size’s herd, breed, ration (in summer and in winter), reason of participation	Round table Each person writes his first name in block letters on a label and sticks it after presenting himself + name plate in front of him	Sticky labels, name plate, markers

2. The transition toward more sustainable beef farming systems: the decrease of feed/food competition **10:40 to 11:00**	20’	45’	Background overview: The animal production sector faces many challenges (i.e. from increases in global food demand due to population growth, climate change, competition for natural resources to economic volatility). The European Research Area Network on Sustainable Animal Production (ERA-NET SusAn) makes the transition to more sustainable animal production systems a strategic plan for the future. ➔ In the beef production sector, one of the avenues envisaged for this purpose is the increase of animal feed based on resources non-edible by humans. Question : What’s your opinion on this idea? Relaunch questions: what are your own current practices? Is it possible in your opinion?	Moving debate (see annexe 1)	Provide a clear space in the room
3. The representation of the innovation **11:00 to 11:30**	20’	1h05	Question : If I say “innovation”, what does it mean to you?	Individual reflection with post-it (1 word/post-it) then sharing: each participant sticks his post-it on the flipchart sheet (or on a board). Possibility of grouping.	Post-it, markers (1/person), flipchart or board (do not forget to take a picture in this case!)
	10’	1h15	Comparison with the definition used in Sustainbeef: “Innovation is the introduction of something <u>new or improved</u> into something that has a well-established character, such as products, processes, marketing or organizational methods. In other words, it means applying ideas, knowledge or practices that are <u>new to</u>	Project the definition used in Sustainbeef	General slides show

			a particular context with the purpose of creating positive change that will provide a way to meet needs, take on challenges or seize opportunities. Innovation is generally synonymous with risk-taking."		
4. The innovations allowing to decrease the feed/food competition in beef farming systems from the breeders and advisors point of view **11:30 to 12:40**	30' (15' for the work in subgroup + 15' for the sharing)	1h45	Question: Which innovations would make it possible to make greater use of inedible resources in beef production in your opinion?	Brainstorming in subgroups (3 person/subgroup) (1 idea/post-it) then sharing and selection of two innovations per subgroup for in-depth reflection	Working space for the subgroup with post-it, markers. Flipchart for the sharing (or a board → take a picture)
	40' (2x15' + 10' for the sharing)	2h25	In-depth reflection in subgroups (2 innovations/subgroup) based on a template Question: Describe the innovation in detail. What are the conditions for its implementation? What does it bring in you?	Work in subgroups based on a template (see annexe 2) then sharing	Working space for the subgroups, template, pens Flipchart, markers
5. Lunch time **12:40 to 13:40**	60'	3h20			
6. Presentation of the innovations identified in	15'	3h40	Presentation of Sustainbeef and its main hypothesis + the part played by the focus group in the conception of the scenarios		General slides show

literature review and open-ended interviews with experts **13:40 to 14:30**			"We hypothesize that cattle farming systems which rely mainly on grasslands and agro-industrial resources non-edible by humans are more or can be designed to be more sustainable than specialized systems which use feedstuffs that could also be directly used as food or that was produced at the detriment of food production."		
	25'	4h05	Presentation of the innovations identified in literature review and open-ended interviews with experts (in a "vulgarized" way) (15') + Questions/answers (10')		Specific slides show
	10'	4h15	Comparison with innovations identified by breeders and advisors		
7. Prioritisation of the innovations according to their feasibility and their relevance **14:30 to 14:50**	20'	4h35	Question: Among all the innovations identified (by you and by experts), could you select those you find: • The most relevant (i.e. from the decrease of feed/food competition point of view); • The most feasible (i.e. the easier to implement). Collective debriefing in order to identify: • The most feasible one • The most relevant one • The most relevant but the less feasible one	Vote with stickers Vote in two times: first the relevance, then the feasibility Give 2x10 stickers to each participant (they don't have to use them all, but it is in order to avoid drastic choice)	Coloured stickers (2 different colours) A3 sheets with the innovations (1 innovation per sheet)
8. Identification of the levers and barriers for the uptake of the more relevant but less	60' (10' for the explanation 2x20'/innovation	5h35	In-depth reflection on the more relevant but less feasible innovations in subgroups (3 persons/subgroup). Please note: if innovations are numerous, ask to the group to select some of them (2 innovations/subgroup).	Work in subgroups (3 persons) based on a template (see annexe 4) then sharing	Template (see annexe 4), pens Flipchart, markers

feasible innovations **14:50 to 15:50**	10’ for the sharing)		Examination of the innovations based on the “ALARME” grid (see annexe 3) and a set of criteria. Question: Do the selected innovations have an impact on: **A**nimal? “**L**ogement” in French, i.e. the buildings? “**A**limentation” in French, i.e. the feeding? “**R**égie” in French, i.e. the herd management? **M**icrobism? “**E**leveur” in French, i.e. the breeder? In your opinion, could the following criteria be a barrier for the uptake of these innovations : the cost, the work load, the skills, the equipment (the pre-requisites), the coordination with the value chain actors (up and downstream), the legislative, regulatory and normative framework, the rapidity of the implementation, the reliability of the innovations, the expected impact ? Do you see other barriers? By contrast, what would facilitate the uptake of these innovations, what would be the levers?		
9. Conclusion **15:50 to 16:10**	15’	5h50	Question: How do you feel at the end of this day?	« Wheater report » (see annexe 5)	
	5’	5h55	Information about the next meeting : validation of the scenarios Acknowledgement		

7.3.2 Interview guide and proceedings for focus groups with value chain actors

Sequences	Time	Accumulated Time	Description	Techniques	Material
1. Introduction **10:00 to 10:25**	5’	5’	Welcome Consent for the recording (reminder) Program of the day		
	5’	10’	Rules of the group: • There is no bad or good opinion: all opinions are welcome (no judgement) • Positive and constructive attitude • Mutual listening in a respectful way • Voluntary participation: no obligation of anything • Shared responsibility in the success of the meeting • Switch off or mute phone • Respect of the agenda to finish on time • … Anything else?	To be written previously and posted on a flipchart sheet visible for all at all times	Flipchart, marker, buddies or sticky tape or magnets
	15’	25’	Presentation (1’ per person) based on the following model: first name, profession, reason of participation	Round table Each person writes his first name in block letters on a label and sticks it after presenting himself + name plate in front of him	Sticky labels, name plate, markers

2. The transition toward more sustainable beef farming systems: the decrease of feed/food competition **10:25 to 10:40**	15’	40’	Background overview: The animal production sector faces many challenges (i.e. from increases in global food demand due to population growth, climate change, competition for natural resources to economic volatility). The European Research Area Network on Sustainable Animal Production (ERA-NET SusAn) makes the transition to more sustainable animal production systems a strategic plan for the future. ➔ In the beef production sector, one of the avenues envisaged for this purpose is the increase of animal feed based on resources non edible by humans. Presentation of Sustainbeef and its main hypothesis: “We hypothesize that cattle farming systems which rely mainly on grasslands and agro-industrial resources non-edible by humans are more or can be designed to be more sustainable than specialized systems which use feedstuffs that could also be directly used as food or that was produced at the detriment of food production.” The objective of this focus group: Collect their opinion on the innovations identified through literature review, open-ended interviews with experts and focus groups with breeders and advisors.		Slides show

3. Discussion on the innovations identified through literature review, open-ended interviews and focus groups with breeders and advisors **10:40 to 12:40**	5’	45’	The definition of innovation used in Sustainbeef: “Innovation is the introduction of something new or improved into something that has a well-established character, such as products, processes, marketing or organizational methods. In other words, it means applying ideas, knowledge or practices that are new to a particular context with the purpose of creating positive change that will provide a way to meet needs, take on challenges or seize opportunities. Innovation is generally synonymous with risk-taking.”		Slides show
	20’	1:05	Presentation of the innovations in a summarized way (in 1 or 2 sentences) through an individual questionnaire: participants have to position themselves on a scale from dark green to dark red according to the type of impact the innovation has on their activity. Dark green: impact +++ Light green: impact + Yellow: mixed impact (even no impact at all) Light Red: impact - Dark red: impact - - - White: no opinion Black: no answer	« Régnier Abacus » (see annexe 6)	Questionnaire
	15’	1:20	Break for the participants during the analysis of the questionnaire		Excel file (template)

	80’	2:40	Collective debriefing and discussion Relaunch question: the barriers and the levers		Results from the analysis of the questionnaire through matrixes
4. Conclusion **12:40 to 13:00**	15’	2:55	Question: How do you feel at the end of this morning?	« Wheater report » (see annexe 4)	
	5’	3:00	Information about the next meeting: validation of the scenarios Acknowledgement		
5.Lunch **13:00**					

7.4 Appendix4: Interview guide (used for Italian focus groups)

7.4.1 Interview guide and proceedings for focus groups with breeders and advisors

Sequences	Time	Accumulated Time	Description	Techniques	Material
1. Introduction **10:15 to 10:40**	5’	5’	Welcome Consent for the recording (reminder) Program of the day		
	5’	10’	Rules of the group: • There is no bad or good opinion: all opinions are welcome (no judgement) • Positive and constructive attitude • Mutual listening in a respectful way • Voluntary participation: no obligation of anything • Shared responsibility in the success of the meeting • Switch off or mute phone • Respect of the agenda to finish on time • … Anything else?	To be written previously and posted on a flipchart sheet visible for all at all times	Flipchart, marker, buddies or sticky tape or magnets
	15’	25’	Presentation (1’ per person) based on the following model: first name, their farm in a few words (region, surface area (grasslands and cereals), size’s herd, breed, ration (in summer and in winter), reason of participation	Round table Each person writes his first name in block letters on a label and sticks it after presenting himself + name plate in front of him	Sticky labels, name plate, markers

2. The transition toward more sustainable beef farming systems: the decrease of feed/food competition **10:40 to 11:00**	20’	45’	Background overview: The animal production sector faces many challenges (i.e. from increases in global food demand due to population growth, climate change, competition for natural resources to economic volatility). The European Research Area Network on Sustainable Animal Production (ERA-NET SusAn) makes the transition to more sustainable animal production systems a strategic plan for the future. ➔ In the beef production sector, one of the avenues envisaged for this purpose is the increase of animal feed based on resources non edible by humans. Presentation of Sustainbeef and its main hypothesis: “We hypothesize that cattle farming systems which rely mainly on grasslands and agro-industrial resources non-edible by humans are more or can be designed to be more sustainable than specialized systems which use feedstuffs that could also be directly used as food or that was produced at the detriment of food production.” The objective of this focus group: Collect their opinion on the innovations identified through literature review and open-ended interviews with experts.		

3. Presentation of the innovations identified in literature review and open-ended interviews with experts **11:00 to 11:35**	5’	50’	The definition of innovation used in Sustainbeef: “Innovation is the introduction of something new or improved into something that has a well-established character, such as products, processes, marketing or organizational methods. In other words, it means applying ideas, knowledge or practices that are new to a particular context with the purpose of creating positive change that will provide a way to meet needs, take on challenges or seize opportunities. Innovation is generally synonymous with risk-taking.” Question: What do they retain?	Project the definition used in Sustainbeef. Underline (or write) what they retain.	General slides show
	30’	1:20	Presentation of the innovations identified in literature review and open-ended interviews with experts (in a “vulgarized” way) (20’) + Questions/answers (10’)		Specific slides show
4. Prioritisation of the innovations according to their feasibility and their relevance **11:35 to 11:55**	20’	1:40	Question: Among all the innovations identified, could you select those you find : • The most relevant (i.e. from the decrease of feed/food competition point of view); • The most feasible (i.e. the easier to implement). Collective debriefing in order to identify: • The most feasible one • The most relevant one • The most relevant but the less feasible one	Vote with stickers Vote in two times: first the relevance, then the feasibility Give 2x10 stickers to each participant (they don’t have to use them all, but it is in order to avoid drastic choice)	Coloured stickers (2 different colours) A3 sheets with the innovations (1 innovation per sheet)

	20’ (10’/innovation: 5’ for the barriers, 5’ for the levers)	2:00	In-depth reflection on the more relevant but less feasible innovations in subgroups (3 persons/subgroup). Each subgroup works on 2 innovations. Please note: if innovations are numerous, ask to the group to select some of them (2 innovations/subgroup). In your opinion, what would prevent the uptake of these innovations (or makes it difficult), what would be the barriers? By contrast, what would facilitate the uptake of these innovations, what would be the levers?	Work in subgroups (3 persons): each subgroup writes on a flipchart’s sheet the barriers and the levers for each innovation it analyses (2 columns). → the subgroup is supervised by one of the facilitators.	Flipchart’s sheets, markers
5. Identification of the levers and barriers for the uptake of the more relevant but less feasible innovations **11:55 to 13:15**	40’ (10’ for the explanation 2x15’/innovation)	2:40	Examination of the innovations based on the “ALARME” grid (see annexe 1) and a set of criteria. Question: Do the selected innovations have an impact on: **A**nimal? “**L**ogement” in French, i.e. the buildings, the equipment? “**A**limentation” in French, i.e. the feeding? “**R**égie” in French, i.e. the work organization? **M**icrobism, i.e. the health of the animal? “**E**leveur” in French, i.e. the breeder? In your opinion, do the following criteria be a barrier for the uptake of these innovations: the cost, the work load, the skills, the equipment (the pre-requisites), the coordination with the value chain actors (up and downstream), the legislative, regulatory and normative framework, the rapidity of the implementation, the reliability of the innovations, the expected impact?	Work in subgroups based on a template (see annexe 2) → the subgroup is supervised by one of the facilitators.	Template (see annexe 2), pens Flipchart, markers

	20’	3:00	Collective sharing: each subgroup presents its own reflection to the others		
9. Conclusion **13:15 to 13:30**	10’	3:10	Question: How do you feel at the end of this day?	« Wheater report » (see annexe 3)	
	5’	3:15	Information about the next meeting: discussion about the results of the scenarios. Acknowledgement		

7.5 Appendix 5: Description of the innovations identified by the participants

7.5.1 Improve the grassland and forage area management by the way of decision making-tool: multi-function GPS collar (FG1)

Name of the innovation: Connected tools: a multi-function GPS collar (grass growth measurement, geolocation of animals and orientation of the herd by sound and/or electric signal (virtual fence))	
Description:	In order to optimize the quality and quantity of grazed or mowed grass, it is necessary for the farmer to know the level of grass growth in his plots throughout the season. As this work can be very time-consuming for the breeder, the idea of this innovation is to equip the animals with a collar equipped with a technology to measure grass. Thanks to a GPS integrated into the collar, the movements made by the animals on the pasture would even make it possible to know the differences in grass height within the plots. The breeder could use this information to accurately adjust the density per hectare every day. This collar could also be used for virtual fencing: by allowing the collar to emit an acoustic or electrical signal to the animals, the breeder can influence the movement of the animals and thus choose the grazing area from an application. The objectives are to: • Practice rotational pasture without the constraint of having to move the physical fences every day; • Enhance areas that were not previously developed (roadsides, railroad tracks) because they were not fenced in; • Allow the grazing of cereal regrowth. Finally, the device could also collect information on animal behaviour and health.
Conditions for its implementation:	• Cost will be the main obstacle to the implementation of this innovation. But as with most innovations that involve new technologies, we can expect a reduction in cost if this product is "democratized". • For the moment, the technical constraint is also important since such a collar that groups these different tools does not yet exist. Reliability of the equipment should be ensured because in the event of failure, the consequences can be significant. • "Connected farm": for some farmers, adopting this type of tool requires the acquisition of digital skills. • Will animals adapt quickly to the functioning of this virtual barrier? Especially if the grazing area changes every day? • We can fear a loss of docility if the breeder is less and less present with the animals • The use of an electrical signal can cause an animal welfare problem (Note: the first prototypes claim to use a lower current and voltage than electric fences)

Expected performance:	• Saving time (fences and observing grass growth) • Reduction in food purchases • Improve the quality of pasture grass • Optimize the amount of pastured grass • Increase the areas that can be valorized
Other comment:	For participants, it is clear that this tool would in no way replace the farmer's eye. It is a decision-making tool.

7.5.2 Develop valorisation for products with less feed-food competition (FG1)

Name of the innovation: Enhance the value of products through a quality approach	
Description:	The idea is to create a quality approach aimed at promoting and enhancing the reduction of feed-food competition. According to a win-win logic, it is a question of satisfying consumers' supposed expectations in terms of feed-food competition, while ensuring that producers are properly remunerated, in line with the efforts invested to reduce this competition on their farms. Various proposals: • a reference to "grass meat" • a colour code or sticker indicating the proportion of non-competitive with food resources that have been used in the production process
Conditions for its implementation:	• The drafting of specifications • The creation of a producers' group: this is a collective and not an individual process. Participants highlight that it goes beyond the profession of breeder and requires an organization at the level of the sector or territory. However, they believe that the breeder must be at the heart of the project. • Direct sales, local consumption and organic farming were mentioned as levers that could help to promote this kind of product. • Traceability must be more readable by the consumer.

Expected performance:	• A fair remuneration • A stronger link between producer and consumer • An adequacy with demand • A better image of livestock farming among consumers
Other comment:	• The main barrier mentioned is the multitude of labels, quality approaches already in place, which create confusion for consumers. Labels are in competition and this makes the message participants want to convey more complex. • There is already confusion among consumers between "local consumption" and "natural consumption". • Despite the growing methods and efforts that livestock farms can make to reduce feed-food competition, how can ensure that the taste of the meat will be the same? In the end, isn't it the main parameter that influences the choice of consumption? If the taste is the same, the objective will be to "sell a story" to promote this mode of production, and convince the consumer to pay more for a product with equivalent organoleptic qualities.

7.5.3 Improve the productivity of area allocated to feed production (FG1)

Name of the innovation: Increase the productivity of surfaces (grasslands, fodder crops, crops, etc.)[8]	
Description:	Put Agronomy back at the centre of thinking, conducts and practices. Examples: diversify the rotation, extent the rotation, Soil Conservation Techniques ("to make the soil live again"), intermediate crops, intercrops,...
Conditions for its implementation:	Adapt in this sense (or continue if already started): • The initial training of farmers, • The continuous training of farmers, • The training of agricultural advisors (content and form: change of posture; move from a profession of prescriber to that of guide and facilitator).

[8] The participants highlight that it is an innovation in the sense that it would be a break with the current trend (expansion that has led to the simplification and standardization of technical itineraries, crop rotation, agronomic deadlocks, ...)

	Develop advice by the way of exchange groups between farmers, within which advisors play the role of facilitator, with occasional call for specific expertise according to need. Pay attention that the profiles of farmers' members of the group have to be diversified and non-specialized even if they work on common issues. Develop research on soils, agronomy and agriculture. Genetic research: (better) integrate hazard resistance into selection, keep variability and diversity for context adaptation. Secure the risk taking related to the modifications to be implemented on the holdings.
Expected performance:	Increase the quantity of feed AND food, which should reduce the competition. This would also make it possible to increase the quantity of by-products (which are not edible by humans). Activating this lever on permanent grasslands would also have the effect of limiting the use of temporary grasslands that are located on arable land (i.e. more in competition with the production of food). In addition, permanent grasslands can be more resistant to climatic hazards than temporary ones.
Other comment:	

7.5.4 Animal's efficiency (FG1)

Name of the innovation: Feed efficiency (animal approach)	
Description:	The participants define the feed efficiency as "the ability of animals to process feed in food". Several innovations were mentioned to improve animal feed efficiency: 1. Have sensors that allow accurate and individual measurements of what animals ingest. The participants were familiar with the weighing trough systems in the experimental stations. They would like to have comparable but accessible tools for commercial farms. 2. Genetic selection: the participants agreed that there is a high genetic variability in French breeds, particularly around food efficiency. This must be made a priority for the indexing of breeders. 3. Ensure a transfer between the different links in the livestock sector of data relating to the performance and production conditions of animals. Participants consider that traceability is efficient in France. However, participants gave several

	examples: a. the case of a fattener who buys grazers and who does not know (most of the time) what were the sanitary treatments they received or how they were raised, b. the breeder does not know what the average daily weight gains of his grazers were during the fattening phase. 4. Decrease in animal size: to have animals with lower maintenance costs (participants agreed that this is a proposal that should be tested on experimental farms to measure its feasibility). 5. Working with "composite breeds", i.e. crossbreeding 6. Adapt breeds to production contexts (pedoclimatic, fodder, etc.) in order to limit the standardization of leading and technical itineraries. There is a loss of link between the breed and the territory. The aim here is to ensure that the most efficient technical itineraries for each breed and each type of animal are referenced.
Conditions for its implementation:	1. Transfer of information between the different livestock actors sector: the problem of "who owns the data? » 2. For the reduction of the size of the breeds: the market must send clear signals 3. Participants warned against a decrease in animal welfare in the case of an improvement in feed efficiency (participants made the analogy with a formula 1... which breaks all the time). 4. "We must work on our breeds in order to measure all their genetic variability"
Expected performance:	This part could not be completed due to lack of time.
Other comment:	

7.5.5 Facilitate pasture by the way of land consolidation (FG2)

Name of the innovation: Plots restructuring to promote rotational grazing

Description:	Rotational grazing is a technique known for: • Reduce grass waste • Improve the quality and quantity of fodder However, it involves rapid rotation on plots and is therefore often constrained by the fragmentation of plots. A land consolidation would therefore make it possible to group together the grasslands of a farm and facilitate rotational grazing.
Conditions for its implementation:	• For rotational grazing: ▪ Requires to adapt grazing dates, forage varieties, ..., ▪ Workload: the fences represent a large amount of work at the beginning, ▪ Problem with the water point: always leave access to water. It is difficult to transport. • For the land consolidation: ○ Human brake. Everyone is afraid of losing lands of quality. But young people are more likely to exchange plots because they are less attached to the land; ○ Rather suitable for large farms.
Expected performance:	• Facilitation of herd management on rotational grazing • Better use of grass
Other comment:	• Question of docility: once the animals are used to changing paddocks often, they become more docile and move easily • About the outdoors: in winter, are animals better outside in a plot or in a building? If they are outside, a plot is sacrificed in which it will be impossible to resow a temporary meadow the following year. On the other hand, we gain in the quantity of straw needed

7.5.6 Use of by-products (FG2)

Name of the innovation: Use agro-industrial by-products as feed	
Description:	Use non-edible agro-industrial by-product as feed. The use of these by-products would be used as supplementation to the grass-based ration, thus replacing concentrates that may compete with food.

	Question: can we imagine new by-products? Waste that are not currently valorised?
Conditions for its implementation:	• Accessibility? Supply can be expensive due to the moisture content of many of the by-products ("a lot of water is transported"). The structuring of a by-product chain could reduce this cost, by allowing farmers to place joint orders. • Quality? Farmers often lack information on this point. • Regularity of supply • Are the volumes sufficient?
Expected performance:	• Reduction of costs by compensating for the use of cereals • Avoid waste/destruction of by-products that would not otherwise be valued • Can improve the image of livestock farming
Other comment:	What about by-products that are already valued differently?

7.5.7 Improve the feed/food efficiency by the way of breeds and genetic selection (FG2)

Name of the innovation: Animal genetics	
Description:	1. "Lighter cows": the idea is that a smaller cow consumes less. But this raises many questions: does the reduction in the cost of feed compensate for the lower production of kg? What about the valorization of these smaller carcasses? 2. Improve the feed/food efficiency of cows. The objective here is to produce more food with less feed, but also to reduce emissions. 3. Offer more rustic and economical cows (vet fees,...). This also involves improving maternal qualities (milk production in particular) and seeking greater docility. 4. To have information to measure the performance of other breeds, bred outside France. Some participants clearly ask the question whether "pure breeds" are the right answer to this

	problem.
Conditions for its implementation:	1. Be careful to take into account consumer and market expectations (one participant wondered whether the expectations of the two are really similar...). Be more attentive to the consumer and communicate in order to try to change certain consumption habits. While looking at / measuring what the consumer is really willing to pay: *"ok to produce on grass, but it will cost more, it will take more time.... will the consumer pay for it"* 2. It is also a question of educating the sector: the logic here is to assume that earlier animals will probably produce fatter meats. 3. Genetic orientation: a work to be carried out with the Herd Bookand avoid privileging the "meat" criterion in the selection choices, but rather work on maternal qualities and milk. 4. At the genetic level, participants believe that we now have effective tools to change things quickly: but they wonder about the acceptability of these practices to society.
Expected performance:	Especially economic gains thanks to: • lower feed costs, • better selling price.
Other comment:	

7.5.8 Feed autonomy by the way of new varieties of fodder (FG2)

Name of the innovation: Create a new species of fodder	
Description:	At the beginning the idea was to have an only one species of grass that will cover all the needs of the animals. But during exchanges, participants highlight that the needs are different from one animal to another and during the year: there cannot therefore be only one species of grass. Moreover, species have to be adapted to climate change

Conditions for its implementation:	• Good yields • Feed/food efficiency • Good distribution of production over the spring and summer period
Expected performance:	• Reduce costs • Be more autonomous: no purchase of supplements, no purchase of fodder in case of drought
Other comment:	

7.5.9 Improve the communication about livestock farming (FG2)

Name of the innovation: Communication	
Description:	• Network promoting links between schools and breeders • Documentary filmmaking • Support for farmers' initiatives showing their work on social networks • Barcode on the products to know where and how the meat was produced
Conditions for its implementation:	• More livestock intervention in schools, more citizen visits to farms • Train farmers to communicate. Give them arguments to defend and promote their work • A more proactive, even more "aggressive" communication agency with national campaigns • More visibility in the media

Expected performance:	• Enhance the image of livestock and meat • Show that farmers work well and that their animals are fine • Reconnecting urban dwellers and farmers
Other comment:	

7.5.10 Optimize land use (FG6)

Name of the innovation: ~~SIE fodders~~ → ~~Intensify land use~~ → Optimize land use[9]	
Description:	The idea is to optimize soil use by working on cover crops. This consists of: • Do not leave the soil at rest after the main crop • Take advantage of the obligation to set covercrops to use it to feed cattle • Choose a cover that is simple to install, of correct quality and low price (e.g. oats and peas, which is not necessarily the most energy-rich) • The covercrops must have a short cycle to be harvested at the end of October N.B.: Can be used as auxiliary solution: it will not replace the majority of fodder, the "classic" fodder

[9] This innovation will change its name three times during the exchanges. It was first called "SIE (i.e. area of ecological interst) forages", then participants renamed it "intensifying land use". The term "intensify" was then replaced by "optimize", as participants felt that this term would be better accepted (reference to the negative image associated with the term "intensify" in society).

Conditions for its implementation:	Implementation depends on: • the main culture (it takes enough time to implement cover crops): what window remains? • the region: it must be a region of cultures (soil and climate conditions)
Expected performance:	• Increase in humus level • Avoid leaching and use excess fertilizer • Secure the supply of fodder • Average 3 T dry matter/year • Does not constitute coarse fodder (because the harvest corresponds to a period when it is difficult to let the harvested products dry)
Other comment:	• For those who do not have crops, one solution would be to make arrangements with neighbouring cereal growers (e.g. the farmer "receives the land for 2-3 months") • Pay attention! Covers can also be harvested for biomethanisation, which could lead to competition (but should this outlet for biomethanisation not be prohibited?). Participants pointed out that the ban should be extended to the use of raw materials (maize is cited as an example) for biomethanisation. • Is ray-grass profitable in cover crops? → Nitrogen requirement ○ Italian Ray-grass grows faster but at a higher cost

7.5.11 Aim for feed autonomy by the way of new crop/pasture mixtures (FG6)

Name of the innovation: New mixtures	
Description:	Use protein-rich mixtures to balance the ration. These mixtures would be produced on the farm (avoid external purchases) and would not require significant cost. Among the possible mixtures: alfalfa (even if this is done a lot in France, it is considered an innovation at the Walloon level given the given definition of innovation), lupin, field beans, nettle (wilted).

Conditions for its implementation:	• Have the hectares available: it is necessary to be able to "sacrifice" other crops to plant the new mixtures *("risk if the crop does not work as expected"*), • Adapt the mixtures to the soil and climate conditions, • Soil quality: PH of the soil, especially for alfalfa, • Seed availability ("If everyone does it, seed companies will not be able to meet the demand") • Be attentive to mechanization, at all stages of production ("either valorisation of machines already present, or by company but at what cost? »)
Expected performance:	• Decrease in feed purchases • Better palatability of the ration • Better use of surface areas • Improve the feed efficiency of the ration
Other comment:	• What about the impact on the quality and quantity of meat produced? • Strong pressure on land availability (horticulture, Christmas trees, real estate speculations, etc.): hectares are expensive!

7.5.12 New by-products: milk powder (FG6)

Name of the innovation: Milk powder	
Description:	Use milk powder for animal feed, but at a later stage than calves. The idea is to recover surplus and/or downgraded powder, i.e. powder that could no longer be used in human food ("either for quality reasons or because of excessive storage time")
Conditions for its implementation:	Go up to 10% of the dry matter ration in the feeding of young bulls (e.g. 12 kg ration → 1.2 kg milk powder) Profitability: everything depends on the price of milk powder: this must of course be economically attractive.

Expected performance:	Would improve the tenderness of the meat
Other comment:	• The price of milk powder will probably be a brake (too high) • Milk powder is already used to "finish" competition animals

7.5.13 Area allocated to the production of feed: alternative crops (FG6)

Name of the innovation: Alternative crops	

Description:	Replace maize with protein crops, because if maize is easy to grow and use for fattening, it does not offer a balanced ration, it lacks protein, etc. As already mentioned above, this innovation does not avoid feed/food competition in terms of area. However, the participants wanted to keep it, because the idea is to be able to substitute protein crops for maize cultivation, which would make it possible to balance the ration from locally produced proteins (lack of protein production in Wallonia).
	• For this, diversification of crops by establishing:
	  ○ Soya, provided that varieties adapted to climatic conditions are planted
	  ○ Other protein sources, such as lupin, field beans, peas, rapeseed, clover, alfalfa, (fescue)

Conditions for its implementation:	• Climate adapted to these crops: for soya, this is not the case here today, but perhaps in the future, following climate change?! • Choice of varieties adapted to soil and climate conditions • Profitability: it must be profitable to grow them yourself

Expected performance:	• Better ration • Diversify the products available
Other comment:	• Does not in itself avoid competition in terms of land allocation • Must still have an income What about quinoa co-products, hemp, supermarket leftovers? Participants highlighted the limitations of the use of by-products. Thus, availability, regularity and security of supply are sine qua non conditions, as the ration cannot be changed *"every 15 days"*, which is a potential source of stress for the animals, which could have repercussions on growth, in particular.

7.5.14 Improve the monitoring of the herd and the efficiency by the way of genetic selection (FG7)

Name of the innovation: Genetic	
Description:	• Improve forage efficiency (make the most of grass) • In parallel with heavier carcasses We act on 3 levels: • Insemination centre • On the farm (choice of mothers) • At slaughter (know the weight of the carcasses)
Conditions for its implementation:	• Staying in an economic circuit • Know what you are producing • The selection must question itself • The product must be adapted to the desires of consumers • You have to know your herd well

Expected performance:	• Milk capacity (no longer having to supplement calves) • Calving Ease • Daily growths • Good valorization of the grass • Ability to suck
Other comment:	• Develop a breed that is characteristic of the country • Castrate the calves • Have a weighing scale to help visualize/objectify During the discussion, the participants pointed out that the Belgian Blue should not specifically disappear, but that the objective of genetic improvement should be rethought. One participant wonders why breeders don't go to a BB that can calve on its own, for example? There is also "a language problem in the agricultural world" when we talk about mixed BB, because it has a negative side, but they agree that mixed meat BB has potential.

7.5.15 Improve grassland and forage area management and productivity by the way of techniques, improve the preservation of fodder (FG7)

Name of the innovation: fodder techniques	
Description:	These techniques can be improved in several ways: • Change the way you graze (e.g. rotational grazing) • Reintroduce alfalfa • Play on the management of refusals • Give hay instead of silage

Conditions for its implementation:	• More for dairy cows? • Must be adapted to the available surfaces, to the types of meadows (mowable or not?) • Soil and climate conditions → crops must be adapted to the region
Expected performance:	• Hay: better animal health (stimulated rumen), better environmental performance, cheaper than haylage. • Grazing: vitamin D intake • General: animal welfare
Other comment:	• Fear of enterotoxemia • The grassland must be worked on to improve its production (interest of rotational vs. continuous grazing) • Weed must not just be an environmental alibi One participant points out that hay eliminates the butyric problems of silage because there is no longer a fermentation phase. In addition, the barn drying technique is mentioned but seems irrelevant from an economic point of view.

7.5.16 Diversify forage sources: optimize land use by the way of cover crops and area of ecological interest (FG7)

Name of the innovation: Area of ecological interest/cover crops	

Description:	• Optimization of the surface area
	• Take advantage of non-core production periods
	• Additional forage production
	• Improving soil quality
	• Exchanges between farmers and herders (straw versus manure)
	• Mixtures of:
	  ▪ legumes
	  ▪ grasses
	  ▪ cruciferous

	• Dependent on:
	  ▪ the date of implementation
	  ▪ soil and weather conditions
	  ▪ the duration of implementation
	• Attention! Forced destruction by legislation → Aberration:
	  ▪ ecological ("obligation to destroy after a delay in establishment even if the crop's potential has not been fully expressed")
	  ▪ agronomic if the crop is well established and could be developed over several years

Conditions for its implementation:	• Area of ecological interest are already regulated • Choice of forage mixes ("see description") • If the farmer sees it as an interest rather than an obligation
Expected performance:	• 3T dry matter/ha or more • Green feeding
Other comment:	One participant highlighted that "now you drive manure and still pay for the straw". However, another participant explains that in his case, a "grain producer makes his land available because he has an obligation to set up covercrops and he doesn't care. He asked me, "Can you put on ray-grass? You pay for the seeds, you put in manure, you collect your grass and then I get my land back once you have ensiled", and I don't owe anything, I just have to pay for my seeds and he has fulfilled his function at the area of ecological interest level, so he is in order and I have my fodder".

7.5.17 Diversify forage sources: Hedgerows as source of forage (FG7)

Name of the innovation: Hedgerows	
Description:	• Different from agroforestry because if you rent the land, it is the owner who will benefit from the added value of the trees *("life span of the trees")* • Take advantage of the trend to replant hedges to use them as suppliers of feed

	• Double value → heating
Conditions for its implementation:	• "Feed" tree species adapted to our regions • "no idea of possible species"
Expected performance:	• potentially deworming and anti-parasitism (except for scabies!) • potential homeopathy • woods • "no idea of feed yield or production quality"
Other comment:	• If we are "obliged" to plant hedges then as much as they have an agronomic interest • Positive image for the public

7.6 Appendix 6: results of the voting sequences

7.6.1 Focus group 1 (FR.LOR-BF)

Innovations	Relevance (n=10)	Feasibility (n=10) (the **less** feasible)	Innovation from Task 4.1	Innovation suggested by participants
Improve grazing management	5	0		x
Referencing technical itineraries related to the genetic variability of pure breeds	5	3		x
Precision livestock farming: multi-function GPS collar	4	3		x
Favouring the milk production of suckler cow	4	4	x	
Traceability throughout the life of the animal	4	6		x
Alfalfa and red clover	3	0	x	
Hay dried in barn	1	0	x	
New sources of proteins: insects and algae	1	0	x	
Crossbreeding (meat breed x breed adpapted to grazing) (races composites)	1	0	x	

7.6.2 Focus group 2 (FR.LIM-CC)

Innovations	Relevance (n=9)	Feasibility (the **less** feasible) (n=9)	Innovation from Task 4.1	Innovation suggested by participants
Genetic selection for feed efficiency	7	x	x	x
Selection of plant species according to conditions, climate	5			x
Genetic selection: choice of breeds: more rustic breeds?	3	x		x
Plant species improvement	2			x
Rotational grazing and land consolidation	1		x	x
Communication	1			x
Creation of a new forage species	1	x		x
Use of by-products	1	x	x	x
Agroforestry	1	x	x	
Reduction of the size of the animals	1	x		x

7.6.3 Focus group 3 (FR.CANT-CC, FR.CANT-DCC)

Innovations	Relevance (n=11)	Feasibility (the **less** feasible) (n=11)	Innovation from Task 4.1	Innovation suggested by participants
Communication on practices	2	2		x
Grass fattening	6	1	x	
Rotational grazing	6	1		
Genetic selection: improving the animal consumption index	6	1		x
By-products	2	4	x	
Feed autonomy	6	1		x
New pricing system	2	10		x
Transparency within the value chain	1	5		x
Precision livestock farming	1	4	x	

7.6.4 Focus group 4 (IT-F900, IT-F226)

Innovation	Relevance (n=10)	Feasibility (the more feasible) (n= 10)	Innovation from Task 4.1	Innovation suggested by Italian experts
Salers and Angus crossbreeding	1	0	x	
Use of grassland made by cereals generally not used for human consumption (barley and wheat) and proteins (vetch, peas) given to animals as forage silage	0	1	x	
Insects	1	0	x	
Seaweesds	2	1	x	
Genomic selection for feed efficiency	2	0	x	
Genetic selection for milk production and persistency	1	1	x	
Robotic and precision farming	3	3	x	
Double crops	2	3	x	
Byproducts of maize, of sugar beets, of wheat etc.	1	1		x
Improvement of farm organization/management in order to reduce feed waste	2	2		x
Utilization of agro-food industry, such as biscuit wasted	1	1	x	
To improve the quality of the herb of permanent meadows or pastures, so that animals' requirements are met without utilizing too large amounts of cereals and pulses	2	1	x	
To sustain farmers' cooperatives or networks for increasing hay production and exchange between hay makers and animal farmers	1	0	x	
To consider new crops as maize BMR or Autumn-Spring crops as silage wheat that can substitute maize silage - Crimping of maize kernel	3	1	x	
Beef crosses or double-aptitude breeds	3	2		x
Use of sexed semen in dairy herds. Beef cross is used for males	0	1	x	

7.6.5 Focus group 5 (IT-BF)

Innovation	Relevance (n=6)	Feasibility (the more feasible) (n=6)	Innovation from Task 4.1	Innovation suggested by Italian experts
Salers and Angus cross-breeding	0	0	x	
Use of grassland made by cereals generally not used for human consumption (barley and wheat) and proteins (vetch, peas) given to animals as forage silage	0	0		x
Insects	0	0	x	
Seaweesds	0	0	x	
Genomic selection for feed efficiency	0	0	x	
Genetic selection for milk production and persistency	0	0	x	
Robotic and precision farming	1	1	x	
Double crops	0	0	x	
Byproducts of maize, of sugar beets, of wheat etc.	0	0		x
Improvement of farm organization/management in order to reduce feed waste	1	1		x
Utilization of agry-food industry, such as biscuit wasted	1	1	x	
To improve the quality of the herb of permanent meadows or pastures, so that animals' requirements are met without utilizing too large amounts of cereals and pulses	0	0		x
To sustain farmers' cooperatives or networks for increasing hay production and exchange between hay makers and animal farmers	0	0		x
To consider new crops as maize BMR or Autumn-Spring crops as silage wheat that can substitute maize silage - Crimping of maize kernel	0	0		x
Double crops in winter and summer	1	1	x	
Beef crosses or double-aptitude breeds	0	0		x
Use of sexed semen in dairy herds. Beef cross is used for males	1	1	x	
Grass fattening	1	1	x	

7.6.6 Focus group 6 (BE-CC2, BE-BF)

Innovations	Relevance (n=7)	Feasibility (the more feasible) (n=7)	Innovation from Task 4.1	Innovation suggested by participants
Optimize land use (production of fodder through cover crops, area of ecological interest)	5	6		x
New mixtures (lupin, alfalfa,...)	4	5		x
Replace competitive concentrates with new by-products (process water for food processing industries, microbreweries, whey, vegetables, downgraded products)	3	0	x	
Integrated crop-livestock system	2	4	x	
Grass fattening (rotational grazing and multi-species grassland)	2	2	x	
New protein sources (algae, insects)	2	0	x	
Alfalfa and red clover as alternatives to soybean meal	1	4	x	
Conservation of by-products in a single silo	1	1	x	
Spring calving (synchronize animal needs with the grass growth)	1	0	x	
Agroforestry	1	0	x	
Dynamic rotational grazing	1	0	x	
Terminal crossing on dairy cows with beef cattle	0	1	x	
Milk powder	0	1		x
Hay dried in barn	0	0	x	
Alternative crops	0	0		x
Limit meat production to non-competitive feed	0	0	x	
Precision livestock farming	0	0	x	
Favouring the milk production of suckler cow through selection	0	0	x	
Crossbreeding (meat breeds and breeds adapted to grazing)	0	0	x	

7.6.7 Focus group 7 (BE-CC1, BE-BF)

Innovations	Relevance (n=7)	Feasibility (the more feasible) (n=7)	Innovation from Task 4.1	Innovation suggested by participants
Alfalfa and red clover as alternatives to soybean meal	6	7	x	
Include temporary grasslands in the rotation	6	7		x
Grass fattening (rotational grazing and multi-species grassland)	4	4	x	
Dynamic rotational grazing	4	1	x	
Integrated crop-livestock system	3	2	x	
Improve the performance information of the herd (farm weighing)	3	7		x
Mixed ration	3	4		x
Fodders from cover crops, area of ecological interest	2	3		x
Crossbreeding (meat breeds and breeds adapted to grazing)	2	4	x	
Spring calving (synchronize animal needs with the grass growth)	1	2	x	
Terminal crossing on dairy cows with beef cattle	1	2	x	
Favouring the milk production of suckler cow through selection	1	3	x	
Replace competitive concentrates with new by-products (process water for food processing industries, microbreweries, whey, vegetables, downgraded products)	0	0	x	
New protein sources (algae, insects)	0	0	x	
Agroforestry	0	0	x	
Conservation of by-products in a single silo	0	0	x	
Hay dried in barn	0	0	x	
Limit meat production to non-competitive feed	0	0	x	
Precision livestock farming	0	0	x	
Hedgerows	0	0		x