Innovative Tools for Assessment and Authentication of chicken meat, beef and dairy products' QualiTies

Grant agreement number: 101000250

H2020 – Research and Innovation Action

Deliverable 1.1

Points of view, expectations of actors and consumers about intrinsic quality of milk/dairy products, beef and chicken meat

Due date of deliverable: 30 November 2022

Actual submission date: 30 November 2022

Re submission after review: 31 May 2023 (Annexes added)

Type			**Dissemination Level**		
R	Document, report	☒	**PU**	Public	☒
DEM	Demonstrator, pilot, prototype	☐	**CO**	Confidential, only for members of the consortium (including the Commission Services)	☐
DEC	Websites, patent fillings, videos, etc.	☐			
OTHER		☐	**CI**	Classified, as referred to Commission Decision 2001/844/EC	☐

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Call	H2020-FNR-2020-2	
Topic	FNR-05-2020-B ● Husbandry for quality	
Project ID	101000250	
Start date of the project	June 1st, 2021	
End date of the project	May 31st, 2026	
Duration:	60 months	
Project management	INRAE	
Person in charge	Bruno Martin	INRAE
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Version	V1	

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1. Executive Summary

INTAQT - ***INnovative Tools for Assessment and Authentication of chicken and beef meat, and dairy products' QualiTies*** is a 5-year H2020 European project that started on the 1st of June 2021. This project is led by INRAE, in France, and consists of a consortium of 20 partners from 10 different countries.

The project main objective is to assess the relationship between animal production systems and their product quality in the poultry, beef, and dairy sectors. INTAQT will involve all the actors in the chicken and cattle production chains and consumers, co-constructing solutions with its diversified consortium and refining it throughout the project in connection with multi-actor groups. INTAQT is organized in eight work packages, including WP1 Multi-actor interactions for project implementation.

According to the expectations of the agri-food chain actors (farmers, breeders, processors, retailers, and consumers) and society, WP1 will

i) refine the experimental network of farms and processors (WP2) providing unprocessed and processed ready-to-eat products to be analysed for the priority quality traits in WP3,
ii) prioritise quality traits, husbandry systems and manufacturing processes to be studied and
iii) contribute to the design of sustainable husbandry practices upgrading product quality (WP2).
iv) WP1 will also analyse the expectations and constraints of food chain actors for the development of analytical tools (WP4) and
v) of stakeholders and consumers for the co-construction of the multi-criteria scoring tools of animal product quality (WP5).

The present report depicts the results on points i), ii), iii) and v) after the first 18 months of the project; for specific results on point iv), see Deliverable 1.2.

The results are based on face-to-face interviews with 161 actors across 7 countries in the poultry, beef, and dairy sectors, focus groups with consumers organised in 4 different countries and the expression of the same actors during national meetings and European meetings.

The husbandry systems to be studied have been specified or newly defined during the consultations.

Involved stakeholders cited many **interesting husbandry practices** that could be tested during the project. Different topics came up such as feeding, husbandry and genetics, highly dependent on the country.

The actors' interviews and participation in groups raised several points that were not anticipated in the initial INTAQT project: the importance of extrinsic qualities to be taken into account with intrinsic qualities. Thus, a common expectation from the stakeholders in the different countries is to include the extrinsic criteria linked to animal welfare, environment, and socioeconomics within the studied qualities in the INTAQT project. Furthermore, actors raised the relevance of considering technological criteria.

Some specific sanitary criteria have been emphasised, like antibiotic residues and more generally contaminant residues while other safety analysis are considered as a prerequisite already covered by regulation and specific controls. Additional analyses are expected on nutritional aspects. All these new criteria and analyses must be confronted with scientific advice to determine which additional criteria can be taken into account bearing in mind the technical and economical means of the project.

Lastly, the concept of **multicriteria scoring tool** divides the stakeholders within each country, some countries being confident and others more cautious. There is a strong expectation to clearly define the target. For example, some people deemed inappropriate to add safety traits in the scoring tool. Another strong expectation is to adapt the content and explain the tool. A common expectation from the stakeholders in the different countries is to include the extrinsic criteria of sustainability, environment and animal welfare. Therefore, the positive and negative points mentioned by

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stakeholders will need to be considered with increasing attention by researchers when they will build this (or these if several targets) tool(s).

The dialog between food chain actors and researchers will continue throughout the life of the INTAQT project.

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2. Background

The H2020 European research project INTAQT aims at developing innovative tools to assess and authenticate beef, chicken, milk, and dairy products quality. This project studies more specifically the link between husbandry systems and intrinsic quality criteria.

INTAQT is organized in eight work packages (WP), including the "multi-actor interactions for project implementation" WP (WP1, led by ACTA-Idele, France). The aim of this WP is to organise participatory involvement of agri-food chain actors (breeders, farmers and their organizations, advisors, processors, retailers, consumers), scientists, policy makers and society to:

i) refine the experimental network of farms and processors (WP2) providing unprocessed and processed ready-to-eat products to be analysed for the priority quality traits in WP3,
ii) prioritise quality traits, husbandry systems and manufacturing processes to be studied and
iii) contribute to the design of sustainable husbandry practices upgrading product quality (WP2).
iv) WP1 will also analyse the expectations and constraints of food chain actors for the development of analytical tools (WP4) and
v) of stakeholders and consumers for the co-construction of the multi-criteria scoring tools of animal product quality (WP5).

See also Figure 1.

The present report depicts the results on points i), ii), iii) and v) after the first 18 months of the project; for specific results on point iv), see Deliverable 1.2.

For details by sector (actors interviewed, composition of national and European groups, specific results in details) see the sectorial reports in Annex 1 (chicken), 2 (beef), 3 (dairy).

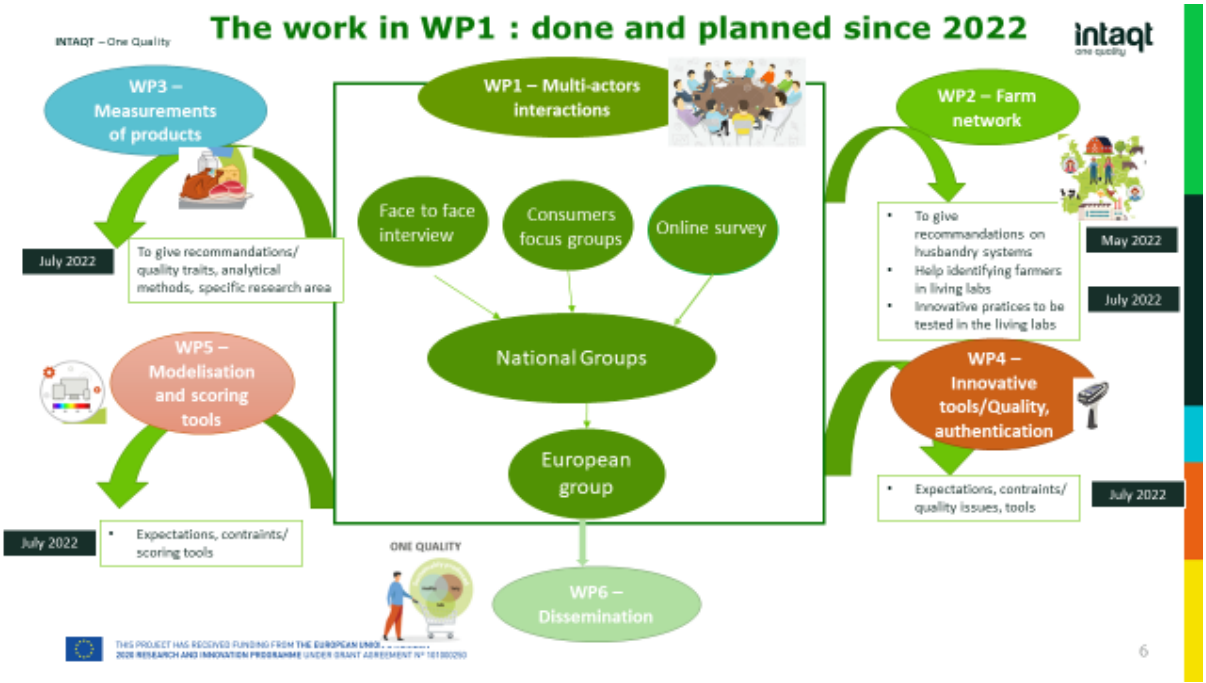

Figure 1: Organization of WP1 during the first year and links to the other WPs in the INTAQT project

The consultation of actors has been organised starting with three distinct activities:

- Face-to-face interviews with actors from the whole supply chain, from farmers to processing plants, to retailers as well as citizens and consumer organizations
- Consumer focus groups
- An online survey towards laboratories

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The face-to-face interviews and national groups were organized by type of products. Consumer focus groups and the online survey have concerned the three kinds of products in the countries involved in this consultation. Figure 2 shows in which country and sector actors were mobilised.

The results from these three activities were presented and discussed in national groups where all the actors from the face-to-face interviews had been invited to participate. Representative from the national groups were then invited to join discussions in the European groups.

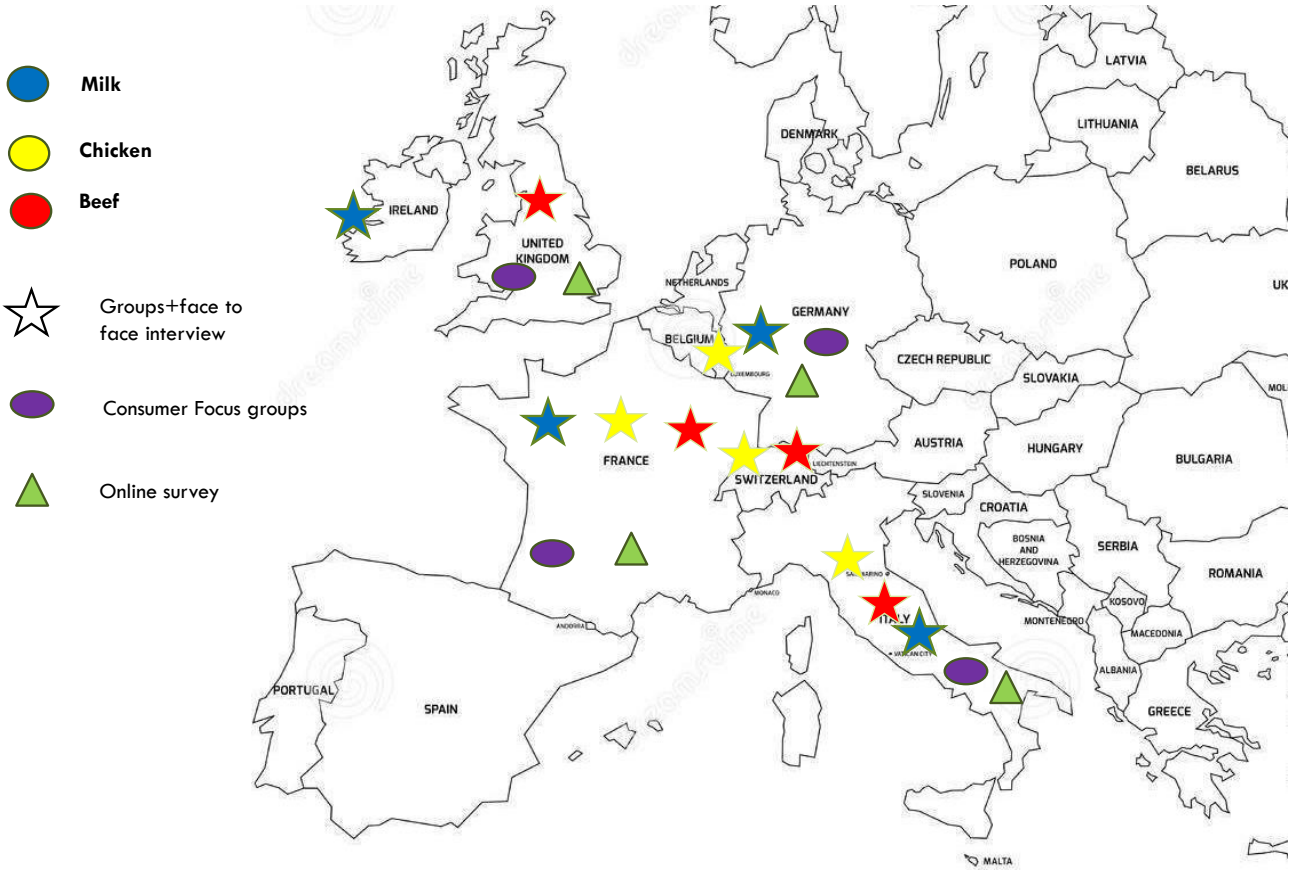

Figure 2: Map of the mobilisation of actors for WP1

3. Material and methods

3.1. Face-to-face interviews

- **Recruitment**

It was planned to interview 15 actors per sector per country.

We sampled those actors with 3 main ideas in mind:

- actors coming from the whole supply chain, from farmers to processing plants and retailers as well as citizens and consumer organizations
- actors from "main stream" supply chain with high volume as well as actors from a "speciality" food chain
- legitimacy of actors, if possible elected persons at boards, representing for example farmers

The "speciality" for each sector and country was chosen by the project partners in the different countries for their relevance in terms of importance of this speciality in the country and were:

- For dairy
  - In Italy : Slow Food
  - In Germany and Ireland : Organic
  - In France : Protected Designation of Origin (PDO) cheese

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- For beef
  - In France : Label Rouge
  - In Italy : Slow Food
  - In Switzerland : Organic
  - In the United Kingdom: Specialised product with specific scheme
- For poultry
  - In France: Label Rouge
  - in Italy: Private Label (slow growth breed, outdoor access, no Genetically Modified Organism (GMO) feed and no antibiotics)
  - In Switzerland: Organic
  - In Belgium: Organic

It resulted in a total of 161 face-to-face interviews conducted between October 2021 and March 2022.

The interviews last around 2 hours and were either conducted on site or online.

It was possible to mobilize all relevant actors, as planned. The only difference to the plan was that retailers of beef and dairy products were not interviewed in Italy.

For details about the actors interviewed see the sectorial report in Annex 1, 2, 3 – part 2.1 of each report.

- **Interview guide and analysis**

The interview guide was co-constructed between the partners in WP1 during autumn 2021. The partners were trained to the interview guide at a training session organised in October 2021.

The interview guide was elaborated in "funnel", in two parts (F. Kling-Eveillard, 2012).

The first one was general. The actors were asked what composed dairy/beef/poultry products quality, its evolution in the past, and the future challenges and perspectives for products' quality. Then, they were asked to describe the link they perceived between husbandry conditions and product quality.

The second part of the interview was dedicated to the INTAQT project's presentation, to which every stakeholder was invited to react and express their expectations and fears. In particular, the initial analyses of the nutritional, safety and sensorial criteria were presented to them. They expressed their opinions on them, and what they would add or remove.

Furthermore, the different husbandry systems were presented to each of the stakeholders. They gave their points of view on the initial choices and whether they would have included other systems that were not already mentioned.

Lastly, the multicriteria scoring tool concept, based on intrinsic quality criteria (nutritional, sensorial, safety) was presented to them. Their reactions were collected.

You can find the complete interview guide in **Annex 4**.

The interviews were recorded and partly transcribed. During the interviews, mind maps were elaborated, synthetizing the actor's sayings on products quality definition and its factors of influence. The interviewee could see the mind map as it was built and eventually correct it, in order to ensure a common understanding of the theme.

The interviews were analysed according to a common analysis grid. The analysis grid included the main thematic and sub-thematic points from the interview guide, completed with those spontaneously expressed during the interviews. It served as basis for a deeper thematic analysis for each theme.

A report was made per country and product by each interviewer.

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3.2. Consumers' focus groups

The main objective of the consumers' focus groups was to assess the type of information consumers seek when purchasing chicken, beef and dairy products, from the raw products to the processed products and discuss with them on how this was linked to their perception of quality. The second objective was to explore the extent to which a multicriteria scoring tool would be useful.

The involved partners of the task planned the focus group and its content, then contacted consumers and invited them to participate at the focus group (10 persons per country), implemented the focus group and lastly reported and exchanged results with project partners.

Consumers were chosen in order to try to catch a broad diversity of consumers, though we did not include vegetarians or vegan persons in the focus groups. We envisage the diversity on the following criteria:

- Gender
- Age
- Family size
- Socio-professional categories / educational level
- Urban / peri-urban / rural

Four focus groups were organised during January and February 2022 in France, Italy, the UK and Germany. Because of Covid19 restrictions, they were hold online with videoconference and using facilitating tools like Klaxoon or Mural. We required that the participants used their camera for a better interaction in the group. This has restricted the diversity of the group to people with a good internet connection and proper IT equipment.

3.3. National groups

National multi-actor groups have been organised for each sector in each country in March/April 2022. All the actors interviewed during the face-to-face interviews were invited: breeders, farmers and their organizations, advisors, processors, retailers, and consumers. The size of the group varied between 5 and 14 participants depending on the country and sector.

In order to maximise the participation of persons who could be spread over different regions, the online video-conference format was preferred in most cases, but the meeting was hold in-person for the French dairy group and hybrid for the poultry Belgian group.

Many actors participated but in some countries, some group of actors were not represented in the respective national group; for example, the consumers' and animal welfare NGO (Non-Governmental Organization) were only represented in 4 out of 12 groups.

The objectives of those national meetings were to:

- remind stakeholders of the fundamentals regarding the INTAQT project
- present results of the national face-to-face interviews, the results of the online survey and of the consumers' focus groups carried out in parallel with the face-to-face interviews during WP1
- discuss and collect priorities regarding husbandry systems, interesting husbandry practices, as well as quality traits to be studied in the project
- gather views, fears and expectations regarding the multi-criteria scoring tool to be built using the project data
- recruit stakeholders for the participation at the European group meeting.

The national groups will be invited for meetings again throughout the life of the project.

3.4. European groups

Initially, it was planned to organize a single meeting for each European group near the annual meeting of the project in the middle of 2022. This schedule was not compatible with the work which started

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earlier in WP2. Two European meetings per product were held online in 2022 by web conference at the beginning of May and at the beginning of July. They last around 2.5 hours each.

The idea was to invite the national stakeholders to exchange views and see differences and similarities between countries and have a dialog with the project's scientists in order to explain the stakeholders' wishes for the project to investigate.

More precisely the first European meeting aimed at:

1. Giving information about husbandry systems and innovative practices planned to be studied in the project, at the European Level, explaining how the expectations had been considered
2. Discuss and give feedback on the choices
3. Giving information on WP2: Presentation of the sampling protocols, the living lab…
4. Informing on the next steps in 2022 and after

The second European dairy meeting aimed at:

1. Exchanging about quality criteria, analysis planned to be studied in the project + expectations on implementation at European level,
2. Exchanging about expectations on multicriteria scoring tool at European level,
3. Informing on the next steps in 2022 and after

In general, there were fewer stakeholders attending the European groups' meetings than the national ones. However, there was a very good dialog in each group and the persons present appreciated the possibility to be listened to by the project's scientists.

The main reasons given by the stakeholders for not joining the meetings were the time required and the English language, even if the presented slides had been translated before the meeting in some national languages (French, for example).

The European groups will be invited for meetings again throughout the life of the project.

3.5. Interactions with the other Work Packages

WP1 aims at collecting views of multiple stakeholders in order to give recommendations to the other Work Packages in INTAQT. It was important to have a good communication inside the project so that the other WPs understood the process and could better take into account the recommendations of the stakeholders. Furthermore, the project manager is invited to attend all the WP1 team's meetings.

Several events were organised to foster this mutual comprehension:

- Participation of the WP1 team to two ExCom-meetings during spring 2022. WP1 team has organized a specific ExCom meeting in February, in order to prepare the collaboration between the national groups, European groups and the other work packages. The second one was dedicated to the results obtained thanks consultation on quality criteria and multicriteria scoring tool.
- Preparation of the European stakeholder meetings together with WP2's leaders for the first meeting on husbandry systems and innovative practices; with all the technical WPS (WP's leaders and task's leaders) for the second European meeting on quality criteria and multicriteria scoring tool.
- Invitation of these WP's leaders and task's leaders to the European meetings. Some of them were invited to do some presentations. Regarding husbandry systems, WP2's leader has proposed choices of systems taking into account the consultation; in the second meeting, WP3 leaders have indicated among the criteria expectations what can be feasible or not, still to be discussed. WP5 leader or WP5 representant has explained the objectives of WP5 and the development of the multicriteria scoring tool.
- INTAQT first annual meeting: consultation results were presented by WP1 team within the different workshops

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Multi-actor consultation in a research project is a relatively new approach and it was important to keep the scientists well informed all along the process in order to facilitate their understanding and their ownership of the results. It is important to have feedback from scientists too in order to explain to stakeholders what is feasible or not, can be done or not because of scientific aspects but also because of costs and practical aspects too.

4. Results

4.1. Perceptions of quality

When starting this study, the focus was on **intrinsic** quality (safety, nutrition and sensorial traits), as planned in the project proposal and in the title of this deliverable but as soon as we started talking with food chain stakeholders as well as consumers, we realised that an important focus for them was on **extrinsic** quality traits and therefore we will present those aspects as well. Extrinsic quality traits are for example: animal welfare, link to a territory, environmental footprint, etc…

- **Quality as expressed in the consumers' focus groups**

The consumers were not directly asked about "quality" but were put in the following situation: "Imagine you are in a shop, on a market or where you usually buy those products. What information do you look at when considering to buy a beef/chicken/dairy product or not buying it?"

The answer to this question tells us a lot about quality perception of the consumers.

For some characteristics the results are similar across all countries, whereas some consumer expectations vary for one or more countries. A comparative analysis of the 4 focus groups is presented in the following Table 1.

Table 1: Attention points named by consumers when deciding if they will buy a product or not from the INTAQT focus groups 2022

+ mentioned; ++ mentioned by several consumers; +++ mentioned by many consumers in the group.

What the consumers named and explained is written in the parenthesis. The categories are made by the researchers who analysed the focus group.

Mentioned quality aspects	France	Italy	Germany	UK
Husbandry practice (Farming labels, incl. organic, Husbandry system, age of the animal, local breed, animal welfare scheme)	+	+++	+++	
Sensory/organoleptic traits (taste, colour, appearance, texture, juiciness, fat marbling)	++	+	++	++
Customer relationship (Price-performance ratio, Pay more for quality, Look for deals on a lower income, Image of label, Personal relations)	++	+	++	+++
Technical aspects (fat content, kind of processing and preservation methods, weight and cut, size of packaging, expiry date, percentage of meat content)	++	++	++	+++
Origin (Origin of product, type of shop (butchers, farm shop))	+++	+++	++	++
Environmental sustainability (Packaging, Organic farming and quality labels, local better for sustainability)	+	+	++	+
Socio-economical sustainability (Fair prices, Supporting small, local retailers)			+	+
Nutritional quality (Fat content, Additives and preservatives, Sugar content, Protein, Probiotics, Gluten free, Nutritional labelling)	++	+	+	++
Food safety (Colour/"freshness", Smell/odour, non-use of antibiotics, no bad preservatives / additives)	++	+		+

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Origin was very important for Italy and France, important for Germany and the UK. There seems to be a need for differentiating between origin of the product (where did the animal live, where was the product processed) and the location of the shop. Additionally, for some customers origin was related to environmental concerns (short transportation distances lower carbon footprint), for some it was related to taste (short transportation distances gives freshness), for some it was to animal welfare (short distances gives lower stress of the animals) and for some others to supporting local businesses (socio-economic dimension).

We observed important differences between countries. Some aspects came out as being more important in some countries than others, for example, animal welfare was more important for the German group than for the other countries. Nutritional quality was more important for consumers in UK and France than in Germany and Italy. Sensory traits were not mentioned in Italy, but important in the other countries.

In general we see for the consumers a combination of intrinsic and extrinsic quality traits taken into account when purchasing beef, poultry and dairy products.

- **Quality as expressed by the food chain stakeholders during the face-to-face interviews**

The importance of extrinsic quality traits was also emphasised by the different stakeholders interviewed, as well as economical and technological aspects.

There are differences from country to country and product to product. In order to depict the different quality dimension and their interdependence as mentioned by the interviewees, we used mind-maps. An example of it is presented in Figure 3.

Mind-map constructed from the 13 individual interviews. Number in parenthesizes represent the number of interviewees that cited the quality criteria in question.

The green arrows show some of the important links cites by the interviewees between the different aspects of quality.

Figure 3: Dairy products quality as expressed by the Irish stakeholders.

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For all products and in all the different countries where the interviews were conducted, the following aspects were very important – they are not mentioned here in a hierarchical order as there were differences of hierarchy between product and countries:

- **Food safety** with regard **to microbiology, chemicals and pollutants.** This was related to pharmaceutical residues like antibiotics, salmonella or listeria, mycotoxins in feed, use of cleaning products on farms
- **Nutritional quality** and nutritional value, like protein content, quality and quantity of the fat, calcium or iron content
- **Sensory traits** and organoleptic quality, like tenderness, juiciness, taste, homogenisation and heating of milk
- **Technological quality aspects**, like water holding capacity of meat, size of muscles, pH, fat content of milk for butter production, freshness/shelf life, uniformity of carcass quality, as well as for example the casein structure which is important for the cheese-making property of the milk.
- **Animal welfare and health.** This was related to many aspects of farm management and rearing systems like feeding management, pasture access as well as protection from weather extremes, the longevity of the animals, regular health/welfare controls, a high health status of the animals in general, clean stables, enough available space, low stress during transportation and slaughter, well-maintained milking equipment as well as a low mortality.
- **Environmental sustainability.** This aspect was mentioned with respect to ecological and/or climatic footprint, respect of natural boundaries and reduction of food waste.
- **Socio-economic sustainability**. This was related to paying good salaries to the employees, fair farmers' income, good and safe working conditions, reduction of processes losses, as well as a transparent and good relationship between companies and farmers.
- **Regulation**. Compliance with specifications, regulations and label standards
- **Customer relationship aspects.** This was related to price-performance ratio, presentation of product (visual, type of piece), packaging, practicality, comprehensive list of ingredients, a transparent and good communication with consumers, raising consumers' awareness for product and process quality aspects and building trust by maintaining a good farm and product management.
- **Origin** / location of the production. This was related to regionality, local breeds and typicity of products in general as well as guaranteed origin.

It is very interesting to point out that extrinsic criteria were expressed as very important regarding quality and in most cases, cited with the same or more importance as intrinsic criteria. All these criteria fit precisely with the quality criteria which emerged from the consumers' groups.

The importance of extrinsic quality criteria was strongly expressed in all contexts and it contributed to the recommendation from the groups to include extrinsic quality criteria in the project (see part 4.4).

4.2. Husbandry systems to be studied

When preparing the project, the researchers had imagined thanks their knowledges in each country which farming systems could be studied in which countries, providing data for all the analyses done in the different WPs. These systems were classified on a scale from intensive to extensive with the idea of covering the existing diversity of both systems and products.

This list of proposed systems was presented to the stakeholders first in the face-to-face interviews, then in the national groups. They were asked to give their feedback and suggestions. The European group presented those suggestions and recommendations to the researchers of the project (in particular from WP2) at the meetings organised in May 2022.

The initial systems were as following (Figures 4, 5, 6):

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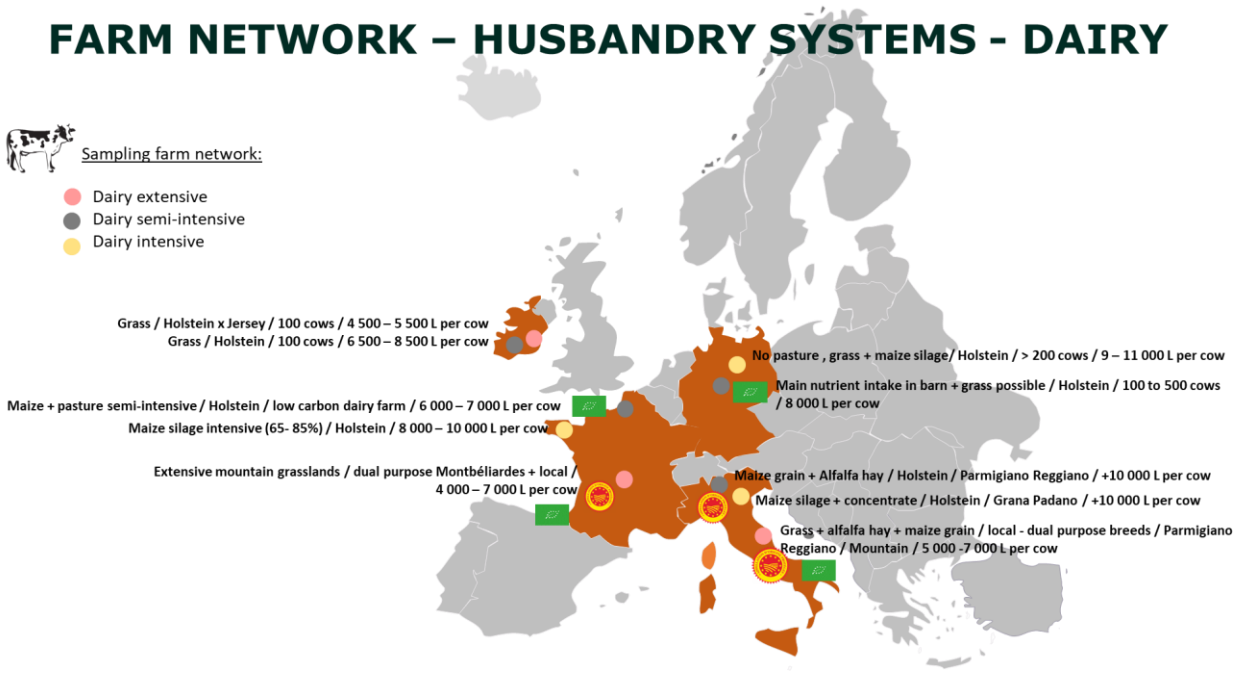

Figure 4: Initial systems included in INTAQT, presented to the dairy stakeholders

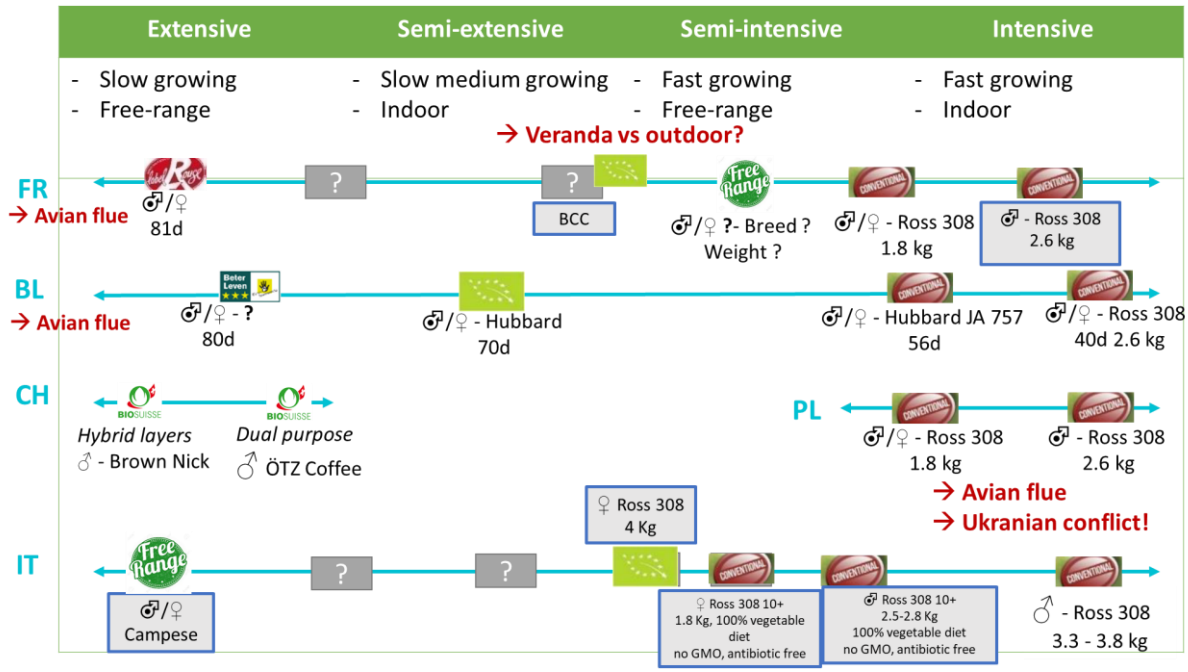

Figure 5: Initial systems included in INTAQT, presented to the poultry stakeholders

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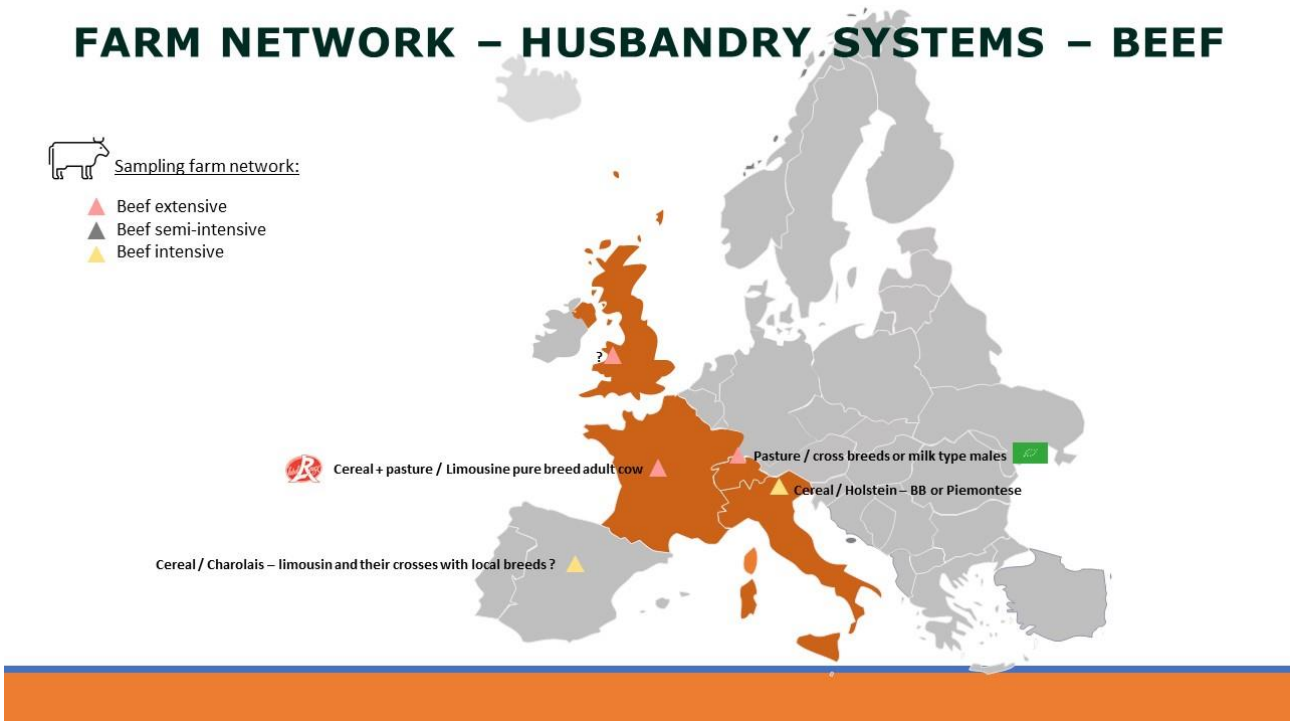

Figure 6: Initial systems included in INTAQT, presented to the beef stakeholders

- **Stakeholder expectations regarding farming systems studied for dairy**

As a whole, the stakeholders were satisfied with the initial systems presented, as they were representative of their countries. Some expectations were common to all the national groups:

- Including practices improving farms' self-autonomy and reducing external inputs (might be explained by economical challenge),
- Including systems using grazing (might be explained by both technical interest, economical stake and growing societal demand),
- Considering animal welfare and environmental issues (might be explained by increased societal demand),
- Considering circular economy (might be explained by increased societal demand).

Some remarks were common to some countries. Italy, Switzerland and Germany were interested in studying the use of crossbreed, and dual-purpose breeds. Irish and French stakeholders were interested in studying different milk systems, in particular systems including Automatic Milking Systems (AMS). In France, the interest for including AMS might be explained by their increased used and less knowledge.

Other expectations were specific to each country. They were connected with feeding, social aspect, herd structure and management, breeds and genetics, animal welfare, and raw milk study. For the latter, we have noted this expectation comes from PDO actors in France.

Italian stakeholders explained the interest for local breeds producing low amounts of milk but are characterised by resistance to disease, in the perspective of a selection strategy towards the reduction of antibiotics use (genetics being a strong tool). Irish stakeholders specified that the choices of systems would be more relevant to the level of production per cow rather than the levels of concentrates used as feed.

The results of the discussion are summed up in Figure 7.

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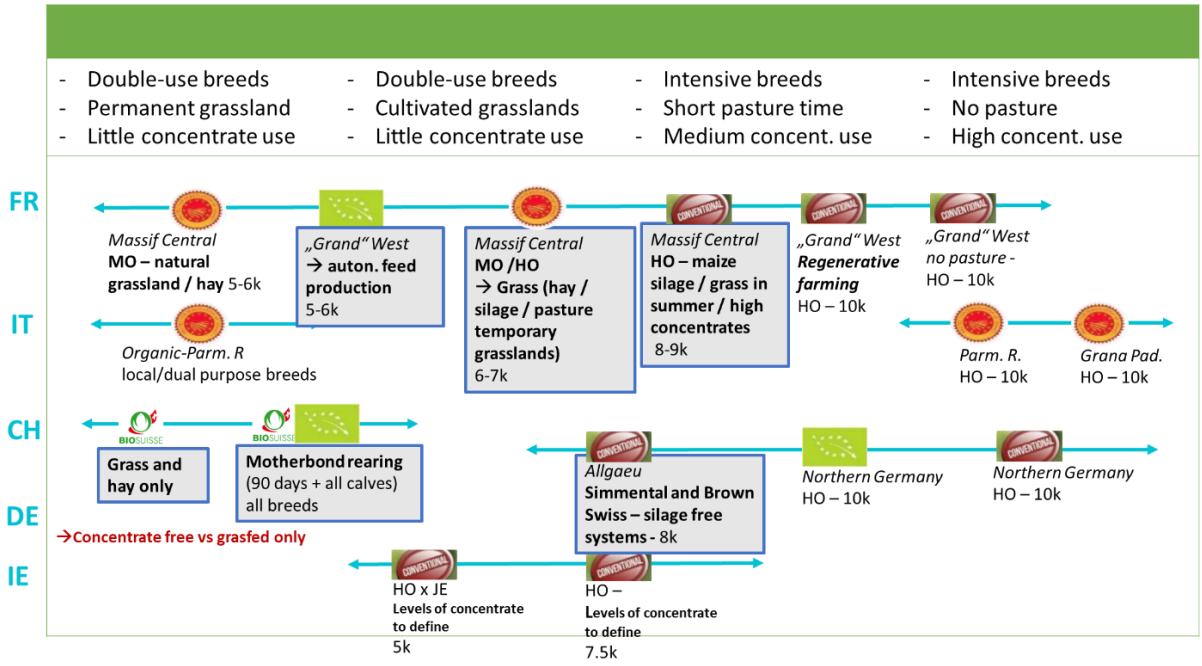

Figure 7: Main dairy husbandry systems proposed to study in INTAQT – the systems outlined in the grey boxes come from the discussions with the stakeholders (NB: 8k = 8 000 liters per cow)

- **Stakeholder expectations regarding farming systems studied for chicken**

As a whole, the stakeholders were satisfied with the initial systems presented, as they were representative of their countries. Main expectations of the stakeholders are linked to societal demands and especially to animal welfare and environmental issues. Important expectations are also linked to consumers and in particular to having a final product that corresponds to market demand, food safety and product traceability.

Regarding the rearing systems to be analysed in the project, the stakeholders agreed on the importance of including systems representative for each country, but also systems of interest such as Best Chicken Commitment (BCC), indoor systems with fast-growing chicken, free range and also future enclosure systems with natural light, environmental enrichment, reduced density (Figure 8).

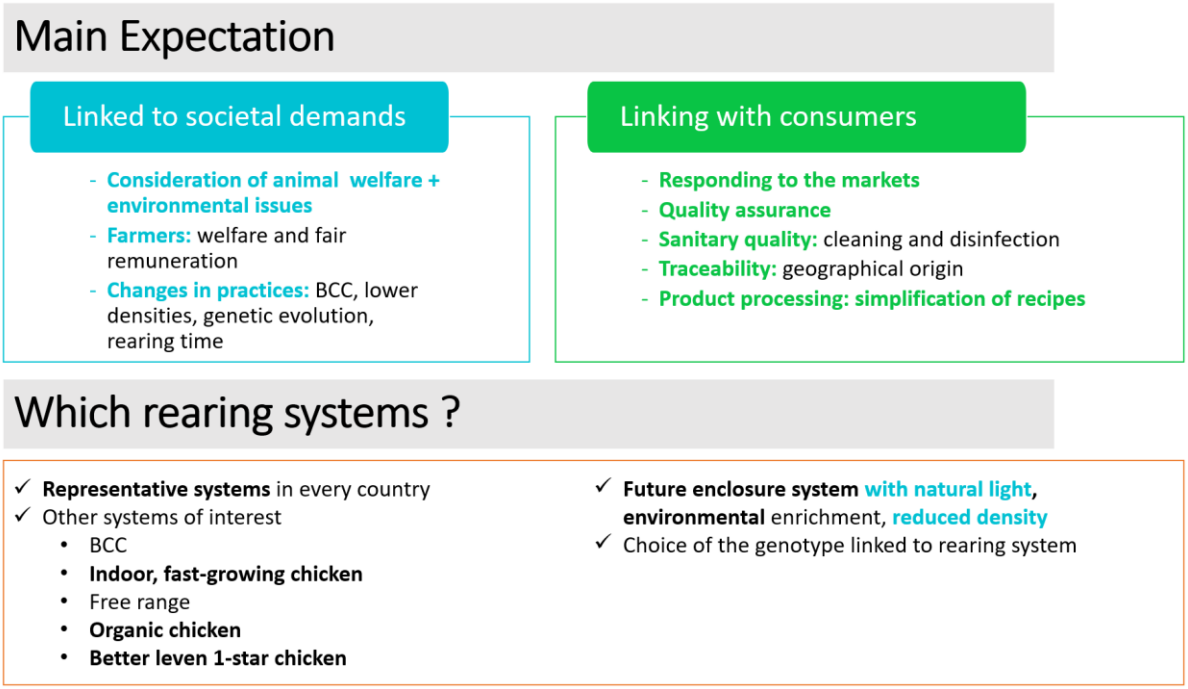

Figure 8: Main specific expectations on husbandry systems for the actors of the poultry sector

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The systems to be included and studied in the project were proposed during the European group, to meet the stakeholders' expectations and discuss them. In particular, 6 out of the 21 systems were designed after the face-to-face interviews and national groups, to consider stakeholder's specific expectations (framed boxes in figure 9). After discussion, stakeholders agreed on the systems to be included and studied during the project (Figure 9).

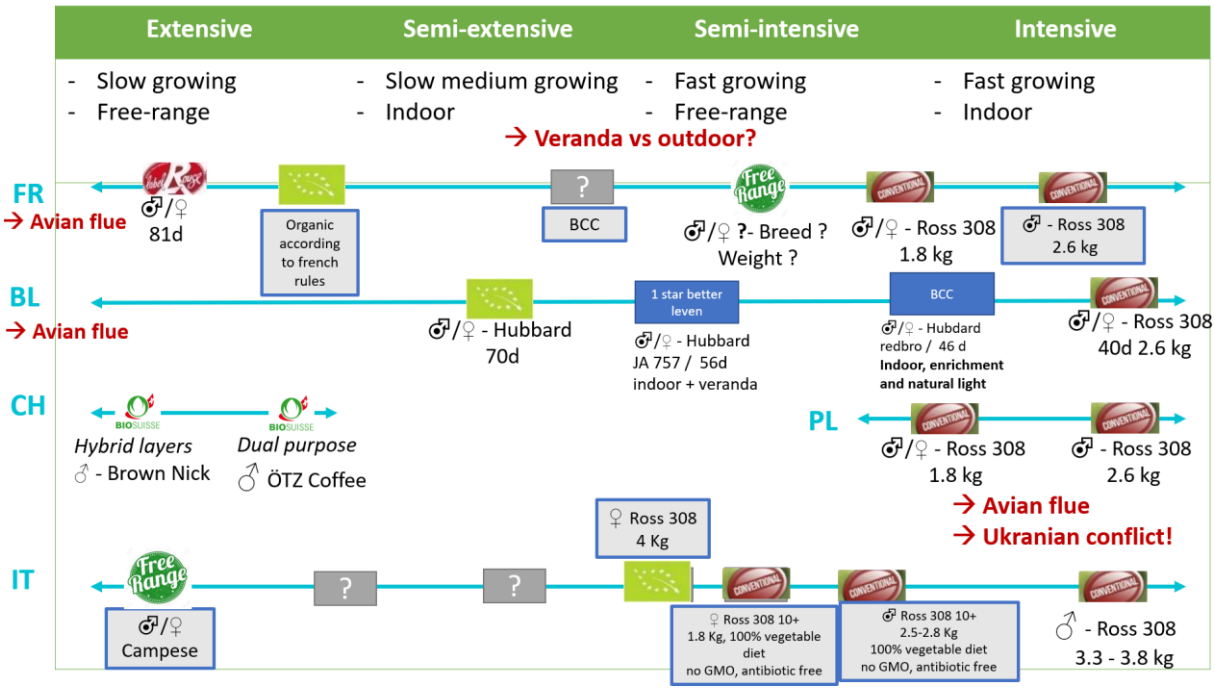

Figure 9: Main husbandry systems proposed during the European chicken group to study in INTAQT

- **Stakeholder expectations regarding farming systems studied for beef**

The project will study 12 husbandry systems in total: 3 or 4 in Switzerland, 2 in France, Italy and the UK, 1 or 2 in Germany and 1 in Spain. Five of these husbandry systems were nearly already defined in the written project, thus before the face-to-face interviews and national group meetings. The last 7 ones had to be decided before summer 2022 according to the face-to-face interviews, and the national and European multi-actors' groups advice, considering research and practical considerations.

- French beef husbandry systems

France has 2 husbandry systems to work on.

The **1st one** (already defined in the written project), represents the highest quality label in the country which is called Label Rouge (LR). The LR system chosen is the most important for beef in France. It concerns mainly cull cows of the Limousine breed and gives heavy carcasses, animals being mostly raised on pastures in the centre of France, with moderate quantities of concentrates, rather distributed during the finishing period.

The **2nd system** (defined according to WP1 exchanges), proposed by the French national group, refers to the Charolais breed, which is the most important beef breed in France. In this country, the beef herd provides around two thirds of the beef produced. Cows and bulls are the 2 main bovine categories to be produced and consumed in France. As for the previous system, cows were again preferred to bulls because they represent almost half of the production whereas bulls only a third. Therefore, approximately 60% of the beef consumed in France comes from cows, a rather uncommon situation around the world. Bulls represent only 15% of the beef production or consumption and heifers and steers less than a quarter.

In order to study 2 sufficiently distinct systems in France, it was recommended to try to work with a more intensive system (less pasture and more concentrates) with the Charolais than with the Limousine breed and to avoid any quality label such as Label Rouge in favour of a conventional

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system for Charolais cows. Indeed, both systems actually concern cull cows of a beef breed originated from the centre of France. The decision to choose the Charolais emerged during the French national group meeting but did not adequately reflect the opinions collected during the face-to-face interviews in France. During this first stage, the public had a broader profile and was not only part of the beef industry. Thus, opinions on the husbandry systems to be studied within INTAQT differed slightly from the points of views expressed (by less persons) during the French national beef meeting. Indeed, many interviewees felt that a system based on a dairy or dual-purpose breeds could be relevant for France where meat is not only provided by the beef herd. A conventional system not linked to any specialized meat breed or to any quality label was therefore seen as a good idea. However, the Charolais breed was also cited, and this was mainly supported by the French beef industry.

- German and Swiss beef husbandry systems

Husbandry systems in Germany and Switzerland will be all managed by the FiBL. In total, 5 systems will be studied with a change regarding their allocation between both countries. Only 1 system will be studied in Germany instead of 2 planned. Thus, 4 systems will be now studied in Switzerland instead of 3.

The **1st system** proposed for **Switzerland** in the INTAQT project referred to organic (Bio Suisse) pasture-raised beef from crossbred animals or dairy males. During the European group meeting it was specified that this system will include pasture-fed oxes and heifers from dairy breeds and crosses ("Weidemast").

A **2nd system** agreed upon in the Swiss national group includes oxes and heifers (beef breeds) from pasture-/grass-fed suckler-cow systems, raised according to organic farming regulations (Bio Suisse).

The European beef group also proposed to include a **3rd system** with fattening animals from dual-purpose breeds with a relatively large amount of concentrate feeding. FiBL is therefore working on a way to include such a system.

The **1st system** originally defined for Germany included intensive fattening of young, pure beef-breed bulls, providing heavy carcasses. During the European meeting, it was stated that this system could probably be more easily studied in Switzerland where FiBL has relevant contacts ("Munimast"). Thus, this system will probably be studied as the **4th system** in Switzerland.

On a more global point of view, Swiss stakeholders are interested in comparing animal roughage-based feeding systems (including whole maize, alfalfa, etc.) *vs* grass and hay-only systems.

At the request of the European beef group, **a system** based on grass-fed old dairy cows could be studied in the northern part of **Germany**. Indeed, very few dairy animals were proposed to be involved in the project whereas INTAQT had initially focussed on dairy herds.

- Italian beef husbandry systems

Two beef production systems are planned for Italy.

The **1st system** (already defined in the written project) concerns beef fattening farms, medium-large size, rearing young bulls from France (pure and crossbred Charolais, some Limousine), fed with maize silage and concentrates (no pasture).

The **2nd system** (defined according to the WP1 exchanges) will focus on farms fattening young crossbred animals (heifers) derived from the dairy sector.

French stakeholders involved in face-to-face interviews and/or in beef national meeting promoted the use of French specialized breeds in the first Italian system. Indeed, such animals born in France and fattened in Italy represent a specific and important European circuit.

The Italian multi-actor group proposed a second system with heifers from dairy farms (dairy breeds or crosses). This is in line with the initial orientation of the INTAQT project, as this one was developed to focus more on dairy herd that on beef. As most of the chosen systems for beef seemed

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to be linked to beef herd, this choice could be a good one to illustrate the European diversity of husbandry systems.

- Spanish beef husbandry system

In Spain, only 1 system is planned to be studied.

This system (already defined in the written project) will probably be close to one of the Italian systems, with maize-concentrate finishing and specialised or crossbred animals (probably Charolais – Limousin pure or crossed with local breeds - to be confirmed).

- UK beef husbandry systems

In the UK, 2 husbandry systems are expected.

Initially 1 system was proposed by the INTAQT project which focused on a grass finishing system with cross breeds (extensive system). Based upon INTAQT partner discussions, 2 systems with varying levels of intensification were proposed (extensive and semi-extensive). However, discussions with stakeholders from the beef industry (face to face interviews, national and European group meetings) the following systems are now proposed.

The **1st system** with crossbreeds (native breeds such as Hereford and Aberdeen Angus) feed on a lifelong diet that is 80-90% forage based, including grass (defined according to the WP1 exchanges). The chosen system would be based on pasture or/and harvested grass with a small amount of concentrates (10% tolerance) as not many cattle are finished entirely on grass in the country. This is an example of a semi-extensive system.

The 2nd system could look at the differences in quality between different breeds (e.g., continental breeds, such as Limousin *vs* native breeds) within the same forage based, semi-extensive system.

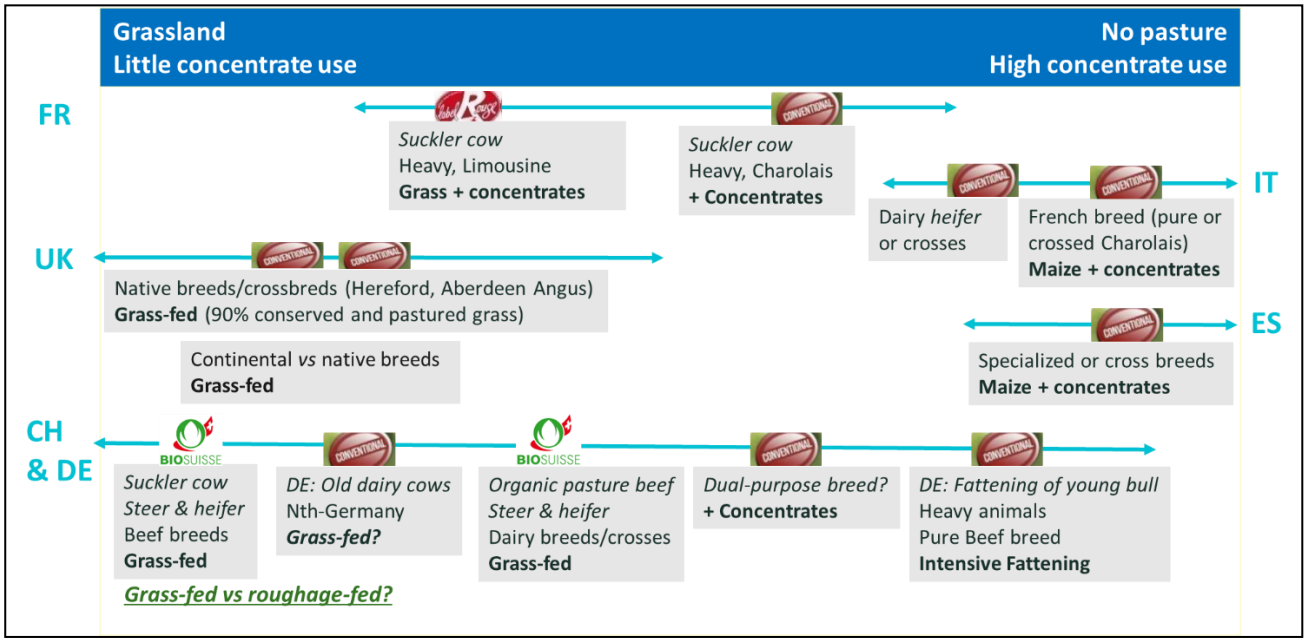

Figure 10: Conclusions of the beef European group regarding the 12 husbandry systems to be studied in the INTAQT project

4.3. Innovative practices to be tested

Many innovative practices were addressed spontaneously by the stakeholders during the face-to-face interviews and national groups.

They could be grouped in themes like feed, genetics and breeds, housing conditions.

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Table 2: Main innovative practices discussed for the dairy sector

Feeding	Breed	Animal management	Other topics
• Self-sufficiency at farm and supply-chain level • Alternative proteins • New species pasture (fodder / resistance to drought) • Improved hay quality	• Crossbreeding • Strategy of high κ-casein selection scheme • PP breeding (polled cows)	• Motherbond rearing (90d with calves) • Longevity of cows / heifers' reproduction	• Ecological transition scenario • Regenerative farming favouring soil biological activity • Extreme herd sizes

Table 3: Interesting practices to be tested in the beef sector according to stakeholders from the 4 countries

Feeding	Husbandry	Genetics
- "Mob"- Grazing (GB, CH) - Grass finishing (90%) at pasture and in shed with tolerance for concentrate (GB) - Finishing techniques in Organic farming (FR) - Finishing techniques allowing feed autonomy of farm (FR) - Feed additives (CH) - Use of Linseed for Omega 3 (CH)	- Nighttime grazing vs insecticides to fight flies (CH) - Effect of castration and lower concentrate use on slaughter weight and conformation (CH) - Marbled meats production (FR) - Production of young (8-18 months) and/or dairy/mixed animals (FR) - Production of lightest carcasses with good meat qualities (FR) - Improvement of animal welfare level (IT)	- "Meaty" Dairy Breeds (e.g., Montbéliarde) (CH) - Organic AI-Bulls (CH) - Adaptation of breeding objectives (CH) - Animal genetics and breeds (link to diff categories and ages) (IT)
- Natural feed - GMO-free feed	- Outside access - No antibiotics	consumers

Table 4: Main innovative practices and systems for poultry

Rearing practices	Housing	Feed
Combine different practices to find alternatives: ➢ enclosed x rearing time; ➢ enclosed x intermediate growth **with/without veranda** ➢ enclosed x intermediate growth x environmental enrichment x natural light ➢ strains x outdoor access/enclosure; ➢ Evaluate the consequences of reduced outdoor runs on the spread of avian influenza in particular	➢ Nestborn ➢ Lower pen density ➢ Effect of natural light ➢ Heat floor linked to footpad dermatitis and behaviour of the birds ➢ Veranda for slow and medium growing chicken	➢ Feed produced with local ingredients **At slaughter** ➢ collect information on slaughter process like cool system of carcasses (cooling rate)

Practices will be tested in commercial or experimental farms in the second part of the project. Voluntary farmers will choose one or some practices to test on their farm during the project.

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4.4. Quality criteria to be studied

- **Initial criteria and analyses planned to be conducted on the products**

The initial criteria and analyses planned to be conducted on the products were reminded to the stakeholders during the face-to-face interviews, national and European groups meetings (Table 5).

Table 5: Initial criteria and analyses initially planned to be conducted on the products

Criteria	Dairy 	Beef 	Chicken 
Sensorial traits	• **Consumer tests** (global liking) • **Trained panellists tests** (quantify intensity, sensory characteristics) • **Technological properties** (pH, colour, rheology) • **Shelf-life**	• **Consumer tests** (global liking) • **Technological properties** (pH, tenderness, cooking loss) • **NIR spectra** • **Shelf-life**	• **Consumer tests** (global liking) • **Trained panellists tests** (quantify intensity, sensory characteristics) • **Technological properties** (pH, tenderness, WHC) • **Shelf-life**
Nutritional traits	• **Fat, protein, lactose, urea, cells** • **Minerals (Ca, Mg, Na, K)** • **Vitamins** (B, E) • **Fatty acid** profile • **Phospholipids**	• **Protein, fat** • **Minerals**, trace elements • **Oligo-elements** • **Vitamins** (A, B, D, E) • **Fatty acid** profile • **Histidine dipeptides**	• **Proteins** • **Minerals**, trace elements • **Oligo-elements** • **Vitamins** (A, B, D, E) • **Fatty acid** profile • **Phospholipids** • **Dipeptides**
Sanitary traits	• **Persistant Organic Pollutant** (Dioxins, PCB, PFAS) • **Antibiotic residues** • **Heavy metals** (As, Cd, Pb) • **Mycotoxins toxins** (aflatoxins) • **Plant toxins** • **Pathogenic microorganisms** (STEC, *Listeria monocytogenes, Salmonella*)	• **Persistant Organic Pollutant** (Dioxins, PCB, PFAS) • **Heavy metals** (As, Cd, Pb) • **Mycotoxins** • **Plant toxins** • **Pathogenic microorganisms**	• **Persistant Organic Pollutants** (Dioxins, PCB, PFAS) • **Antibiotic residues** • **Heavy metals** (As, Pb) • **Plant toxins** (aflatoxins, mycotoxins) • **Pathogenic microorganisms** (STEC, *Campylobacter*, *Salmonella*)

- **Stakeholders expectations on other criteria to include in the dispositive**

During the second European meeting, the stakeholders' expectations were discussed with the WP2 and WP3 leaders, to precise their expectations, what could be done or not, what was under discussion.

Extrinsic criteria:

Some expectations were common to all the sectors and the countries: expectations on extrinsic quality. The stakeholders wanted to include:

- Environment,

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- Welfare,
- Socio-economic aspects

For environment, many points were included in the questionnaire/diagnostic from WP2, particularly to approach carbon food print. Some aspects were not included: impact of a pasture-based system on biodiversity (beef), climate, cutting losses (chicken).

For welfare, common expectations focused on diagnostic, which is in fact already included in WP2.

Measurements were expected on products, too, for milk and beef. Milk indicators on animal welfare, besides urea content and somatic cell counts, are not known and need more research. Infra-Red spectra could be used but it is not sure it will work. For beef, measurements on slaughtered animals using final pH are already planned, as well as the health of the animal's inner organs is a measurement they want to include and non-initially planned.

For milk, calf mortality is evaluated as important indication for welfare to be taken into account. Udder health, expected to be evaluated, is assessed by the somatic cell count.

Socio-economic aspects are considered important to be taken into account to ensure income, creation of value (beef); good working conditions, salary (milk) and linked to the origin of product (beef, milk). Price are requested for chicken and willingness to pay for milk sector.

Regarding animal husbandry, stakeholders of the chicken production sector are additionally interested in the chemical analyses of feedstuffs used.

Intrinsic criteria:

Technological/technical aspects were not initially included in the dispositive, but the actors are expecting some analyses linked with technological issues which are specific regarding the concerned sector (Figure 11).

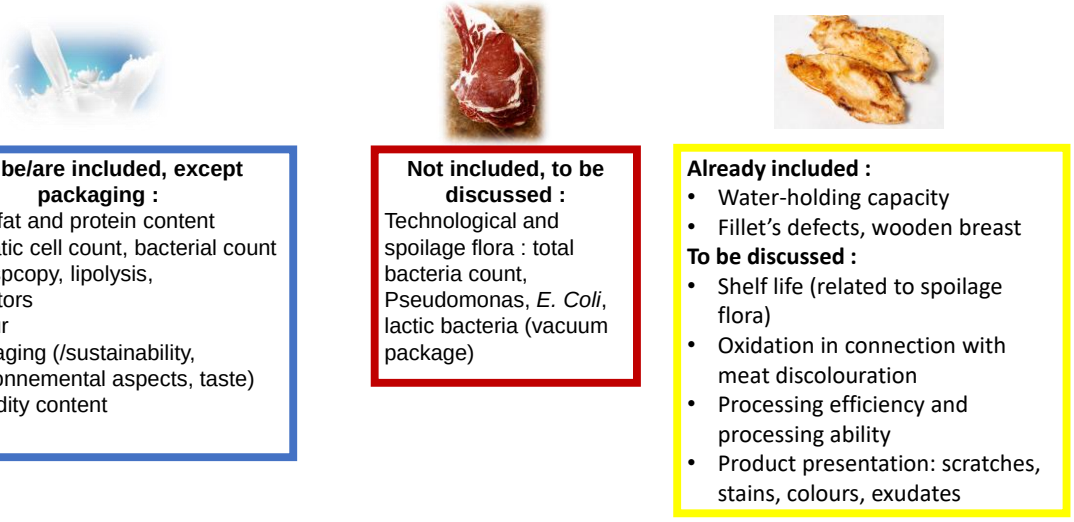

Figure 11: Technological analyses expected by stakeholders and answers by WP3 leaders

For milk, even if it was not presented to stakeholders, the milk payment criteria were already included and meet stakeholder's expectations. Colour and humid content are planned. Packaging was stated by stakeholders as it can impact the taste and it represents an environmental issue: it will not be included in the project.

For beef, they mentioned microbiological criteria such as total bacteria count, *Pseudomona*s, lactic bacteria (which grow up under vacuum package). These florae can be useful (lactic bacteria) or are spoilage bacteria which can cause depreciation of products. If their presence is too important, it can compromise the food safety (see sanitary criteria).

For chicken, there are a lot of expectations which are still to be discussed within WP3 for taking them into account or not.

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Concerning milk sector, some stakeholders (France, Germany) would like to approach microbial diversity. It is already planned in France to use the farm network to do microbial analyses in the environment and milks financed by another project (Tandem, INAE). If other samples from other countries are expected to be analysed, it will need additional budget.

- **Expectations on other analyses concerning criteria already included**

Regarding the intrinsic quality criteria, the stakeholders agreed that almost of the initially proposed in the project were well representative of the quality of concerned products. Only pathogens bacteria were considered not relevant by beef sector (see below). Some stakeholders proposed adding some criteria that they felt were important for assessing the quality of products.

Sanitary criteria

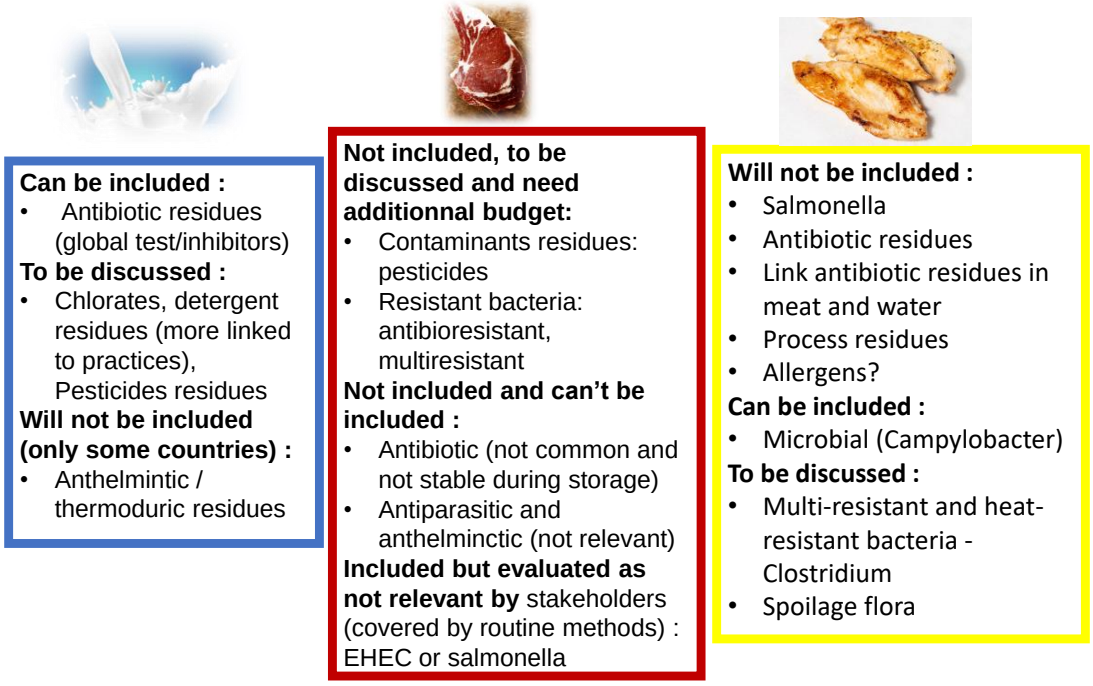

Figure 12: Additional safety analyses expected by stakeholders and answers by WP3 leaders

Regarding sanitary criteria, common expectations (Figure 12) for the 3 sectors concern antibiotic residues. Contaminants residues as pesticide are requested by beef and milk sector. Beef and poultry sectors want to include multi-resistance bacteria topic. The other expectations are specific to the considered sector.

For milk, global test for antibiotic residues and other inhibitors are included. Chlorates and detergent residues depend on the hygienic conditions and milking machine rather than on the farming system. This point is still to be discussed within the project. Pesticides and other residues are probably possible to be included (multi methods). Anthelmintic/thermoduric residues are only requested by one country.

For beef, they mentioned microbiological criteria (see above) such as total bacteria count, Pseudomonas, lactic bacteria (which grow up under vacuum package) or resistant bacteria (antibio and multiresistant bacteria). By contrast, they found it unnecessary to measure the presence of enterohemorrhagic *Escherichia coli* (EHEC) or Salmonella that are already covered by routine tests. Indeed, food must be safe, and systems already exist to measure routinely the sanitary quality of meat.

Contaminant residues were also mentioned, mainly regarding pesticides (glyphosate, Asulam), and animal treatments (antiparasitic, anthelmintic and antibiotic).

For poultry, Salmonella, antibiotic residues on meat would not be analysed since it is part of legal monitoring and because the sample size farm network is too small. For Campylobacter, faecal sampling will be done. The possibility to include analysis of multi-resistant bacteria is explored

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(common expectation for 3 countries). The farm sampling plan is not suitable for a specific research question: the link between antibiotic residues in meat and water.

Nutritional criteria

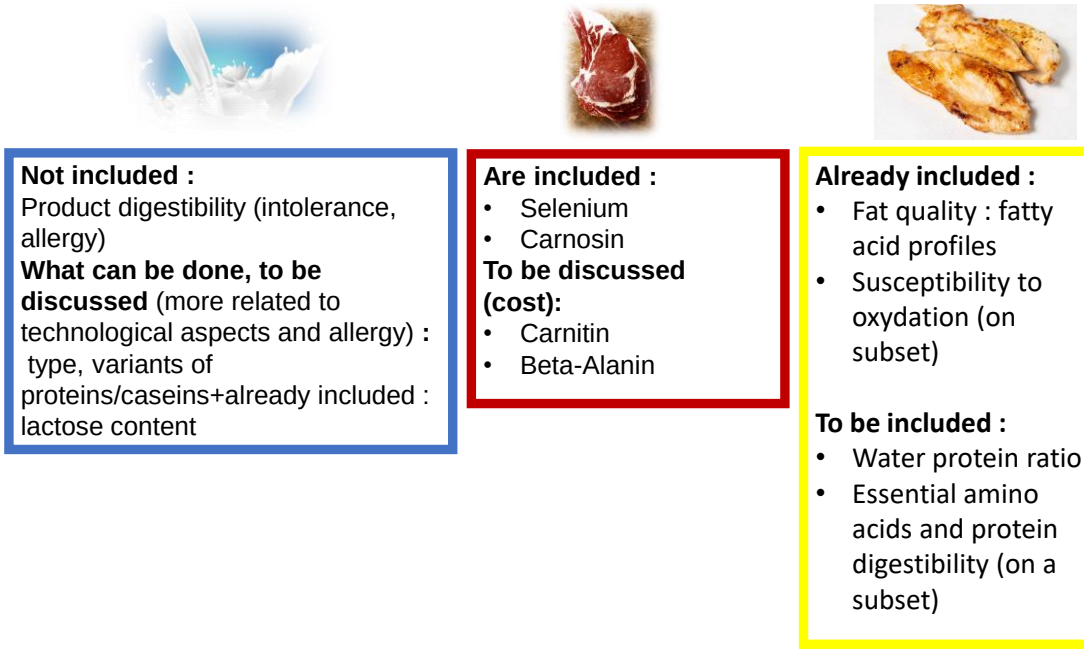

Figure 13: Additional nutritional analyses expected by stakeholders and answers by WP3 leaders

Additional nutritional analyses are expected Figure 13).

For milk, some questions concern product digestibility (intolerance and protein allergies). Lactose is already included. Casein types (αs1, β, κ, αs2) is a point to be discussed (Total caseins will be covered by spectral measurements in WP4. For Casein types, it still possible to do it, even if expensive. A compromise could be to select a sub-sample). There is an interest for this criteria which is a technological criteria too (see above). The morphogenetic variant of β-casein (alleles A2-A2) were discussed, but are very expensive, and scientific based approach is still insufficient. The fatty acids are planned, among which are the omega 3. Phospholipids will be analyzed separately.

For beef, a specific term was mentioned: the nutrient density. This is the amount of nutrients (macronutrients, e.g., protein, micronutrients, e.g., vitamins and minerals) present in 100 calories of a specified food whereas nutritional quality is the presence of a nutrient per gram of the product. The INTAQT project should be able to calculate this nutrient density with data collected.

Measuring nutrient quality is linked to communication on health and beef consumption.

Other traits that would be interesting to include are: amino acid (carnitine, carnosine, beta-alanine) and antioxidants (selenium is already planned to be measured). The stakeholders also considered vitamin D3 as an indicator of pasture access which could be interesting to measure on the carcasses studied in the project.

For poultry, susceptibility to oxidation could be analyzed on a subset (3 production systems). Water/protein ratio will be included in the analysis on all samples. Fatty acid profiles are included in the analysis. Essential amino acids and protein digestibility are too expensive to conduct on all samples and no large differences to be expected between most systems. They could be analysed on a subset (3 production systems) in relation to texture defects (wooden breast) that may result in different amino acids profile.

Sensorial criteria

For the three sectors, each sensorial expectation is already planned to be studied in the project.

Particularly for beef, it was the case for colour, marbling, water holding capacity, shelf life or meat ageing. People were also interested in tenderness prediction. This topic will be approached thanks to

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the IMR3GF model as many beef carcasses will be classified according to the MSA (Meat Standards Australia) methodology within INTAQT WP2. This will allow the INTAQT project to get a prediction of overall meat palatability which takes tenderness into account.

To conclude, various new criteria and analyses were mentioned by stakeholders during face-to-face interviews, national groups, and the European groups. These criteria must be confronted with scientific advice to determine which additional criteria can be taken into account bearing in mind the technical and economical means of the project.

4.5. Opinions, fears and expectations regarding the multi-criteria scoring tool to be built

The concept of a multicriteria scoring tool (Figure 14) was presented to the stakeholders during the face-to-face interviews, national and European meetings.

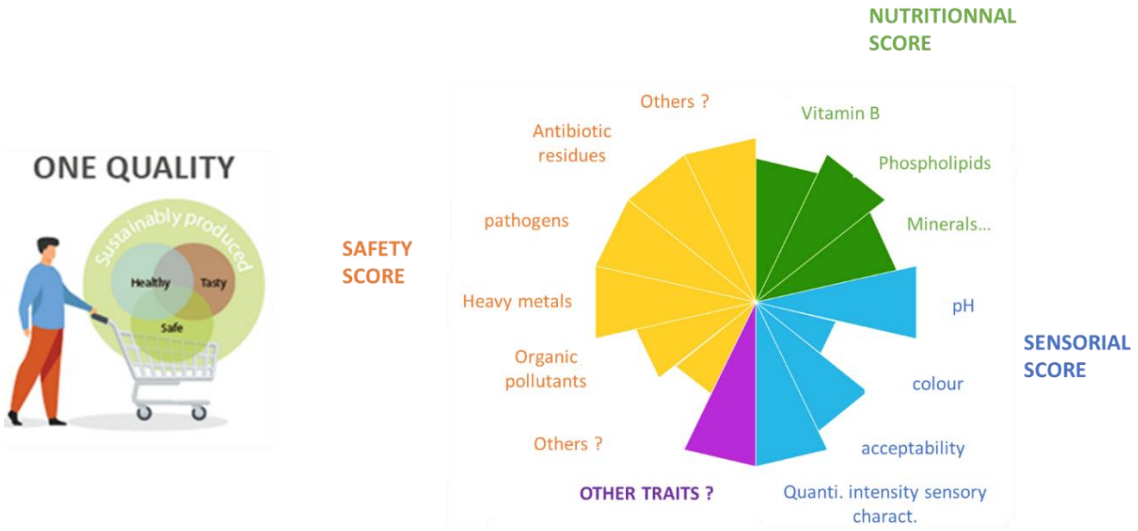

Figure 14: Example of multicriteria scoring tool conception

This tool is planned to be built at the end of the project based on the data get through WP2, 3 and 4. It should combine safety, sensory, and nutritional results obtained from the beef / poultry / dairy samples collected and possibly other quality criteria. This multi-criteria scoring tool should give a product's quality global view and synthetic information to the agri-food chain actors and/or the consumers.

- **Consumers' points of view**

According to the 4 focus groups hold in France, Germany, Italy and the UK, consumers felt that such a multi-criteria score placed on the products could be a good idea. It is seen as a simple presentation of a complex reality.

However, some disadvantages were expressed. There are doubts that this score would be convenient. It seems very complicated and there are questions regarding its reliability: what will be behind it? Will the standards be sufficient? Who will control the data used?

Regarding the implementation of such kind of tool, it could be fine to add a QR code to make details available for consumers willing to know more about the score. Transpose eggs scores (0, 1, 2, 3) was seen as a good idea by French and Italian persons as this score is well-known by consumers. In Germany, some people were in favour of a global score with sub-scores linked to environment, animal welfare or nutritional information.

- **Stakeholders' opinions: Which target for this tool?**

One of the important discussions about the tool is its target: should it be an internal tool for stakeholders to coordinate inside the food chain only? Should it be used towards consumers? For

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societal debates and political decisions? There were very different opinions on those questions. An example of those divergence is shown in Table 6 which represent the beef stakeholders' discussions.

Table 6: The multicriteria scoring tool target as discussed in the beef groups, one big question

Target / Country	For beef industry	For consumers	For societal debates, political decisions
France	Yes / Yes if...	No	No
UK	Yes. The best	Yes ? The least	Not discussed
Italy	Yes if... it is easy to use		
Switzerland	Not discussed	Yes if... it includes animal welfare and environmental aspects	

- **Expectations regarding the multi-criteria scoring tool**

Regarding a **consumer use**, a multi-criteria scoring tool could help to build up trust, inform and educate consumers, according to some stakeholders. Some of them would be fine with the development of a smartphone communication linked to the tool.

The use of QR codes to convey information was mentioned by the UK beef group. Combining metrics into one score (in reference to existing colour guides or star systems) was also regarded as a good idea. For the UK, the tool could help consumers to understand information put on packs by retailers and help to enhance consumer knowledge. It could also be a way to convey to consumers the best products and to showcase to them the industry efforts to achieve this quality. Improve knowledge and awareness of consumers when they buy a product was the main advantage of this tool for some stakeholders. In the dairy sector, the tool is seen as very useful to temper the effect of Nutriscore (where many dairy products have a low score).

Other advantages were mentioned if the tool was dedicated to **industry** (from breeders to retailers).

For some stakeholders, it could allow professionals to improve themselves, to improve quality criteria measurements and provide arguments in defence of specific practices or, more globally, of meat consumption. Italian stakeholders also found that such a scoring tool could improve quality.

In the UK, people agreed that it would be a better way to measure product quality beyond Euro Grid. This tool would interest processors and buyers who want detailed information. However, it should have a link to already existing quality assurance schemes. This could be a way to verify the scores around safety and to bring to light the efforts made by beef industry to enhance food and feed safety.

For some stakeholders it was considered as an opportunity to have a more general overview of different production systems for a range of criteria. It was also said that it could be a tool for producers, for benchmarking within and between production systems.

- **Fears and concerns regarding the multi-criteria scoring tool**

Many concerns, of different kinds, were expressed by actors in the 6 involved countries.

One fear dealt with the **building of the scoring tool**.

Such a tool was seen as very complex because of the number of metrics to consider. UK actors felt that it could be difficult to rank products based on criteria which could evolve diametrically. Their opinion, more globally, was that in order to enhance beef quality it would be better to spend money to provide recommendations to farmers and processors on the best practices (including processing) to help to reduce poor quality products for consumers. The problem of how to deal with **conflicting**

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goals (such as animal welfare *vs* exposure to environmental pollutants) was mentioned by several stakeholders.

Other points related to the **relevance and representativeness of the tool**. These points are linked:

- to sampling as we will extrapolate from one muscle to the whole carcass, and then from 10 animals to the farm, and finally from 5 farms to the husbandry system,
- to the synthesis of many criteria which means simplifying reality,
- to the weighing of each criterion, a passage that could be discriminatory and that raises to that question: do we have to choose instead of consumers? Moreover, for which consumer as there is no single consumer?
- to the objectivity of this scoring tool towards interest groups.
- to the validation of tool and data
- to the masking information through a single score

The potential to manipulate the scores to get a "good mark" (*e.g.*: inclusion of additives…) was also mentioned as a concern by some stakeholders.

Another kind of concern was related to **the use of the score.** As expressed by Italian stakeholder, who thought that the scoring tool will only be used if its computation is **low-time demanding**. A question raised was to think about how to obtain **co-benefits** with its use, for producers and processors? (if none the multicriteria scoring tool will soon be abandoned)

Furthermore, **if the tool was dedicated to stakeholders**, it would be too synthetic to allow them to improve themselves. For the UK, instead of a scoring tool it would be better to use pre-existing systems to ensure minimum quality standards, especially regarding food safety. There were also concerns about governance and quality assurance, which means: how do we ensure that famers and processors are carrying out the methods associated with better product quality?

Regarding **a target related to consumers**, several stakeholder groups felt that such a scoring tool should not be aimed at consumers, as it is too complicated to understand and could lead to misinterpretation. For some, it is not needed by consumers who want something simple not an overload of details. They just want to be able to trust a product. Moreover, we cannot communicate everything to consumers. For UK beef stakeholders, consumers do not have enough time to make a purchase decision, and for French beef stakeholders, this could even be dangerous. To avoid this risk the beef industry should be the only body to drive a potential tool dedicated to consumers.

In the UK beef sector, people globally found that it would be better to promote good products than to compare products at retail. They also felt that if we really wanted to affect consumers, we should incorporate key aspects of the quality into existing brands already known to consumers. In general, it was pointed out that it is d**ifficult to find a balance** between "easy to understand" and "over-simplification of complex realities". If the tool is meant for consumers, it is seen **dangerous for the food chains to include food safety aspects,** as it will put doubt in the mind of consumers. The risk of already too many existing tools/scores which are confusing for the consumer was also emphasized.

Specific fears were debated in the beef groups related to the fact that this tool could **damage the beef industry**. Many reasons were cited. It could lead to competition between husbandry systems and between products. For French stakeholders, it will complicate the marketing of products by an additional segmentation, a competition with existing official quality labels. This idea is not far from the one of the UK regarding the use of existing labels to convey quality recommendations instead of developing a new scoring tool. UK stakeholders felt the tool will lead to losers and winners whereas stakeholders believe all meat has value and will be suitable for specific purposes. There is a risk that such a tool reduces the value of lower scoring meat instead of increasing the value of the best meats. So, there will be a need to pay attention to the communication around the lower products. The Italian group raised another danger linked to the fact that a single farmer could not have the possibility to collect all the data needed for the calculation of the multi-criteria scoring. Thus, the tool could create a division within the beef industry.

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Technical criteria to take into account within the scoring tool.

The stakeholders expected to include **extrinsic criteria** in this tool, *i.e.* sustainability, environment (like climate impact, land and water consumption, avoidance of food waste) and animal welfare criteria.

This point will be discussed in more details in the coming years of the project.

More precisely, some of the aspects mentioned were:

- **Husbandry practices :** type of feed, carbohydrate-based or animal-based feed (fish or other); type of breeding: organic, free range, conventional, animal welfare
- An indication on **antibiotics use**
- **Origin of the farm (region, country) –** where the animal was born, raised and slaughtered
- **Sustainability** in the production process (use of energy, transport, water, chemical use, carbon footprint, durability of packaging and recyclability etc.)
- **Ethics** behind production: fair price for farmers and labour security

And some related to intrinsic qualities:

- A table of nutritional values
- Organoleptic characteristics
- Presence of contaminants (toxins, heavy metals) and non-healthy additives

See figures 15 and 16 for further details concerning beef sector.

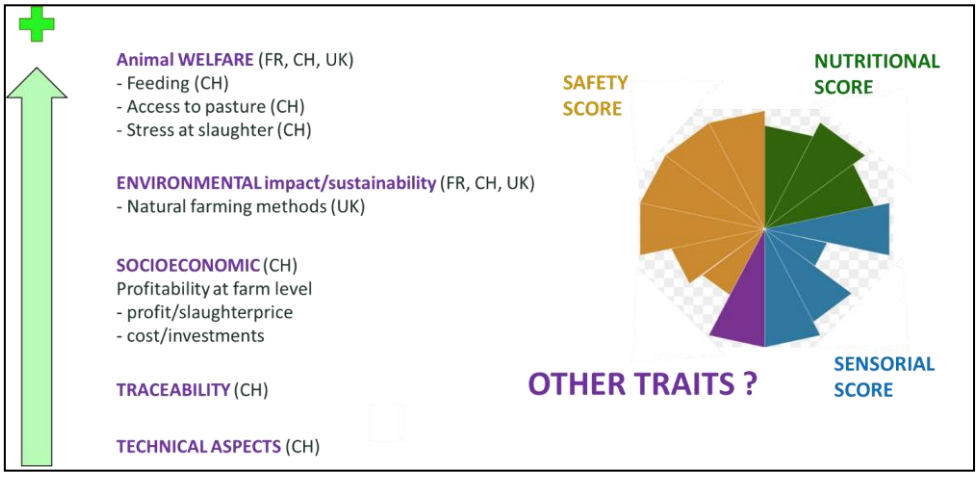

Figure 15: Extrinsic criteria to include within the scoring tool according to the beef stakeholders.

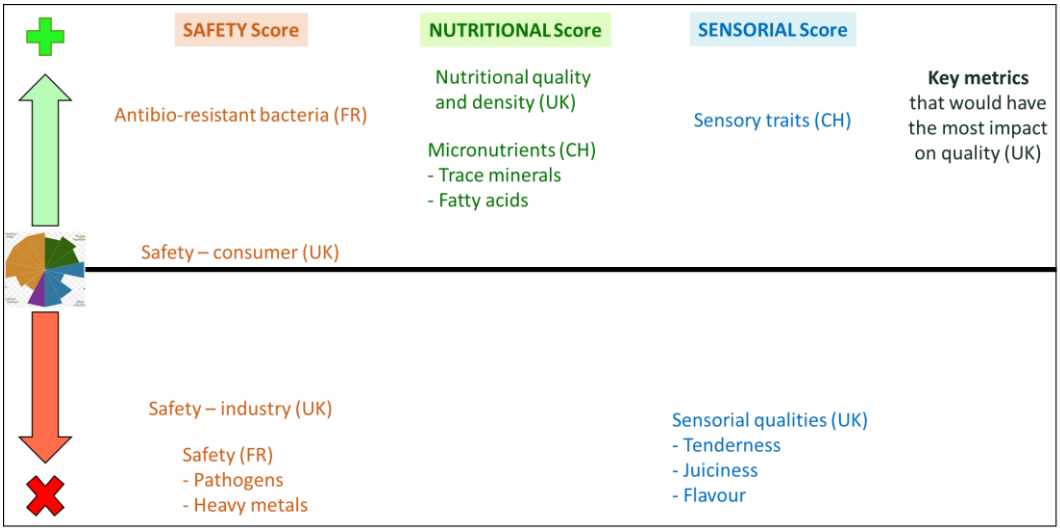

Figure 16: Intrinsic criteria to enhance, to add, or to reduce within the scoring tool according to the beef stakeholders.

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5. Conclusion

The consultation of the actors in this first year of the project has been very fruitful. The dialog between actors of the food chain (like farmers, processing industry, retailers) and researchers is not a common practice but it has started and both parts can see the relevance of it. The actors appreciated a lot the fact that they could have a real influence on the research experiments which are conducted in the project with a specific budget allocated to answer to some of the questions and interest points, they raised. On the other hand, researchers can directly feel the relevance of their work for practice and ensure a better impact and dissemination of their research result.

We hope that this collaboration within Multi-actor Research project will be repeated in the future for other projects.

The **husbandry systems** to be studied have been specified or newly defined during the consultations.

Involved stakeholders cited many **interesting husbandry practices** that could be tested during the project. Different topics came up such as feeding, husbandry and genetics, highly dependent on the country.

The actors' interviews and participation in groups raised several points that were not anticipated in the initial project: the importance of extrinsic qualities to be taken into account with intrinsic qualities. Thus, a common expectation from the stakeholders in the different countries is to include the extrinsic criteria linked to animal welfare, environment, and socioeconomics within the studied qualities in the INTAQT project. Furthermore, actors raised the relevance of considering technological criteria.

Some specific sanitary criteria have been emphasised, like antibiotic residues and more generally contaminant residues while other safety analyses are considered as a prerequisite already covered by regulation and specific controls. Additional analyses are expected on nutritional aspects. All these **new criteria and analyses** must be confronted with scientific advice to determine which additional criteria can be taken into account bearing in mind the technical and economical means of the project.

Not all aspects can be treated in the project but it can also give ideas for new research projects.

Lastly, the concept of **multicriteria scoring tool** divides the stakeholders within each country, some countries being confident and others more cautious. There is a strong expectation to clearly define the target. For example, some people deemed inappropriate to add safety traits in the scoring tool. Another strong expectation is to adapt the content and explain the tool. A common expectation from the stakeholders in the different countries is to include the extrinsic criteria of sustainability, environment and animal welfare. Therefore, the positive and negative points mentioned by stakeholders will need to be considered with increasing attention by researchers when they will build this (or these if several targets) tool(s).

The dialog between food chain actors and researchers will continue throughout the life of the project. Next year, the stakeholders will be informed at national level of the dispositive finally retained in the project. The consultation in the middle of the project will focus on results already obtained and the conception of the multicriteria scoring tool. At the end of the project, national and European groups will give final recommendations to disseminate results of INTAQT.

6. References

F. Kling-Eveillard, B. F. (2012). *Les enquêtes qualitatives en agriculture. De la conception à l'analyse des résultats.* Institut de l'Elevage.

7. Annexes

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ANNEX 1: European poultry group, multi-actor's expectations

1- Introduction and Objectives

The H2020 European research project INTAQT aims at developing innovative tools to assess and authenticate beef, chicken, milk, and dairy products quality. This project studies more specifically the link between husbandry systems and intrinsic quality criteria. A group of stakeholders has been involved to consider their expectations, suggestions, and concerns. They represent the whole supply chain, from farmers, to processor plants, retailers up to citizens and consumers organizations. Their consultations were meant to address recommendations to add to the experimental dispositive 1/ husbandry systems and practices of interest to them, 2/ quality criteria, and analysis according to the expressed needs. Furthermore, one of the challenges in the project is to build a synthetic multicriteria scoring tool including the quality criteria studied and consider stakeholders' expectations and fears.

This survey will focus on poultry multi-actor's expectations at the European level, plus consumer's expectations. The methodology used will be detailed as well as the results concerning husbandry practices, innovative practices, quality criteria and analytical methods, multicriteria scoring tools.

We'll note that the project was meant to work exclusively on intrinsic quality. However, one of the strong expectations from the stakeholders is to consider extrinsic quality factors. Thus, this point will be tackled in the results. This survey will not include online surveys' results, as a specific report will be dedicated to that.

2-Methods

2.1-Actors' consultation

To comply with these objectives, for poultry, around 15 face-to-face stakeholders' interviews were led in each of the following involved country: Italy, France, Belgium and Switzerland. The people selected often were representatives from national organizations. Moreover, they were chosen so as to get a broad view on their supply-chain. Consumer's focus groups were displayed to get their points of views, expectations and fears, in Italy, France, Belgium and Switzerland. The next step was to have the stakeholders discuss and prioritize those results during national meetings, held in presential or online for each product. A European poultry group was constituted (Figure 1). Two European meetings were held online in 2022. Two to four stakeholders, designed as national groups' spokesperson, were invited to the European group. The concerned work package (WP) and tasks leaders attended the meeting too. The objective was to discuss and prioritize expectations to be included in the project.

Figure 1 : Work Package 1 organisation

2.1.1-Face-to-face interviews

In order to avoid biased interviews, the interview guide was elaborated in "funnel", in two parts (Kling-éveillard et al., 2012). The first one was general. The actors were asked what composed poultry meat quality, its evolution in the past, and the future challenges and perspectives for poultry meat quality. Then, they were asked to describe the link they perceived between rearing conditions and poultry meat quality.

The second part of the interview was dedicated to the INTAQT project's presentation, to which every stakeholder was invited to react, express their expectations and fears. In particular, the initial analysis amongst the nutritional, safety and sensorial criteria were presented to them. They expressed their opinions on them, what they would add or remove.

Further to this, the different dairy systems were presented to each of the stakeholders. They gave their points of views on the initial choices and told what they would include in the scientific disposal.
Lastly, the multicriteria scoring tool concept, based on intrinsic quality criteria (nutritional, sensorial, safety) was presented to them. Their reactions were collected.
To conduct the interviews in a concerted way, a hybrid training was organized in France from the 10th of October to the 11th of October, with all the interviewers / referents, for the 3 products.

The interviews were led in presential or with online web conferences and were all recorded. They began in October 2021 and ended in March 2022. Each face-to-face interview lasted from 1 hour to 2.5 hours. The composition of the interviewed people is described in Table 1.

Table 1: European stakeholders interviewed

	Switzerland	Belgium	Italy	France
Number of interviews	9	22	8	15
Boards represented	1 feed company for organic feed 1 researcher for Animal Welfare 1 feed company for conventional feed 1 Vet/Health services 1 Hatchery 1 Retail company 3 farmers	2 breeders 2 hatcheries 2 farmers 1 feed company 2 slaughter houses 2 processors 4 retailers 6 consumers and citizens NGO 1 advisor: data collection	1 hatchery 3 farmers 1 slaughter houses 1 food certification organization 1 retailer 1 consumer and citizen NGO	1 breeder 1 hatchery 3 farmers 1 Vet 1 feed company 2 slaughter houses 2 processors 2 retailers 2 consumers and citizens NGO

During every interview, map minds were elaborated, synthetizing the main actors' sayings on poultry meat quality definition and its influence factors. The whole note taking added to the script transcription of the most relevant remarks enabled to construct a specific analysis grid. The analysis grid included the main thematics and sub-thematics from the interview guide, completed with those spontaneously expressed during the interviews. Based on this, a deeper thematic analysis was conducted.

2.1.2-National groups

All the interviewed stakeholders were invited to the national groups. The national groups were managed by two persons among whom the interviewers. The national groups objectives were to:

1- Remind the stakeholders of the INTAQT project,
2- Share the whole results: face-to-face interviews, online surveys, consumer's consultations by focus groups, on the:
    a. Criteria and analysis to include
    b. Husbandry systems and practices to consider in the project
    c. Innovative practices (this point was optional)
    d. Expectations and fears on the multicriteria scoring tool concept
3- Have the stakeholders react to those results, express their points of views
4- Make the stakeholders prioritize their expectations

To facilitate those meetings, Klaxoon board was used in online meetings to prioritize the criteria and analysis to recommend, as well as the systems and practices.

The national groups gathered the following stakeholders:

Table 2: National groups compositions

	Belgium	France	Italy	Switzerland
Day	23rd of March 2022	24th of March 2022	1st of April2022	2022
Number of participants	14	12	8	7
Type of meeting	Hybrid (0,5 day)	Online (0,5 day)	Online (0,5 day)	Online (0,5 day)
Present boards	Breeders, Hatchery, Farmers, Service firms/feed company, Slaughterhouses, Processors, Retailers, Animal welfare NGO	Breeders, Farmers, Service firms/feed company, Slaughterhouses, Processors	Hatchery, Farmers, Retailer, Consumer NGO	Breeders, Hatchery, Farmers Vet, Feed provider, Advisor/Consultant Animal Welfare Researcher
Missing boards	Vets, Consumer NGO,	Vets, Hatchery, Retailers, Consumer NGO, Animal welfare NGO	Breeders, Vets, Slaughterhouses, Processors Animal welfare NGO	Processor Retailers Consumer NGO

2.1.3-European chicken groups and meetings

Two European chicken meetings were held online by web conference, the 5th of May 2022 and the 5th of July 2022. They lasted 2.5. The first European chicken meeting aimed at:

1- Giving information about husbandry systems and innovative practices planned to be studied in the project, at the European Level, explaining how the expectations had been considered
2- Giving information on WP2: Presentation of the sampling protocols, the living lab…
3- Informing on the next steps in 2022 and after

The following people attended the 1st European meeting (Table 3):

Table 3: First poultry European meeting composition (2022-05-05)

2022-05-05	Selection	Poultry producer / production organization	Feed industry	Vets	Slaughter / processor	Distribution, trade, catering	Consumer association	Project scientist
number of people	2	2	1	1	3	1	1	14
Countries present	Germany Netherland	Italy France		Switzerland	Italy Belgium France		Belgium	Belgium France Germany Italy Switzerland
Work Package involved	1	1	1	1	1	1	1	1, 2, 3 and Coordinator

The second European dairy meeting aimed at:

1- Exchanging about quality criteria, analysis planned to be studied in the project + expectations on implementation at European level,
2- Exchanging about expectations on multicriteria scoring tool at European level,
3- Informing on the next steps in 2022 and after…

The following people attended the 2nd meeting (Table 4):

Table 4: Second poultry European meeting composition (2022-07-04)

05/07/2022	Poultry producer / production organization	Feed industry	Vets	Slaughter / processor	Project scientist
number of people	1	1	1	2	7
Countries present	France		Switzerland		Belgium Netherlands France Switzerland
Work Package involved	1	1	1	1	1, 2, 3, 4, 5 and Coordinator

3-Poultry results

3.1-Husbandry practices

As a whole, the stakeholders were satisfied with the initial systems presented, as they were representative of their countries.

Main expectations of the stakeholders are linked to societal demands and specially to animal welfare and environmental issues. and also, with consumers. Important expectations are also linked to consumers and in particular to having a final product that corresponds to market demand, food safety and product traceability (Figure 2).

Regarding the rearing system to analyse in the project, the stakeholders agree on the importance of including systems representative of each country, but also systems of interest such as Best Chicken Commitment (BCC), indoor system with fast-growing chicken, free range and also future enclosure system with natural light, environmental enrichment, reduced density… (Figure 2)

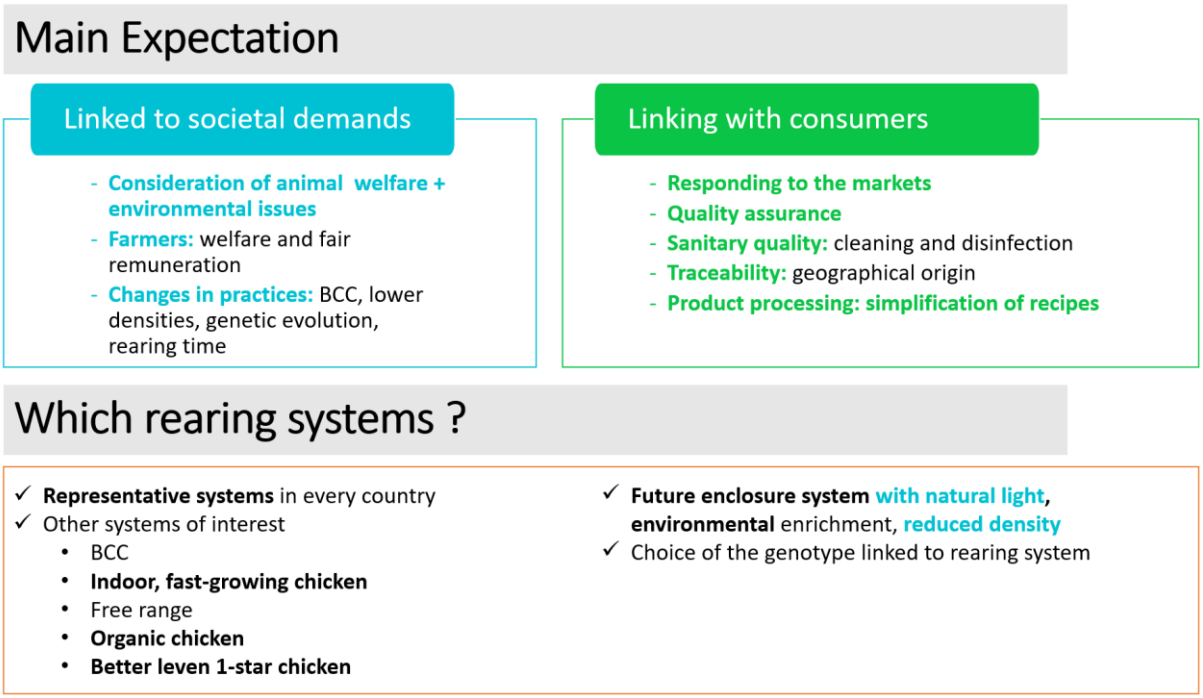

Figure 2: Main specific expectations on husbandry systems

The systems to be included and studied in the project were proposed during the European group, to meet the stakeholders' expectations and discuss them. In particular, 6 out of the 21 systems were designed after the face-to-face interviews and national groups, to consider stakeholder's specific expectations (framed boxes in figure 3).

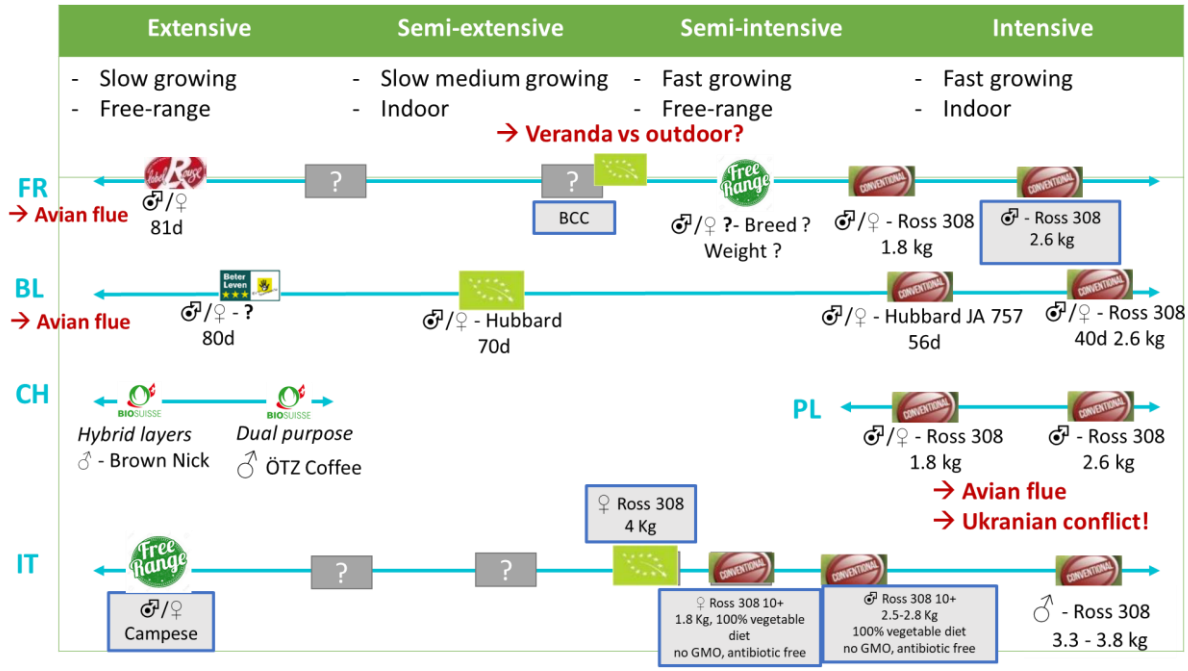

Figure 3: Main husbandry systems proposed to study in INTAQT

During the first European chicken meeting, the stakeholders had few things to add. The proposals quite complied with their expectations. After discussion, stakeholders agreed on the system to be included and studied during the project (Figure 4).

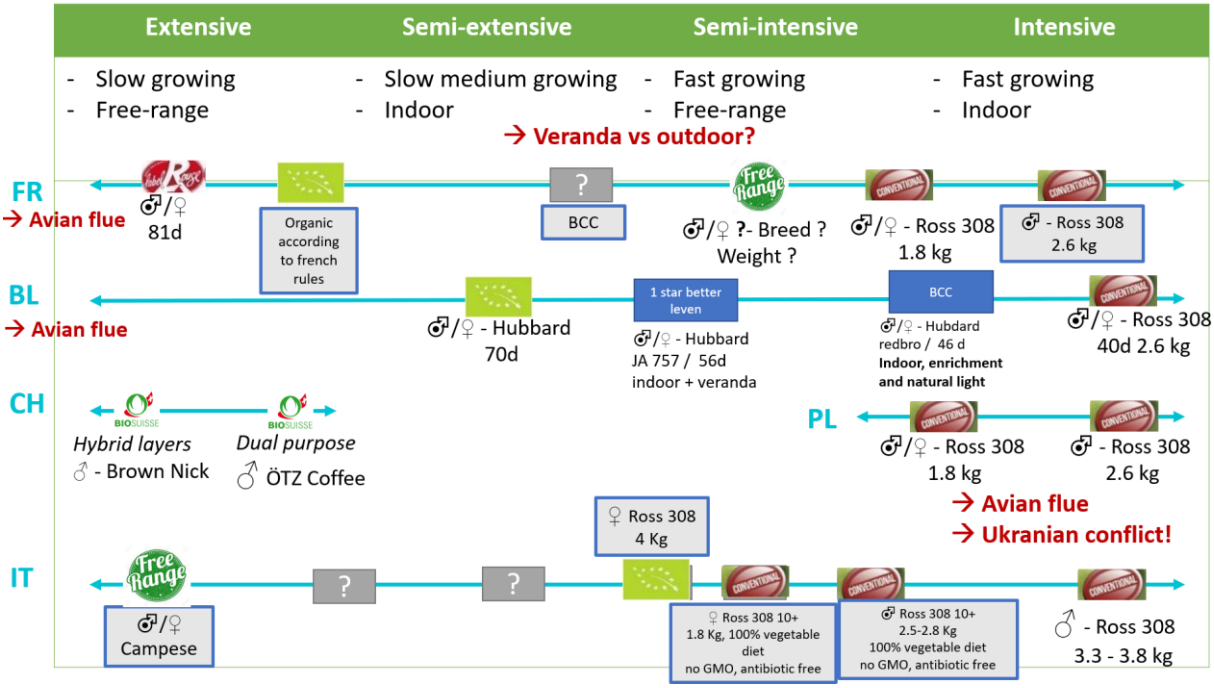

Figure 4 : Main husbandry systems proposed during the European chicken group to study in INTAQT

3.2-Innovative practices

Many innovative practices were addressed spontaneously by the stakeholders during the face-to-face interviews and national groups. Some national groups prioritized the most important innovative practices. Thus, during the European chicken meeting, on the 5th of May, the main innovative practices and systems were discussed (Table 5):

Table 5: Main innovative practices and systems for poultry

Rearing practices	Housing	Food
Combine different practices to find alternatives: ➢ enclosed x rearing time; ➢ enclosed x intermediate growth **with/without veranda** ➢ enclosed x intermediate growth x environmental enrichment x natural light ➢ strains x outdoor access/enclosure; ➢ Evaluate the consequences of reduced outdoor runs on the spread of avian influenza in particular	➢ Nestborn ➢ Lower pen density ➢ Effect of natural light	➢ Feed produced with local ingredients

The stakeholders were in agreement with the proposals made. However, during the discussions at the meeting, four new proposals were added to those presented:

- Heat floor linked to footpad dermatitis and behavior of the birds…
- Early feeding in on farm hatching way or at hatchery
- Veranda for slow and medium growing chicken
- At slaughter: collect information on slaughter process like cool system of carcasses (cooling rate)

3.3-Quality criteria and methods

The initial criteria and analysis to be conducted on the poultry meat were reminded to the stakeholders during the face-to-face interviews, national and European groups meetings (Figure 5).

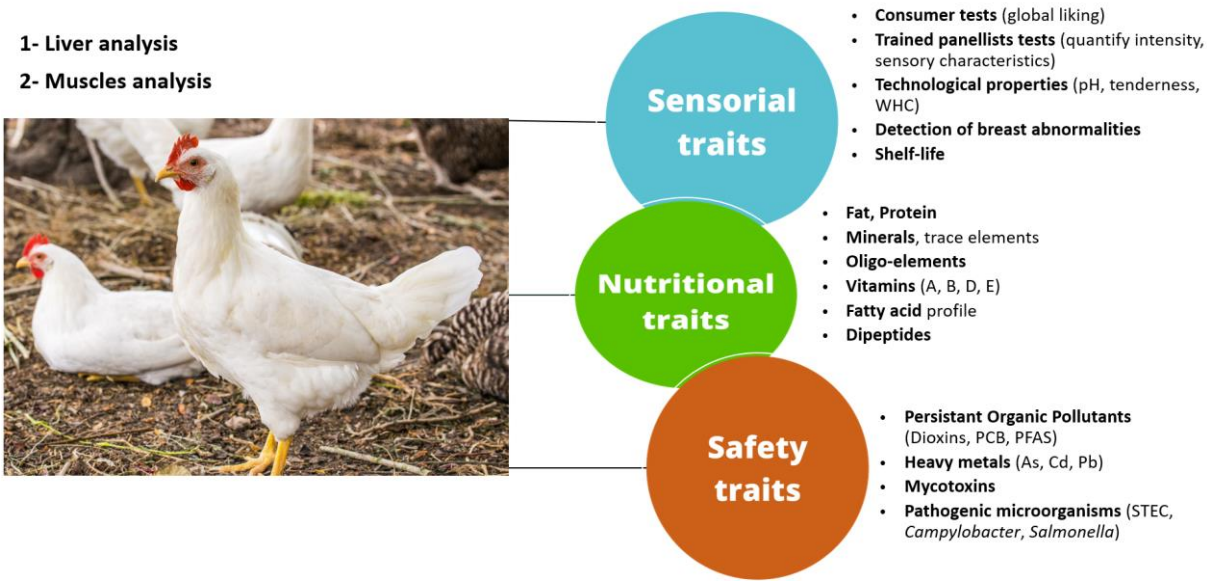

Figure 5: Criteria and analysis initially foreseen in INTAQT

The stakeholders had many expectations and made many remarks concerning criteria and analysis to include. Some criteria expected were common to different countries and specially those related to extrinsic qualities (animal welfare, environment, socio-economic). With regard to the intrinsic quality criteria, the stakeholders agreed that those initially proposed in the project (Figure 5) were well representative of the quality of poultry meat, although some stakeholders proposed adding some criteria that they felt were important for assessing the quality of poultry meat.

During the second European meeting, the stakeholders' expectations were discussed with the work package leaders 2 and 3, to precise 1/ their expectations, 2/what could be done or not, 3/ what was under discussion (Table 6).

Table 6: Exchange with Work Package leaders on feasibility

Categories		Quality criteria	Countries	Comments from other WPs
Safety		Microbial (*Salmonella*, *Campylobacter*)	FR	*Salmonella* on meat would not be analysed since part of legal monitoring and sample size farm network too small. For *Campylobacter*, faecal sampling would be done.
		Process residues, Chemical (AB), Allergens	BE	Antibiotic residues in meat would not be analysed since part of legal monitoring and sample size farm network too small. Process residues, allergens????
		Multi-resistant and heat-resistant bacteria – *Clostridium*	BE, FR, SW	Possibility to include analysis of multi-resistant bacteria is explored.
		Spoilage flora	FR	Possibility to include analysis of multi-resistant bacteria is explored.
		Link antibiotic residues in meat and water	BE	Farm sampling plan not suitable for this specific research question
Nutritional and Sensorial quality		Susceptibility to oxidation	FR	Would be analysed on a subset (3 production systems)
		Water/protein ratio	BE	Will be included in the analysis on all samples.
		Fat quality	FR	Fatty acid profiles are included in the analysis
		Essential amino acids and protein digestibility	BE	Too expensive to conduct on all samples and no large differences to be expected between most systems. Would be analyzed on a subset (3 production systems) in relation to texture defects (wooden breast) that may result in different AA profile.
		Tenderness, texture	FR	Shear force and sensory tenderness are included.
		Blind tasting vs informed tasting	BE	Beyond the scope of the present project??
Technological quality		Water-holding capacity	BE	Drip loss, cooking loss are already included.
		Shelf life	FR	Shelf life: requires a lot of meat samples! Under discussion to be added
		Fillet's defects, Wooden breast	FR	Muscle myopathies are already included.
		Oxidation in connection with meat discoloration	FR	
		Processing efficiency and processing ability	FR	
		Product presentation: scratches, stains, colours, exudates	FR	
Analyses to be added		Analysis of the feed	BE	Is not planned to be analysed. Too complex to sample on farms.
		Slaughterhouse process: Important to properly qualify the products leaving the slaughterhouse in order to assess the impact of process changes on product quality (electrostimulation, carcass cooling, etc.)	FR	Included in meta-data questionnaire.
Extrinsic qualities	Animal welfare	Outdoor access Footpad lesions, broken wings & legs Enrichment material Light levels, health + mortality rate of chicks, Bone health as measure for animal welfare	BE, FR, IT, SW	Animal welfare assessed with EBENE protocol
	Environment	Climate Ecological aspect Cutting losses	BE, FR, IT, SW	Is not planned to be analysed
		Use of renewable energy, transport distance to produce meat, food waste, resource consumption		Energy, water and feed consumption is included in environmental analysis
	Socio-economic	Economic analysis included production costs, Quality / price ratio	BE, FR, IT	Prices not included due to integrated production and difficulty to compare prices. Include economic sustainability in the living lab.

All the points in orange in the Table 6 were further discussed with the stakeholders. They prioritized their choice (Table 7).

Tableau 7 : Criteria and analyses to be added discussed during the second European chicken meeting

Quality criteria	Very important	Important	Not important
Multi-resistant and heat-resistant bacteria – *Clostridium*	2	1	
Spoilage flora in relation to shelf life	3		
Water/protein ratio			1
Fat quality	3		
Susceptibility to oxidation (colour, lipid and protein oxidation)	3		
Processing ability	2		
Product presentation: scratches, stains, colours, exudates	2	1	

As a conclusion, the points expected to be included by the stakeholders need to be discussed by the INTAQT scientists.

3.4-Multicriteria scoring tools

The concept of a multicriteria scoring tool (Figure 6) was presented to the stakeholders during the face-to-face interviews, national and European meetings.

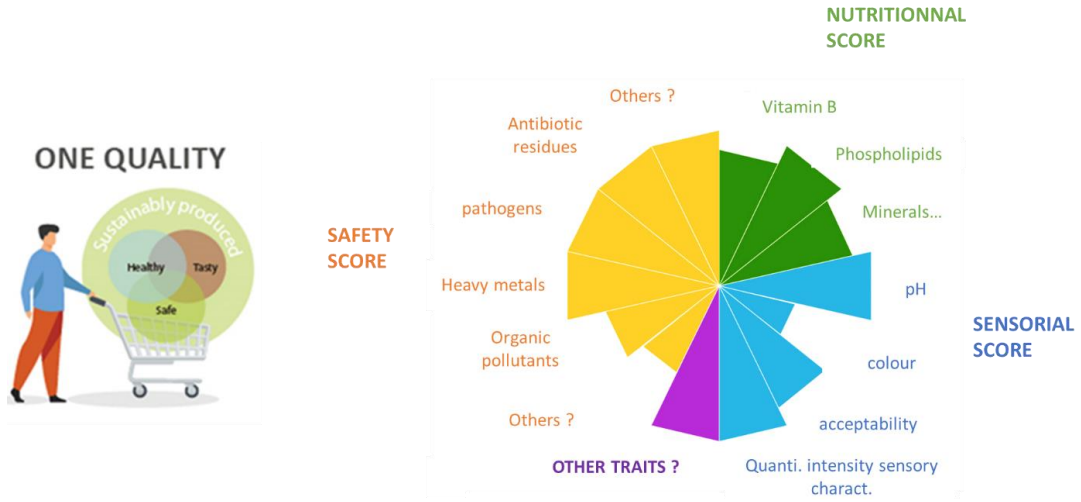

Figure 6: Example of multicriteria scoring tool conception

In every European country, stakeholders considered positive and negative points to this tool (Table 8).

Tableau 8: Positive and Negative points addressed to the multicriteria scoring tool by European chicken group

Positive points	Negative points
• Very interesting, and **is an opportunity to have a more general overview of different production systems for a range of criteria** • Which among these **quality criteria are the main important** for assessing the finished product (meat) • Have information about characterization of products • Results could influence consumer opinions	• Looks so **complex** that it seems difficult to make it a precise, reliable and applicable tool in all contexts • **Make good use of the tool without distracting from its initial objective** - system comparison! • **Concern for the reliability of the data** / Statistical results and weight of each variables → How will the score be made? • How will **the score be used in the sector**? • **Difficult to find a balance** between "easy to understand" and "over-simplification of complex realities" • **Dangerous to include food safety aspects** • **Risk of conflicting goals**, like animal welfare versus food safety or feed efficiency

On the whole, the need to clearly define the target and explain the tool was important to the stakeholders. Moreover, the stakeholders expected to integrate the pillars of sustainability which allows the different indicators to be positioned on the same tool. They would like also that scientists pay attention to economics because what is wonderful is not necessarily economically viable. Finally, have a focus on what is consumed in Europe by integrating imports could be a good point since we are in a Mondial market.

Conclusion

European stakeholders were satisfied with the 21 systems proposed to be studied as they were representative of the diversity each country involved.

All the European stakeholders agreed on the interest to include the extrinsic criteria of animal welfare, environment, socio economic. Some specific interest on technological aspect, microbial diversity, consumer relationship and social aspects need to be discussed within the project.

Lastly, the concept of multicriteria scoring tool divides the stakeholders, within each country. Several positive and negative points will need to be considered for its appropriation by the stakeholders. We'll note that a strong expectation is to define clearly the target, adapt the content and explain the tool. A common expectation from the stakeholders in the different countries is to include the extrinsic criteria of sustainability, environment and animal welfare.

Those consultations allowed to consider the professional and societal expectations as core questions of this European research program. They will enable to bring some implementations to the experimental dispositive, considering its feasibility. Thus, it will bring objectified scientific elements to answer to those expectations.

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ANNEX 2

Multi-actor interactions for project implementation – Beef part

Work package	WP1	
Work package leader	Cécile Laithier	ACTA-Idele
Author(s)	Isabelle Legrand	ACTA-Idele
Additional Authors	Aubert Nicolazo de Barmon	ACTA-Idele
	Christophe Denoyelle	ACTA-Idele
	Marco Berton	UNIPD
	Rennie Eppenstein	FiBL
	Verena Bühl	FiBL
	Shannon McLaughlin	QUB

1. Background

The goal of Work Package 1 (WP1) is to organize participatory involvement of agri-food chain actors (breeders, farmers and their organizations, advisors, processors, retailers, consumers), scientists, policy makers and society in order to:

i) prioritize quality traits, husbandry systems and practices as well as manufacturing processes to be studied
ii) refine the experimental network of farms and processors (WP2) providing unprocessed and processed ready-to-eat beef products for further measurements in WP3
iii) provide expectations and constrains regarding the development of analytical tools (WP4)
iv) contribute to the design of a multi-criteria scoring tool (WP5) and of innovative sustainable husbandry practices complying with high product quality to be tested in WP2.

ACTA displayed and trained partners of the involved countries to a common methodology for managing the groups.

One partner by country and type of product was in charge of organizing and animating each multi-actor group. Regarding beef, this position was assumed by ACTA-Idele for France (Isabelle Legrand and Aubert Nicolazo de Barmon), FiBL for Switzerland (Rennie Eppenstein), UNIPD for Italy (Marco Berton), QUB for the UK (Shannon McLaughlin). Each partner reported back to ACTA the discussions and main conclusions of its group to make a synthesis that has been considered by the beef European multi-actor group.

Figure 1 shows the organisation implemented during INTAQT first WP.

Figure 1: Work Package 1 organisation

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2. Material and methods - Work done for beef

2.1. Face-to-face interviews

For beef, four contexts corresponding to four countries have been considered, to study various production and consumption habits: France (ACTA), Italy (UNIPD), Switzerland (FiBL) and the UK (QUB).

These countries conducted face-to-face interviews with several beef industry stakeholders and sometimes representatives of consumers' associations or of non-governmental organisations (NGOs) dealing with animal welfare or environment (Table 2).

In France, eighteen 2 hours long interviews were conducted between 17th November 2021 and 16th March 2022, involving 22 persons. Most interviews were completed online. Each kind of actor was represented, processors and retailers being particularly present: farmers (2), processors (4), mixed profiles (2), retailers-catering (5), inter-branch representatives (2), consumers' association (1), NGO (2).

The **Italian** face-to-face interviews, held between January and March 2022, involved 11 stakeholders. All the interviews were conducted via online video conference, except one. Stakeholders were mainly linked to producers (2 farmers, 2 cooperatives, 2 associations) or to the society (2 NGO, 1 consumers' association). Processing was less represented (1 + 1 mixed profile) and retail was not interviewed.

Table 2: Details regarding the national face-to-face interviews (mainly online)

F2F interviews	France	Italy	Switzerland	UK
Date	17/11/2021 – 16/03/2022	01/2022 - 03/2022	19/11/2021 – 7/01/2022	21/12/2021 - 17/02/2022
Nb of interviews (stakeholders)	18 (22)	11	11	15

The **Italian** face-to-face interviews, held between January and March 2022, involved 11 stakeholders. All the interviews were conducted via online video conference, except one. Stakeholders were mainly linked to producers (2 farmers, 2 cooperatives, 2 associations) or to the society (2 NGO, 1 consumers' association). Processing was less represented (1 + 1 mixed profile) and retail was not interviewed.

In Switzerland, 11 face-to-face interviews were conducted between 19th November 2021 and 7th January 2022. All but one of them were done online. Stakeholders linked to production (1 farmer, 2 interest groups representing farmers with specialized rearing systems) and retail (3) were the most represented beside processors (1), inter-branch (1) and education (1).

In the UK, 15 face-to-face interviews were conducted from 21st December 2021 to 17th February 2022. All the interviews were conducted via online video conference. Those interviews included farmers (4), processors (2), retailers (2), national meat industry representatives (1), animal welfare NGO (1) and research (1).

2.2. Consumers' focus groups

Four focus groups were organised after several online meetings to define a common methodological protocol:

- **in France** on January 26, 2022 (Acta-Idele, Florence Bedouin, Christèle Couzy)
- **in Germany** on February 16, 2022 (FiBL, Verena Bühl, Rennie Eppenstein)
- **in Italy** on February 8, 2022 (UNIPD, Francesco Pagliacci, Enrico Sturaro, and UNIG, Alice Cartoni Mancinelli)
- **in the UK** on February 10,2022 (QUB, Shannon McLaughlin and Ryan McGuire)

The consumers were sampled to catch a broad diversity of profiles, though vegetarians or vegan persons were not included in the focus groups. The diversity took the following criteria into account: gender, age, family size, socio-professional categories and educational level, urban / peri-urban / rural.

The results of the 4 focus groups were used to analyse the expectations of consumers on the quality (intrinsic and extrinsic) of chicken meat, beef and dairy products in different European countries.

2.3. National beef meetings

National multi-actor groups have been organized by each of the four countries involved in INTAQT beef part. Around 15 people per group were initially desired, representing the agri-food chain (breeders, farmers and their organizations, advisors, processors, retailers, and consumers), scientists, policy makers, and society. However, this number was not

achieved, the 4 beef national multi-actor groups comprising between 6 and 9 participants (Table 3). The time required may have been a problem within this beef industry where people are always under pressure.

One or two meetings with these groups were organized in order to:

- remind stakeholders of the fundamentals regarding the INTAQT project
- present results of the national face-to-face interviews and sometimes also of the consumers' focus groups carried out in parallel with the face-to-face interviews during WP1
- discuss and collect priorities regarding husbandry systems, interesting husbandry practices, as well as quality traits to be studied in the project
- gather views, fears and expectations regarding the multi-criteria scoring tool to be built using the project data.

Table 3: Details regarding the national beef meetings (mainly online)

National meetings	France	Italy	Switzerland	UK
Date	13/04/2022	1/04/2022	17/03/2022	24 + 31/03/2022
Nb of participants (stakeholders + researchers)	11 + 4	8	9 + 2	6 + 1

In France, 11 persons representing the French beef group gathered for a 3h-online meeting on April 13, 2022. Each sector of the beef branch was represented, especially the slaughtering and processing sector, but there was nobody from consumers' associations or NGO. The meeting was facilitated using Microsoft Teams and Klaxoon software.

In Italy, a 2h30 online meeting was organized on April 1, with 2 parts. The first one was shared by the 3 specific industries: dairy products, poultry, and beef. The second part was a specialized meeting involving 8 participants for beef. Mixed profiles linked to the production and process fields were well represented, unlike retail.

In Switzerland, a 3h30 online meeting was managed on March 17 with 9 beef participants. Each beef sector was present, especially the production one, but as in France, nobody represented consumers, citizens, or NGO. The meeting was facilitated using Microsoft Zoom and Mentimeter software.

In the UK, two online meetings were held on the 24th and 31st March 2022. Meetings were facilitated using Microsoft Teams and Kahoot quiz software. The duration of each meeting was 64 minutes and 102 minutes, respectively. Six stakeholders from across the UK participated in this national meeting, representing processors, animal welfare, quality assurance, professional bodies for butchery, and research. As for France, processors were well represented, more than the production sector.

As an illustration, the report of the UK beef national group meeting is appended hereto.

2.4. European beef meetings

The European multi-actor group should initially include 2 representatives of each national groups, plus one of each WP1 partners, one of living labs (WP2), all WP leaders and European and national beef referents. In practice, the stakeholders' involvements were quite different according to the country.

The time required and the English language may have been problems, even if the presented slides had been translated before the meeting in some mother languages (French, for example).

Propositions and advice made by the national groups were explained to the European group regarding all the topics discussed in order to drive the scientists in the best way for each topic and to orient the project for the better. Group discussions were based on a short presentation followed by a discussion to share opinions and identify consensus and dissensus.

A **1st online meeting of the Beef European group** was conducted on May 2, 2022. This meeting lasted two hours. It was focussed on husbandry systems and innovative practices to be studied in the project, as it was urgent to get rapid decisions on these points. British and Swiss stakeholders had an active participation in the meeting and made interesting contributions to go ahead within the project protocol.

A 2nd online meeting took place on July 5, for 2 hours in the beginning of the afternoon. This second meeting aimed at presenting and discussing the results of the 4 national groups regarding quality traits to be studied in INTAQT and the multi-criteria scoring tool that is planned to be built with the project data to evaluate beef quality.

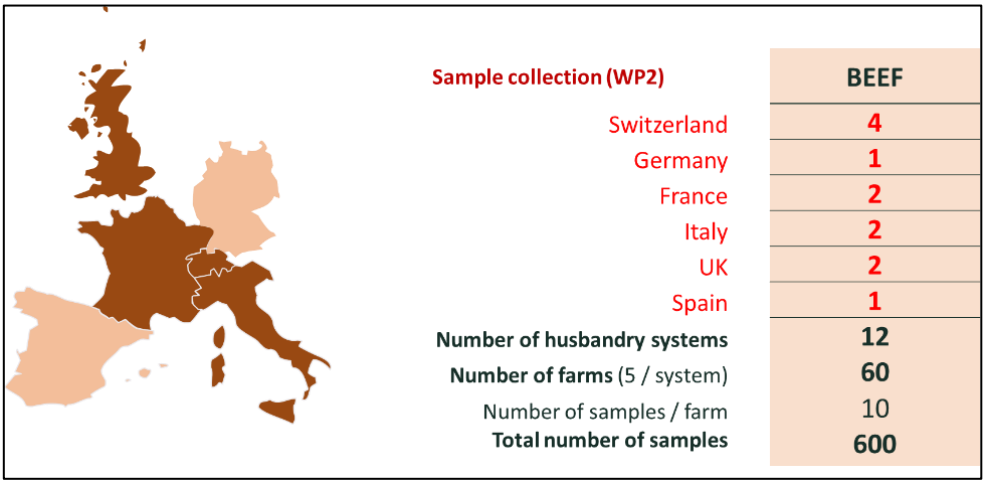
Thereafter, in 2024, the different groups (nationals and European) will become aware of the main results of the project and participate in the development of final recommendations on husbandry practices to be encouraged in Europe.

3. Results

3.1. Husbandry systems to be studied for beef

Six countries are involved in the beef sampling: France, Germany, Italy, Spain, Switzerland, and the UK. However, only 4 out of these 6 countries were involved in the work done with national multi-actor groups in WP1: Germany and Spain did not participate (Figure 2).

Figure 2: Number of beef husbandry systems studied by country in the INTAQT project

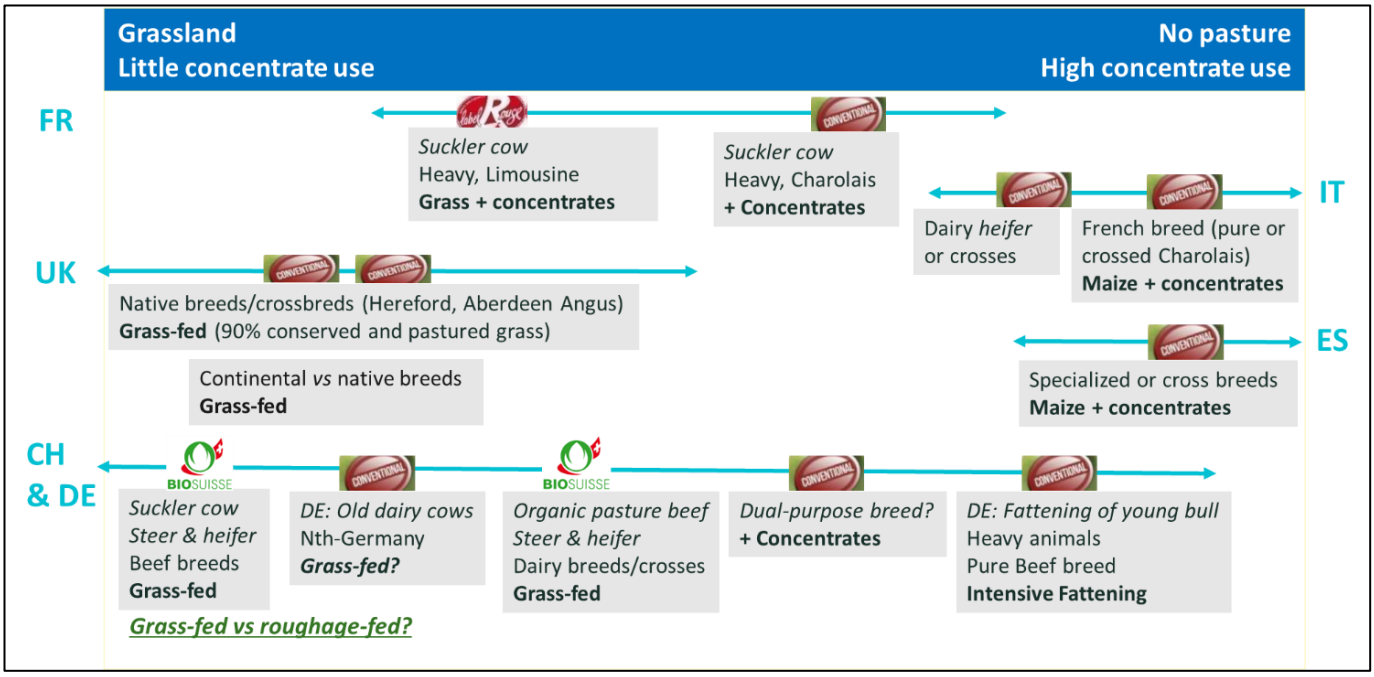


Sample collection (WP2)	BEEF
Switzerland	4
Germany	1
France	2
Italy	2
UK	2
Spain	1
Number of husbandry systems	**12**
Number of farms (5 / system)	**60**
Number of samples / farm	10
Total number of samples	**600**

The 6 countries will allow the project to study 12 husbandry systems in total: 3 or 4 in Switzerland, 2 in France, Italy and the UK, 1 or 2 in Germany and 1 in Spain. Five of these husbandry systems were nearly already defined in the written project, thus before the face-to-face interviews and national group meetings. The last 7 ones had to be decided before summer 2022 according to the face-to-face interviews, and the national and European multi-actors' groups advice, considering research and practical considerations (Figure 3).

The conversation during the European meeting was focused on currently common systems in the concerned countries as well on the systems to be studied in the project.

Figure 3: Conclusions of the beef European group regarding the 12 husbandry systems to be studied in the INTAQT project



- ## Consumers' points of view

Results from the 4 focus groups managed with consumers in France, Germany, Italy, and the UK showed that those consumers didn't have specific expectations regarding husbandry systems.

- ## French beef husbandry systems

France has 2 husbandry systems to work on.

The **1st one** (already defined in the written project), represents the highest quality label in the country which is called Label Rouge (LR). The LR system chosen is the most important for beef in France. It concerns mainly cull cows of the Limousine breed and gives heavy carcasses, animals being mostly raised on pastures in the centre of France, with moderate quantities of concentrates, rather distributed during the finishing period.

The **2nd system** (defined according to WP1 exchanges), proposed by the French national group, refers to the Charolais breed, which is the most important beef breed in France. In this country, the beef herd provides around two thirds of the beef produced. Cows and bulls are the 2 main bovine categories to be produced and consumed in France. As for previous system, cows were again preferred to bulls because they represent almost half of the production whereas bulls only a third. Therefore, approximately 60% of the beef consumed in France comes from cows, a rather uncommon situation around the world. Bulls represent only 15% of the beef production or consumption and heifers and steers less than a quarter.

In order to study 2 sufficiently distinct systems in France, it was recommended to try to work with a more intensive system (less pasture and more concentrates) with the Charolais than with the Limousine breed and to avoid any quality label such as Label Rouge in favour of a conventional system for Charolais cows. Indeed, both systems actually concern cull cows of a beef breed originated from the centre of France. The decision to choose the Charolais emerged during the French national group meeting but didn't adequately reflect the opinions collected during the face-to-face interviews in France. During this first stage, the public had a broader profile and was not only part of the beef industry. Thus, opinions on the husbandry systems to be studied within INTAQT differed slightly from the points of views expressed (by less persons) during the French national beef meeting. Indeed, many interviewees felt that a system based on a dairy or dual-purpose breeds could be relevant for France where meat is not only provided by the beef herd. A conventional system not linked to any specialized meat breed or to any quality label was therefore seen as a good idea. However, the Charolais breed was also cited, and this was mainly supported by the French beef industry.

- ## German and Swiss beef husbandry systems

Husbandry systems in Germany and Switzerland will be all managed by the FiBL. In total, 5 systems must be studied with a change regarding their allocation between both countries. Only 1 system will be studied in Germany instead of 2 originally. Thus, 4 systems will be now studied in Switzerland instead of 3.

The **1st system** proposed for **Switzerland** in the INTAQT project referred to organic (Bio Suisse) pasture-raised beef from crossbred animals or dairy males. During the European group meeting it was specified that this system will include pasture-fed oxes and heifers from dairy breeds and crosses ("Weidemast").

A **2nd system** agreed upon in Swiss national group includes oxes and heifers (beef breeds) from pasture-/grass-fed suckler-cow systems, raised according to organic farming regulations (Bio Suisse).

The European beef group also proposed to include a **3rd system** with fattening animals from dual-purpose breeds with a relatively large amount of concentrate feeding. FiBL is therefore working on a way to include such a system.

The **1st system** originally defined for Germany included intensive fattening of young, pure beef-breed bulls, providing heavy carcasses. During the European meeting, it was stated that this system could probably be more easily studied in Switzerland where FiBL has relevant contacts ("Munimast"). Thus, this system will probably be studied as the **4th system** in Switzerland.

On a more global point of view, Swiss stakeholders are interested in comparing animal roughage-based feeding systems (including whole maize, alfalfa, etc) *vs* grass and hay-only systems.

At the request of the European beef group, **a system** based on grass-fed old dairy cows could be studied in the northern part of **Germany**. Indeed, very few dairy animals were proposed to be involved in the project whereas INTAQT was initially focussed on dairy herds.

- ## Italian beef husbandry systems

Two beef production systems are planned for Italy.

The **1st system** (already defined in the written project) concerns beef fattening farms, medium-large size, rearing young bulls from France (pure and crossbred Charolais, some Limousine), fed with maize silage and concentrates (no pasture).

The **2nd system** (defined according to the WP1 exchanges) will focus on farms fattening young crossbred animals (heifers) derived from the dairy sector.

French stakeholders involved in face-to-face interviews and/or in beef national meeting promoted the use of French specialized breeds in the first Italian system. Indeed, such animals born in France and fattened in Italy represent a specific and important European circuit.

The Italian multi-actor group proposed a second system with heifers from dairy farms (dairy breeds or crosses). This is in line with the initial orientation of the INTAQT project, as this one was developed to focus more on dairy herd that on beef. As most of the chosen systems for beef seemed to be linked to beef herd, this choice could be a good one to illustrate the European diversity of husbandry systems.

- **Spanish beef husbandry system**

In Spain, only 1 system is planned to be studied.

This system (already defined in the written project) will probably be close to one of the Italian systems, with maize-concentrate finishing and specialized or crossbred animals (probably Charolais – Limousin pure or crossed with local breeds - to be confirmed).

- **UK beef husbandry systems**

In the UK, 2 husbandry systems are expected.

Initially 1 system was proposed by the INTAQT project which focused on a grass finishing system with cross breeds (extensive system). Based upon INTAQT partner discussions, 2 systems with varying levels of intensification were proposed (extensive and semi-extensive). However, discussions with stakeholders from the beef industry (face to face interviews, national and European group meetings) the following systems are now proposed.

The **1st system** with crossbreeds (native breeds such as Hereford and Aberdeen Angus) feed on a lifelong diet that is 80-90% forage based, including grass (defined according to the WP1 exchanges). The chosen system would be based on pasture or/and harvested grass with a small amount of concentrates (10% tolerance) as not many cattle are finished entirely on grass in the country. This is an example of a semi-extensive system.

The 2nd system could look at the differences in quality between different breeds (e.g., continental breeds, such as Limousin *vs* native breeds) within the same forage based, semi-extensive system.

3.2. Innovative practices to be tested

Regarding the innovative practices that could be tested within the project, several topics were seen as interesting according to the 4 multi-actor national groups. In some countries (e.g., France), the terms “innovative technics” were not used since it could lead to long discussions regarding the meaning of “innovative”. The terms “interesting practices” were preferred.

People cited different types of practices during face-to-face interviews, as well as during the national and European meetings. Three types of practices have been mentioned: feeding, husbandry and genetics practices (Table 3). Practices will be tested in commercial or experimental farms in the second part of the project. Voluntary farmers will choose one or some practices to test on their farm during the project.

Table 3: Interesting practices to be tested according to stakeholders from the 4 countries

Feeding	Husbandry	Genetics
- "Mob"- Grazing (GB, CH) - Grass finishing (90%) at pasture and in shed with tolerance for concentrate (GB) - Finishing techniques in Organic farming (FR) - Finishing techniques allowing feed autonomy of farm (FR) - Feed additives (CH) - Use of Linseed for Omega 3 (CH)	- Nighttime grazing vs insecticides to fight flies (CH) - Effect of castration and lower concentrate use on slaughter weight and conformation (CH) - Marbled meats production (FR) - Production of young (8-18 months) and/or dairy/mixed animals (FR) - Production of lightest carcasses with good meat qualities (FR) - Improvement of animal welfare level (IT)	- "Meaty" Dairy Breeds (e.g., Montbéliarde) (CH) - Organic AI-Bulls (CH) - Adaptation of breeding objectives (CH) - Animal genetics and breeds (link to diff categories and ages) (IT)
- Natural feed - GMO-free feed	- Outside access - No antibiotics	consumers

- **Feeding practices**

About **feeding**, in the UK and Switzerland, people were interested in testing the mob grazing system. Some farms willing to study this practice were already identified in the UK. This practice was seen as an innovative way for animals to pasture, with relevant environmental and economic advantages.

Finishing techniques enhancing farming autonomy and grass utilization were also mentioned by France, and the UK.

Furthermore, French stakeholders were interested in testing new finishing techniques usable in organic farms. Indeed, in France some animals produced by these farms are not well finished, because of the cost of organic raw material.

The use of feed components or additives such as linseed (related to omega-3 fatty acids) were also discussed. In Switzerland, stakeholders expressed interest in the effects of these feeds/feed additives on the nutritional quality of beef products.

- **Husbandry practices**

Concerning **husbandry practices**, Swiss stakeholders mentioned practices against the exposure to flies without using insecticides such as night grazing.

In Switzerland, interest was also expressed in the effect of castration and the reduction of concentrates on beef slaughter weight and carcass conformation.

In France, actors were willing to study practices to enhance marbling levels that are currently low in French beef.

Because there is a lack of meat in France at the moment, professionals of beef industry also wanted to study new productions such as young animals (8-18 months) coming from dual-purpose or dairy breeds. Moreover, carcasses are increasingly heavy (sometimes more than 500 kg), which is a problem for beef industry. Indeed, the size of meat pieces can make it difficult to sell them. Thus, testing production systems that allows to produce lightest carcasses with a good meat quality could be a relevant solution.

In Italy, people were really interested to study practices to enhance animal welfare. This topic has been mentioned many times during face-to-face interviews and national groups' meetings.

- **Genetics**

With regards to **genetics**, Swiss stakeholders expressed interest in working on meaty dual-purpose breeds, as Montbéliarde, for example.

They were also willing to study the performance of animals originating from artificial insemination and to explore methods to adapt breeding objectives to market demands. This aspect was also mentioned by Italian stakeholders, but this time, linked to categories and ages of animals.

- **Consumers' points of view**

Results from the 4 focus groups conducted with consumers in France, Germany, Italy, and the UK showed that these consumers were quite interested in some concepts such as natural feeding of animals, including GMO-free feed. In

addition, no antibiotics should be given to the animals and these animals should have access to pasture during their life. As already stated, there was nothing specific regarding the husbandry systems.

3.3. Quality criteria to be studied for beef

- **Consumers' points of view**

During the consumers' focus-groups, the main point of concern raised was the extent to which consumers can trust information on. In this respect, consumers found traceability and transparency to be important.

Including extrinsic quality, such as animal welfare (in the farm, during transport and at the slaughterhouse), environment and socio-economical sustainability, was also underlined as important.

Similarly, some other criteria should be taken into account for intrinsic quality as the presence of contaminants (toxins, heavy metals), for instance.

- **European beef group's points of view**

Stakeholders proposed to add or remove various criteria within the project in order to better qualify the quality of beef produced by the various husbandry systems chosen. As for consumers, 2 aspects were discussed: intrinsic and extrinsic qualities.

Regarding **intrinsic quality**, stakeholders mainly spoke about safety, nutritional, and sensorial criteria.

On a **safety point of view**, they mentioned microbiological criteria such as total bacteria count, *Pseudomona*s, lactic bacteria (which grow up under vacuum package) or resistant bacteria (antibio and multiresistant bacteria). By contrast, they found it unnecessary to measure the presence of EHEC or Salmonella that are already covered by routine tests. Indeed, food must be safe, and systems already exist to measure routinely the sanitary quality of meat.

Contaminant residues were also mentioned, mainly regarding pesticides (glyphosate, Asulam), and animal treatments (antiparasitic, anthelmintic and antibiotic).

Regarding **nutritional quality**, a specific term was mentioned: the nutrient density. This is the amount of nutrients (macronutrients, e.g., protein, micronutrients, e.g., vitamins and minerals) present in 100 calories of a specified food (Drewnowski, 2009[1]) whereas nutritional quality is the presence of a nutrient per gram of the product. Measuring nutrient quality is linked to communication on health and beef consumption.

Other traits that would be interesting to include: amino acid (carnitine, carnosine, beta-alanine) and antioxidants (selenium is already planned to be measured). They also considered vitamin D3 as an indicator of pasture access which could be interesting to measure on the carcasses studied in the project.

Each **sensorial aspect** raised by stakeholders was already planned to be studied in the project, as was the case for colour, marbling, water holding capacity, shelf life or meat ageing. People were also interested in tenderness prediction. This topic will be approached thanks to the IMR3GF model as many beef carcasses will be classified according to the MSA (Meat Standards Australia) methodology within INTAQT WP2. This will allow the INTAQT project to get a prediction of overall meat palatability which takes tenderness into account.

the eating quality of meat pieces will be calculated by

Extrinsic quality criteria mentioned related to animal welfare, environmental quality, and socioeconomic quality (Table 4).

Table 4: Interesting extrinsic quality criteria to take into account according to the stakeholders

Animal welfare is considered as an important criterion to be measured. It will be addressed through farm observations (planned in the project) and measurements on slaughtered animals using final pH (planned), as well as the health of the animal's inner organs (non-planned).

Regarding **environmental quality**, stakeholders spoke about carbon footprint, which could be

[1] * Drewnowski, A. (2009). Defining Nutrient Density: Development and Validation of the Nutrient Rich Foods Index. *Journal of the American College of Nutrition*, 28(4), 421S-426S, DOI: 10.1080/07315724.2009.10718106

approached thanks to the farm questionnaire (WP5). They would also be interested in measuring the impact of a pasture-based system on biodiversity.

Socioeconomic quality was also cited. This was an important point for stakeholders as it is linked to the creation of value for each actor of the value chain and to the origin of the product (link to territories).

Topic	Quality traits
Animal welfare	Observations in farm
	Measurements on slaughtered animals: - Final pH after slaughter - Health of inner organs
Environmental quality	Carbon foot print
	Impact of pasture system on biodiversity
Socio-economic quality	Creation of value (for each actor of the value chain)
	Origin of the product (link to territories)

To conclude, various new criteria were mentioned by stakeholders during face-to-face interviews, national groups, and the European groups. These criteria must be confronted with scientific advice to determine which additional criteria can be taken into account bearing in mind the technical and economical means of the project.

3.4. Opinions, fears and expectations regarding the multi-criteria scoring tool to be built

This tool is planned to be built at the end of the project based on the data get through WP2, 3 and 4. It should combine safety, sensory, and nutritional results obtained from the beef samples collected and possibly other quality criteria. This multi-criteria scoring tool should give a product's quality global view and synthetic information to the agri-food chain actors and/or the consumers.

- **Consumers' points of view**

According to the 4 focus groups hold in France, Germany, Italy and the UK, consumers felt that such a multi-criteria score placed on the products could be a good idea. It is seen as a simple presentation of a complex reality.

However, some disadvantages were expressed. There are doubts that this score would be convenient. It seems very complicated and there are questions regarding its reliability: what will be behind it? Will the standards be sufficient? Who will control the data used?

Regarding the implementation of such kind of tool, it could be fine to add a QR code to make details available for consumers willing to know more about the score. Transpose eggs scores (0, 1, 2, 3) was seen as a good idea by French and Italian persons as this score is well-known by consumers. In Germany, some people were in favour of a global score with sub-scores linked to environment, animal welfare or nutritional information.

- **Stakeholders' general opinions on the multi-criteria scoring tool to be built**

Three out of the 4 involved countries had a general discussion on who would be the target of this scoring tool (Table 5).

Table 5: The multicriteria scoring tool target, one big question

Country \ Target	For beef industry	For consumers	For societal debates, political decisions
France	Yes / Yes if...	No	No
UK	Yes. The best	Yes ? The least	Not discussed
Italy	Yes if... it is easy to use		
Switzerland	Not discussed	Yes if... it includes animal welfare and environmental aspects	

This point was sparsely tackled during the national group meeting **in Switzerland** due to time restrictions. However, during the face-to-face interviews Swiss stakeholders mentioned that it might be better to design different tools with different contents for different groups such as farmers, processors, and consumers. One main concern expressed in Switzerland was the lack of criteria that are of increasing importance for consumers: the environmental impact and animal welfare.

French stakeholders identified 3 possible targets: beef industry, consumers and citizens' representatives or policy makers. However, they did not want such a tool for consumers' use, societal debates, or political decisions. On a global point of view, France was not in favour of this multi-criteria scoring tool: it may have an interest for the beef industry but only under certain conditions. In particular, the French group thought that the tool should be driven by stakeholders as it is not possible to communicate everything to the consumer: communication may be useless and even dangerous for beef industry.

UK stakeholders were more positive, even if some of them were apprehensive of scoring tools. Globally, people seem to be more comfortable with a tool focused on the beef industry than on consumers.

In Italy, stakeholders seemed rather happy with this kind of tool as long as it is easy to use (and provides economic and management co-benefits).

Neither the UK nor Italy talked about societal debates or political decisions.

- ### Expectations regarding the multi-criteria scoring tool

Potential advantages of such a tool were not discussed in **Swiss** national group meeting, but during the face-to-face interviews with Swiss stakeholders. As in the other countries, stakeholders distinguished between 2 major targets: beef industry (from producers to retailers) and consumers.

Regarding a **consumer use**, a multi-criteria scoring tool could help to build up trust, inform and educate consumers, according to the **Swiss** and **French** stakeholders. Some of them would be fine with the development of a smartphone communication linked to the tool.

The use of QR codes to convey information was also mentioned by **the UK** group. Combining metrics into one score (in reference to existing colour guides or star systems) was also regarded as a good idea. For the UK, the tool could help consumers to understand information put on packs by retailers and help to enhance consumer knowledge. It could also be a way to convey to consumers the best products and to showcase to them the industry efforts to achieve this quality.

Improve knowledge and awareness of consumers when they buy beef was the main advantage of this tool for **Italian** stakeholders.

Other advantages were mentioned if the tool was dedicated to **beef industry** (from breeders to retailers).

For some **Swiss** and **French** stakeholders, it could allow professionals to improve themselves, to improve quality criteria measurements and provide arguments in defence of specific practices or, more globally, of meat consumption.

Italian stakeholders also found that such a scoring tool could improve quality.

In **the UK**, people agreed that it would be a better way to measure product quality beyond Euro Grid. This tool would interest processors and buyers who want detailed information. However, it should have a link to already existing quality assurance schemes. This could be a way to verify the scores around safety and to bring to light the efforts made by beef industry to enhance food and feed safety.

- ### Fears regarding the multi-criteria scoring tool

Many fears, of different kinds, were expressed by actors in the 4 involved countries.

One fear dealt with the **building of the scoring tool**.

Such a tool was seen by **France**, **Italy** and **Switzerland** as very complex because of the number of metrics to consider. However, some people from the same countries found that there were limitations in the list of criteria initially selected. In their opinion, extrinsic quality criteria should be added.

UK actors felt that it could be difficult to rank products based on criteria which could evolve diametrically. Their opinion, more globally, was that in order to enhance beef quality it would be better to spend money to provide recommendations to farmers AND processors on the best practices (including processing) to help to reduce poor quality products for consumers.

The problem of how to deal with conflicting goals (such as animal welfare *vs* exposure to environmental pollutants) was also mentioned by several **Swiss stakeholders**.

Other points related to the **relevance and representativeness of the tool**. These points are linked:

- to beef sampling as we will extrapolate from one muscle to the whole carcass, and then from 10 animals to the farm, and finally from 5 farms to the husbandry system,
- to the synthesis of many criteria which means simplifying reality,
- to the weighing of each criterion, a passage that could be discriminatory and that raises to that question: do we have to choose instead of consumers? Moreover, for which consumer as there is no single consumer?
- to the objectivity of this scoring tool towards interest groups.

Another kind of fear was expressed by **Italian people** who thought that the scoring tool will only be used if its computation is **low-time demanding**.

French people were mainly concerned by the **lack of target for this scoring tool**. This topic was at the centre of debates. As previously said, French actors identified several kinds of targets on which their opinions differed.

This was quite similar, with perhaps fewer opposite opinions **in the UK**, where actors distinguished 2 kinds of targets: beef-branch stakeholders on the one hand, and consumers on the other hand.

Furthermore, **if the tool was dedicated to stakeholders**, it would be too synthetic to allow them to improve themselves.

For **the UK**, instead of a scoring tool it would be better to use pre-existing systems to ensure minimum quality standards, especially regarding food safety.

There were also concerns about governance and quality assurance, which means: how do we ensure that famers and processors are carrying out the methods associated with better product quality?

Regarding **a target related to consumers**, **France**, and at a lesser extent **the UK**, felt that such a scoring tool should not be aimed at consumers, as it is too complicated to understand and could lead to misinterpretation. For the UK, it is not needed by consumers who want something simple not an overload of details. They just want to be able to trust a product.

Moreover, we cannot communicate everything to consumers. For **UK** stakeholders, consumers do not have enough time to make a purchase decision, and for **French people** this could even be dangerous. To avoid this risk the beef industry should be the only body to drive a potential tool dedicated to consumers.

In **the UK**, people globally found that it would be better to promote good products than to compare products at retail. They also felt that if we really wanted to affect consumers, we should incorporate key aspects of the quality into existing brands already known to consumers.

Although it has been difficult to separate the different kinds of fears expressed, some people in **France**, **Italy** and **the UK** thought that this tool could **damage the beef industry**. Many reasons were cited.

It could lead to competition between husbandry systems and between products. For French stakeholders, it will complicate the marketing of products by an additional segmentation, a competition with existing official quality labels… This idea is not far from the one of the UK regarding the use of existing labels to convey quality recommendations instead of developing a new scoring tool.

UK stakeholders felt the tool will lead to losers and winners whereas stakeholders believe all meat has value and will be suitable for specific purposes. There is a risk that such a tool reduces the value of lower scoring meat instead of increasing the value of the best meats. So, there will be a need to pay attention to the communication around the lower products.

The **Italian group** raised another danger linked to the fact that a single farmer could not have the possibility to collect all the data needed for the calculation of the multi-criteria scoring. Thus, the tool could create a division within the beef industry.

Finally, some people didn't want INTAQT project be **only focussed on the multi-criteria scoring tool calculation**.

- **Technical criteria to take into account within the scoring tool**

It is quite difficult to know if the comments made on this subject were comprehensive or not since people already made comments regarding the quality criteria to include in the project analysis. We don't know if these first comments also dealt with quality criteria to take into account during the scoring tool building. This may be the case and people may have forgotten to repeat it when speaking about the scoring tool.

The most important point is probably linked to **beef extrinsic qualities** (Figure 4). Three out of the 4 involved countries, **France**, **Switzerland,** and **the UK** said that the multi-criteria scoring tool should include **animal welfare and environmental aspects** (like climate impact, land and water consumption, avoidance of food waste). In the UK and Italy, this aspect was debated during national groups. It was felt that consumers do not require in-depth information regarding the environmental footprint but could be directed to a website to have information about that point.

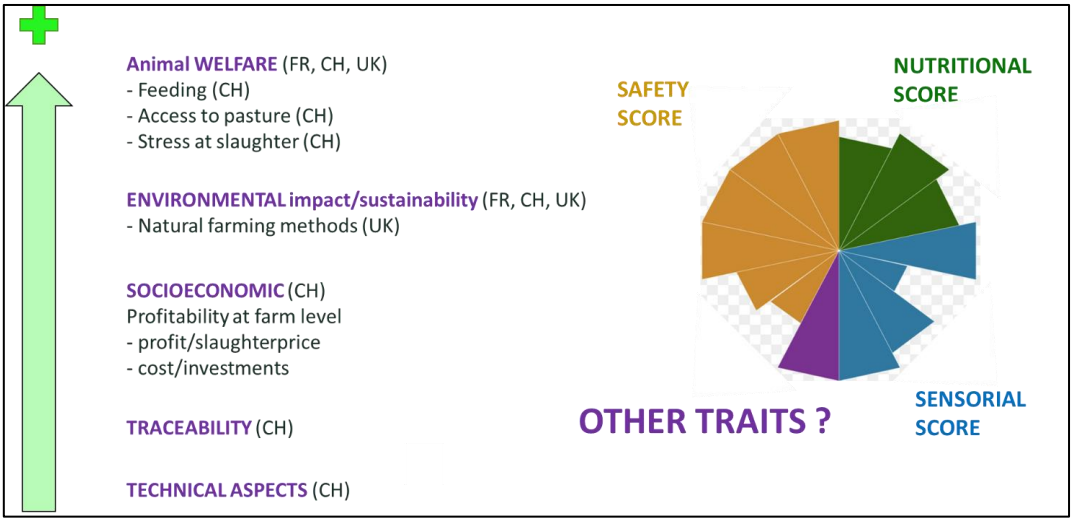
Swiss stakeholders gave details on animal welfare aspects, such as feeding, access to pasture and stress at slaughter.

Husbandry practices such as pasture- or roughage-based feeding and the general use of local, natural resources were seen as an indicator for environmental sustainability.

Swiss actors were also willing to include elements regarding socioeconomically aspects, in particular profitability at farm level. In their opinion, 2 major ratios could be used: profit/per slaughter price and cost/per investments.

Finally, they also expressed interest in product traceability.

Figure 4: Extrinsic criteria to include within the scoring tool according to the stakeholders



Other comments dealt with **beef intrinsic qualities** to be added, strengthened, removed, or lightened according to some stakeholders (Figure 5).

Concerning **the safety score**, **France** and **the UK** had comments. Both considered food safety to be already covered by the standards and systems already in place: it is a prerequisite for product selling. Beef products cannot be segmented using this quality. Therefore, the tool should not consider food safety, especially regarding pathogens and heavy metals.

However, there was another point of view in **the UK** if the tool was dedicated to consumers. Some actors felt the project could still include safety metrics as a contributor to quality by the tool. This may be a recognition of the efforts done by the industry to enhance this important part of the quality.

According to the **French actors,** analysis should take antibio-resistant bacteria into consideration.

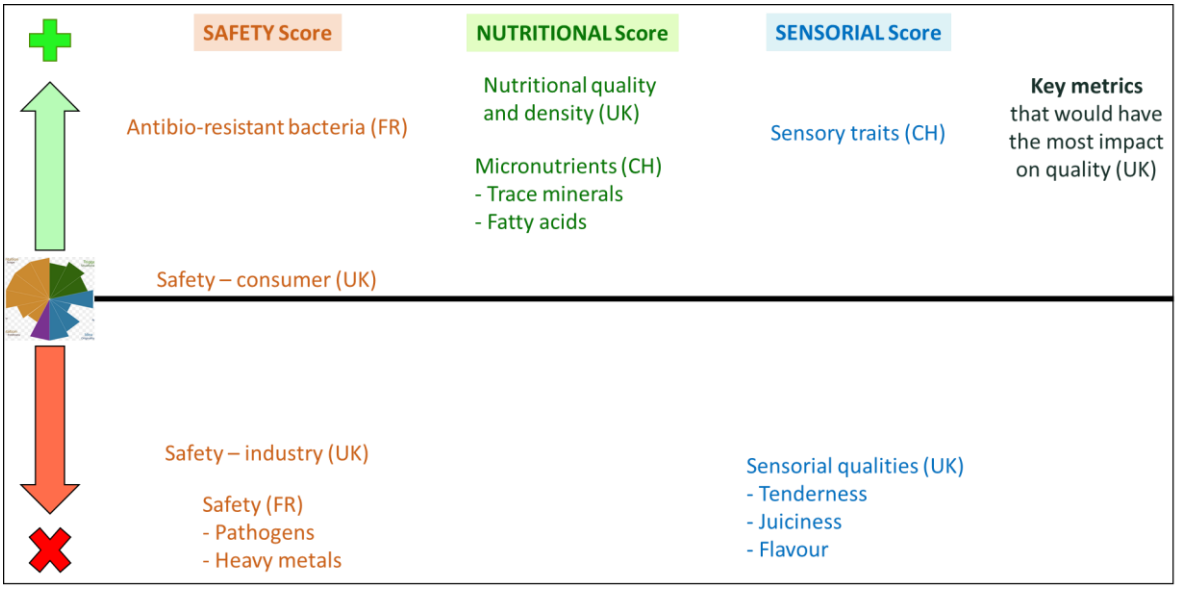
Concerning **nutritional quality**, **Switzerland** and **the UK** considered this point as crucial, to be enhanced in the scoring tool. Trace minerals, fatty acids and nutrient density (already defined) were especially mentioned.

Sensory traits were highlighted by **Swiss stakeholders** whereas some **UK actors** were not keen on scoring sensorial qualities such as tenderness, juiciness or flavour.

More generally, **actors form the UK** suggested that we should select some key criteria that would have the most impact on the product quality and avoid too many metrics in the tool as it will be hard to communicate everything using this tool.

Italian stakeholders didn't express themselves on the criteria to be included (or not) in the scoring tool.

Figure 5: Intrinsic criteria to enhance, to add, or to reduce within the scoring tool according to the stakeholders



4. Conclusions

Our national and European consultations allow to **identify the professional and societal expectations** regarding beef to take them into account within the INTAQT European research program. **Four topics** were discussed with stakeholders: the livestock systems and interesting practices to be tested within the project, the criteria to add or remove in the selected analyses and the muti-criteria scoring tool that will be developed during the project.

The **12 husbandry systems** to be studied for beef have been specified or newly defined during the consultations evoked. They reflect a wide variability of European systems for beef production in term of breed, grass use and certification label, but also national stakeholders' interests. As a result, dairy husbandry systems might be slightly underrepresented in our sampling.

Furthermore, a common expectation from the stakeholders in the different countries is to include the **extrinsic criteria** linked to animal welfare, environment, and socioeconomics within the studied qualities in the INTAQT project.

However, studying **safety criteria** may raise problems as it is a prerequisite already covered by regulation and specific controls and not a criterion to characterize the quality of beef products.

Involved stakeholders cited many **interesting husbandry practices** that could be tested during the project. Different topics came up such as feeding, husbandry and genetics, highly dependent on the country. Thus, marbling and finishing technics seemed important for France; animal welfare and genetics for Italy; feed, castration or fight against flies for Switzerland, and grass finishing with concentrate for the UK… These practices were linked to stakeholders' interests in term of quality and economic performances.

Lastly, the concept of **multicriteria scoring tool** divides the stakeholders within each country, some countries being confident and others more cautious. There is a strong expectation to clearly define the target to avoid harming the European beef industry. For example, some people deemed inappropriate to add safety traits in the scoring tool. Therefore, the positive and negative points mentioned by stakeholders will need to be considered with increasing attention by researchers when they will build this (or these if several targets) tool(s).

This work, based on stakeholders' and consumers' consultations, **gives recommendations to adapt the experimental dispositive** of the INTAQT project, considering their feasibility on practical and financial points of view. Indeed, the beef industry organization makes it difficult to collect samples needed for analysis and linked to specific farms, representing the husbandry systems chosen.

5. Annexes

Results of the UK Beef National Group Meeting

Due date of meeting(s): 24th and 31st March 2022

Report submission date: 29th April 2022

Work package	WP1	
Work package leader	Cécile Laithier	ACTA-IDELE
Author(s)	Shannon McLaughlin	QUB

Report displaying the results of the UK Beef National Group meeting

This report is split into 6 sections. Section 1 describes the duration and format of the meeting as well as an outline of the stakeholders in attendance. Section 2 focuses on stakeholder reactions to the general presentation of the project. Sections 3-4 refer to the quality traits and husbandry systems to be studied by the project while section 5 captures stakeholder expectations and concerns regarding quality scoring tools for those in the industry and consumers.

1. Description of the meeting

Two online meetings were held on the 24th and 31st March 2022. Meetings were facilitated using Microsoft Teams and Kahoot quiz software. The duration of each meeting was 64 minutes and 102 minutes, respectively. Six stakeholders from across the UK participated in the national group meeting, representing processors, animal welfare, quality assurance, professional bodies for butchery, and research.

Figure 1. Description of stakeholders present at the national group meetings.

2. Comments on the general presentation

Stakeholders had a positive view of the project and were very keen to contribute to the discussion. Many felt that the industry in the UK should do more to address the quality of food products, especially eating quality and the sensorial attributes. The discussions were mainly cantered on the quality traits and husbandry systems to be studied, as well as multi-criteria scoring tools. Sections 3-5 will discuss each of these aspects below.

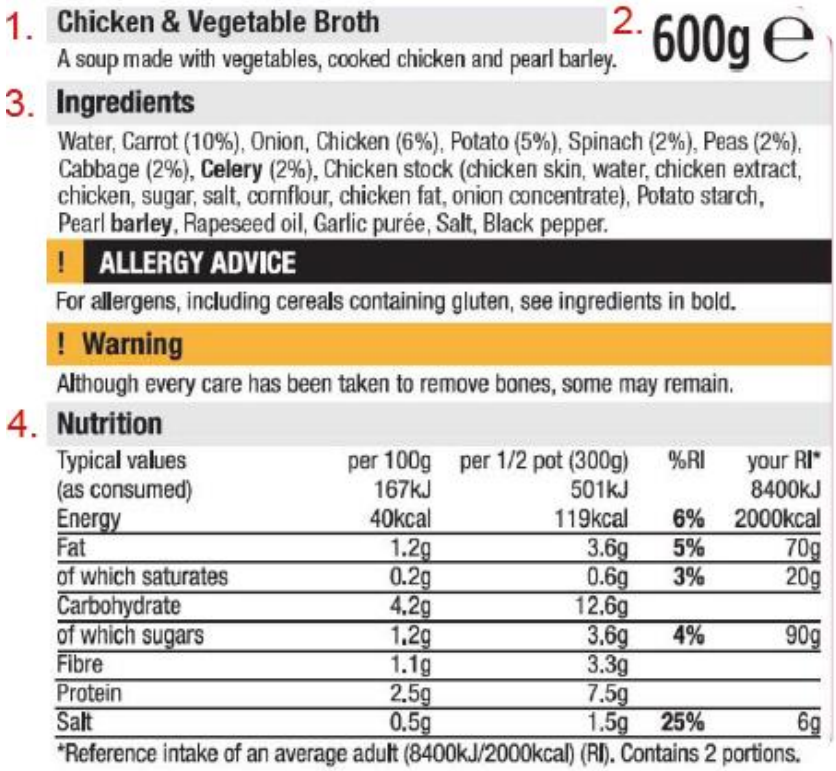
3. Quality traits to be studied by the project

Many of the stakeholders present were happy with the traits to be studied and felt the project was conducting a comprehensive investigation into product quality. However, some felt it could be a challenge to manage all the information and effectively communicate the results of our research.

In terms of the nutritional aspects of quality the concept of nutritional density was highlighted as vitally important to promote the benefits of animal-based proteins to consumers. Stakeholders consider nutritional density as top priority and believe consumers to be highly motivated by the nutritional quality of the foods they consume. The INTAQT project is already planning to assess the nutritional quality of livestock products by measuring macronutrient (carbohydrates, fat, and protein) content of foods in terms of grams. In addition, micronutrient (vitamins and minerals) content of products in terms of grams and micrograms will also be assessed.

However, nutrient density may provide a better indication of the nutritional quality of differing food stuffs as nutrient density refers to the amount of nutrients present in 100 calories of a specified food (Drewnowski, 2009). Stakeholders were very keen to compare the nutrient density of red meat such as beef to plant-based proteins as they believe beef to have a higher nutrient density.

Furthermore, by calculating nutrient density the INTAQT project can go beyond nutritional information currently given on food labels in the UK (see figure 2 below). At present only the amount of nutrients contained within 100g or per serving are provided. Moreover, it is a legal requirement for food labels to display the amount of energy, fat, saturates, carbohydrates, sugars, protein, and salt per 100 g/ml (FSA, 2022). Additional information on the unsaturated fat, fibre, vitamin, and mineral content of foods can be added to the label but this is voluntary (BDA, 2022).



1. **Chicken & Vegetable Broth**
A soup made with vegetables, cooked chicken and pearl barley.

2. **600g** e

3. **Ingredients**

Water, Carrot (10%), Onion, Chicken (6%), Potato (5%), Spinach (2%), Peas (2%), Cabbage (2%), **Celery** (2%), Chicken stock (chicken skin, water, chicken extract, chicken, sugar, salt, cornflour, chicken fat, onion concentrate), Potato starch, Pearl **barley**, Rapeseed oil, Garlic purée, Salt, Black pepper.

! **ALLERGY ADVICE**

For allergens, including cereals containing gluten, see ingredients in bold.

! **Warning**

Although every care has been taken to remove bones, some may remain.

4. **Nutrition**

Typical values	per 100g	per 1/2 pot (300g)	%RI	your RI*
(as consumed)	167kJ	501kJ		8400kJ
Energy	40kcal	119kcal	6%	2000kcal
Fat	1.2g	3.6g	5%	70g
of which saturates	0.2g	0.6g	3%	20g
Carbohydrate	4.2g	12.6g		
of which sugars	1.2g	3.6g	4%	90g
Fibre	1.1g	3.3g		
Protein	2.5g	7.5g		
Salt	0.5g	1.5g	25%	6g

*Reference intake of an average adult (8400kJ/2000kcal) (RI). Contains 2 portions.

Figure 2. Example of information on food labels in the UK. Source: BDA, 2022.

Stakeholders had conflicting views on the aspects of quality relating to safety. All felt that safety is important. However, a common concern was that food should already be safe and should not be on the market for consumption if it is unsafe. Consequently, many of the stakeholders expressed that as there are already systems in place to govern food safety it would be redundant for the INTAQT project to assess food safety. Others felt that food safety should be assessed by the project as information on pathogen/bacteria loading information/residues/heavy metals/toxins would be important for the industry to know but this information should not reach the consumer.

On this note, one of the stakeholders raised the point that the project could be split in two and two lists could be created of what is important for the industry and another for consumers. I.e., information on food safety is essential for the industry but for consumers having information on nutrient density is more beneficial.

4. Husbandry systems to be studied by the project

The system to be studied by the project for UK farms relates to grass finishing with cross breeds. However, stakeholders had differing views on whether grass finishing should be the husbandry system to be investigated by the project. Some felt that grass finishing should be studied as a niche, upper end of the market as it is a novel approach.

Others felt that the project should focus on a grass finishing as well as native breeds as this type of system can allow farmers to leave animals out for longer on pasture. There is also an increased interest from consumers about how animals are reared with a grass-based system being an attractive option to consumers. Farmers may find it hard to switch from concentrates to a grass-based diet but the future of beef in the UK will be moving toward grass with native breeds. This will allow for the animals to be outside more with the system becoming less intensive and requiring lower management. A lower management system is especially important as many farmers are part time and have secondary employment. Furthermore, a "Naturally reared, pasture story much easier to convey and is easier to have" with consumers than an intensive type of production.

Innovative practices: Suggestion to use mob grazing systems to better utilize the land/grass. Mob grazing is described by intense grazing with a high stocking density over a short period of time (Billman et al., 2020). This is followed by longer recovery or 'rest' period (AHDB, 2022). Farmers utilizing this technique report improved soil and animal health as well as lower food, fuel, and labour costs (Soil Association, 2022).

Stakeholders felt strongly that there is a need for the project to define what we mean by grass finishing. Is it defined by an animal that has spent its life on grass (pasture) or majority forage-based feed alongside grass (mixed diet)? Many felt that UK beef animals are predominantly fed a forage-based diet that includes grass, conversed grass (silage), and forage. Therefore, grass finishing may not be a representative system for UK beef. A common sentiment was that the project shouldn't be too niche and must consider the supply base to be realistic for farmers. It was agreed that the project should study grass finishing, but this should be defined by both grass and forage as compared to 100% pasture. It was expressed that systems need to have a tolerance for concentrate and cereal use. Furthermore, many felt that consumers are more concerned with how intensive the system is and factory farming rather than small levels of concentrate usage.

There were some suggestions that the project should use the definition adopted by the Protected Geographical Indication (PGI) for Irish Grass Fed Beef. In this scheme grass fed beef is defined by an animal that is fed on 90% grass which can be pasture based in the summer (220 days) and come from conserved grass in the winter (145 days) (Department of Agriculture, Food and the Marine, 2021). The system studied should be a pragmatic system that produced the yield that the industry needs and must therefore look at a forage-based diet at pasture and in the shed as majority of beef animals in the UK come from a mixed system.

A common theme emerged from the stakeholders that there needs to be a balance of using the natural resource we have (grass) in the UK and getting across to the consumer all the imagery that goes along with a grass-based system. Stakeholders were concerned that if we make the market too niche (i.e., 100% grass based at pasture) the industry will not be able to supply beef for the market and consumers will go to other products. There was the fear that the stakeholders don't want to "back the industry into a corner" and stipulate that we will only sell grass feed beef as this would tie the industry to a production system that is too ambitious. Therefore, the move to a more grass-fed diet must be a transition that takes time.

Stakeholders felt that there is a need to promote the "naturally" produced element of grass-based production to consumers, but we cannot drive the industry down a road and produce a product that we cannot fulfil. Furthermore, it was felt that there is a need to ensure that consumers understand that there is a difference to how the UK produces beef to other countries such as Argentina or Brazil that are dependent heavily on concentrates.

The views on the breeds to be studied by the project were less mixed as the stakeholders were happy for cross breeds to be investigated. Many felt that native breeds such as Hereford or Angus should be included as native breeds are associated with better quality beef. Moreover, while continentals are still the majority

within the UK industry, native breeds are becoming more popular. Especially, the Hereford and Aberdeen Angus breeds.

Additional comments:

- To deliver the results of the project there needs to be a driver or financial incentive to encourage uptake as farmers historically have a link with continental breeds. They need to be educated in the benefits of native breeds or have a financial benefit.

5. Expectations and concerns regarding quality scoring tools

In general, some stakeholders had concerns with scoring tools like Meat Standards Australia (MSA) as there is a fear that ranking products results in a winner and a loser. There is also the risk that rather than increasing the value of high-quality products we run the risk of reducing the value of lower scoring meat. This is particularly concerning for the group as they believe all meat has value as it will be suitable for manufacturing if it isn't suitable for other purposes. Stakeholders felt that such a scoring system would be damaging to the industry, and we need to exert caution to ensure the project doesn't create something that is detrimental.

The members of the national group also discussed the difficulties associated with ranking products. For example, it may be possible to rank the nutritional quality of beef by the fatty acid profile to determine whether the animal's diet was grass based. However, a grass-fed diet will take longer to finish and may increase the age of slaughter which is linked to lower sustainability. Increased use of concentrates may reduce age at slaughter but reduce the taste. Therefore, stakeholders expressed that it will be difficult to rank products as not everything will always be in balance (nutrition vs sustainability).

The sections below describe specific comments the stakeholders had in relation to tools for processors and famers (industry) as well as tools for consumers.

Tool for processors and farmers (industry)

Stakeholders felt that a tool for processors and farmers would be more relevant than a tool aimed at consumers as processors and buyers will want more detailed information than the consumer. Furthermore, a quality scoring tool would be a way for the industry to move beyond the current yield-based Euro grid system. However, some stakeholders consider food safety to be already covered by the standards and systems already in place. Therefore, the tool should not consider food safety as this would be redundant and isn't a novel approach.

In addition, it was raised by one stakeholder that the project should recognise the efforts already being undertaken to enhance the food safety. There is a need to make sure that the industry gets recognition for these efforts. This could be done by linking in with other already existing quality assurance schemes help to verify the scores around safety. For example, the farm quality assurance (FQA) scheme in Northern Ireland which monitors antibiotic residues. Rather than "reinviting the wheel" the project should make sure that we use pre-existing systems to our benefit, e.g., FQA, Red Tractor as well as legislation to ensure minimum quality standards.

Stakeholders also felt that rather than ranking products the project could provide recommendations to farmers and processors on the best practices to ensure high product quality. For example, this could take the form of a blueprint which is based on scientific evidence. I.e., "if you do X, you could increase the quality of your product by Y". The UK industry hasn't had a blueprint since the early 90s and may be more helpful and less discretionary to avoid some of the market losing out.

However, if the project is to create a blueprint of activities needed to produce a product there is a need to consider slaughter format, journey time, farm type, breed, age at slaughter. Furthermore, the project should also consider hanging methods, whether electrical stimulation used as well as glycolytic rate. Essential the project should be able to outline the methods that should be used to increase the quality of livestock products.

Others with the same sentiment also suggested that the project should start with "the low hanging fruit" and clearly state what the production base could do first that would have the most significant increase in quality.

To promote uptake and effectively communicate the findings of the project we should select two or three of the key priorities that would have the most impact and be the most straight forward in terms of delivery. This was suggested to mitigate the fear that there are too many metrics in the tool that it will be hard to communicate everything.

Additional comments:

- Comprehensive list but is a lot to convey in a message.
- There were also concerns about governance and quality assurance. I.e., how to we ensure that farmers and processors are carrying out the methods associated with better product quality?

Tool for consumers

Stakeholders had a range of concerns with quality scoring tools aimed at consumers:

- Danger of information overload and being careful of providing too much information as that may scare consumers. The tool needs to be simplistic.
- Difficulties combining all the metrics into one score as there are a lot of considerations and metrics. How do you rate each metric and how does that metric contribute to quality?
- Some stakeholders are happier with a scoring tool that is aimed at farmers and processors and not consumers. I.e., outlining the minimum threshold products must reach to go to the consumer. This already happens with retailer specifications.
- Can't communicate all those things in the pie chat to consumers if they have got 9 seconds to choose the product to buy.
- How do you package this? Let's focus on the things we know we can deliver. This project may assist the industry in communicating those aspects of quality (nutrient density, welfare).
- Perhaps we should use the scoring system to promote things that we already know are great. I.e., a good welfare friendly production and farming systems, natural forage-based feed, and nutritional quality of beef.
- The consumer facing piece should be used to promote all the good things about the industry rather than trying to say this bit of beef is better than that bit of beef.
- Is a tool or building a brand for this project feasible? This will cost millions of pounds. It must get backing and be communicated and understood. How to you ensure the consumer isn't confused by the score.
- Instead of a scoring system stakeholders would rather spend the money investigating which strategy during animal production, slaughter, and processing is going to help to reduce the instances of poor eating quality for the consumers.
- Could tie in with existing brands and incorporate the key aspects of quality into those brands which are already known by consumers. "The retailers could potentially do the work for us then".

There were also more specific concerns with the MSA type grading systems. The concerns and reservations were in relation to:

- Ranking products as good or bad quality may not be fair as different quality of meats can be used for different purposes.
- The fact that a fillet steak does not eat the same as a grilling steak and when the consumer is at the shop shelf looking at a score for 3 for a piece of stewing steak and 5 on a piece of fillet steak the stakeholder isn't convinced this score will add value or help with that shopping trip.
- The language we use to describe products that score lower. I.e., using fail or not good would be challenging to the industry but all it means is that product is not suited to a particular use. I.e., it might not be suited for frying or grilling but is suited to a casserole, stew or minced into a burger.
- Some consideration needs to be given to the language used to describe products.
- What do you do when you get more poorer outcomes than expected when you rate products with a score?

- Understands that the industry should promote beef and reduce any negativity but thinks an MSA system would be a positive thing.

However, stakeholders also had positives views of the MSA system and quality scoring tools:

- We owe the consumer the opportunity to have the best product on the plate in front of them that we can.
- QR codes may be beneficial for consumers to scan products and a score, or rating is flagged up for that product "that would be a good way to guide the consumer".
- Doesn't think consumers will need detailed information after knowing the score. Maybe to have detail into how that information is gathered.
- However, a colour coordinated guide to identify how that product rates in terms of nutritional quality, least amounts of residues etc. would be beneficial.
- MSA system does relate the score to how you are going to cook and use the piece of meat. This is how the scoring system is balanced. You wouldn't score the lower end products, but the system rates the top end stuff. E.g., a fillet steak.
- Not all pieces of meat will be ranked as they will go into manufacturing and different uses.
- It is really aimed at benefitting the consumer who have become more distant in terms of knowledge and understanding about meat. They are more reliant on what the retailer tells them about it. The scoring system is to help the consumer understand what they are being told by the retailer.
- On the pack a consumer might read pasture raised, Hereford beef, dry aged for 30 days but what does this mean in terms of the eating quality of the beef? But you wouldn't want to be too detailed. I.e., it's a star system but it is applied to a particular cooking method.
- For example, the product might receive a 3 star for grilling but a 5 star for casserole. (The other stakeholders seemed to relax their view upon hearing this).
- Not all abattoirs use electrical stimulation, not all measure pH or pH decline which has a far greater impact on eating quality. Unsure of how many are applying hip suspension to better their meat. So, the industry owes the consumer the application of the best meat science to achieving the best outcomes and we need to be able to have some way of telling consumers that, i.e., the tool.

In general, some stakeholders seemed very apprehensive of MSA type grading systems but also had limited knowledge of how products are grading. I.e., many felt that it was unfair to compare a fillet of beef and braising steak for a casserole. However, one of the stakeholders explained that the MSA system does not say that this piece of beef is better but would be better used for a particular cooking method to get the best outcome. This seemed to ease the worries of the stakeholders who were against the MSA system. Therefore, with more information any fears surrounding scoring tools could be reduced.

For any quality scoring tool, it was agreed that consumers take that food is safe as a given but some also felt the project could still include safety metrics as a contributor to quality by the tool. Furthermore, while nutrient density and micronutrient quality was seen as critical to the whole project and vital to the industry, there are other contributors as well and we should not ignore eating quality or customer expectations of that product. In contrast, some of the stakeholders were not keen on scoring sensorial qualities such as tenderness, juiciness, flavour or whether you merge all these metrics into a score for acceptability.

6. Link with the project for the next years

Two stakeholders have been identified to partake in the European Group Meetings. These stakeholders represent processors and those involved in research.

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Appendices

Figure A.1. Stakeholders present at meeting 1.

Figure A.2. Stakeholders present at meeting 2.

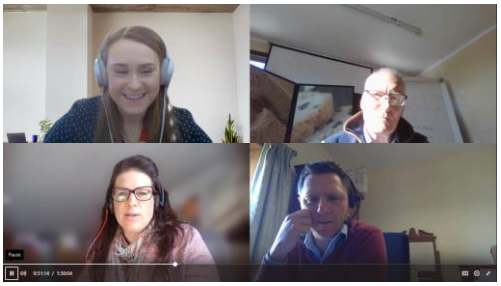


Figure A.3. Screenshot 1 Kahoot quiz software.

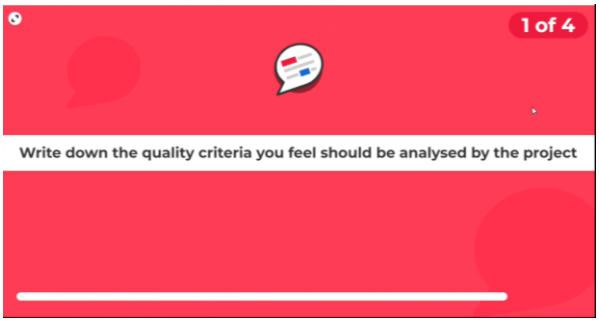
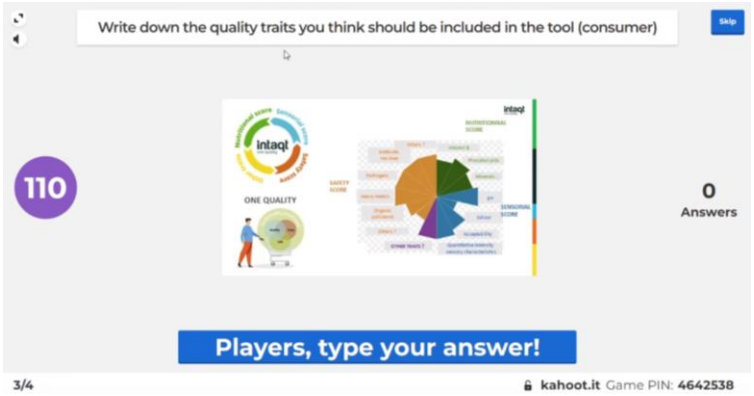


Figure A.4. Screenshot 2: Kahoot quiz software.

Figure A.5. Screenshot 3 of the Kahoot quiz software.



ANNEX 3: European dairy group, multi-actor's expectations

1- Introduction and Objectives

The H2020 European research project INTAQT aims at developing innovative tools to assess and authenticate beef, chicken, milk, and dairy products quality. This project studies more specifically the link between husbandry systems and intrinsic quality criteria. A group of stakeholders has been involved to consider their expectations, suggestions, and concerns. They represent the whole supply chain, from farmers to dairy plants, to retailers up to citizens and consumer organizations. Their consultations were meant to address recommendations to add to the experimental dispositive 1/ husbandry systems and practices of interest to them, 2/ quality criteria and analysis according to the expressed needs. Furthermore, one of the challenges in the project is to build a synthetic multicriteria scoring tool that includes the studied quality criteria and considers stakeholders' expectations and fears.
This survey has been focused on dairy multi-actor expectations at the European level, plus consumer's expectations. The methodology used is reported in detailed as well as the results concerning husbandry practices, innovative practices, quality criteria and analytical methods, and multicriteria scoring tools.
This survey does not include online surveys' results, as a specific report will be dedicated to that.

2-Methods

2.1-Actors' consultation

To comply with these objectives, for dairy, around 15 face-to-face stakeholders' interviews were led in each of the following involved country: Italy, France, Germany and Ireland. The people selected often were representatives from national organizations and companies. Moreover, they were chosen so as to get a broad view of their supply chain. In every country, the people selected represented the general channel, and also some people were selected to represent a specificity from its national dairy context (cf. table 1). Consumers' focus groups were displayed to get their points of view, expectations and fears, in Italy, France, Germany and the United Kingdom. The next step was to have the stakeholders discuss and prioritize those results during national meetings, held in face to face or online for each product. A European dairy group was constituted (cf. figure 1). Two European meetings were held online in 2022. Two to four stakeholders, designed as national groups' spokespersons, were invited to the European group. The concerned work package (WP) and tasks leaders attended the meeting too. The objective was to discuss and prioritize expectations to be included in the project.

*Figure 1 : **Work Package 1 organisation***

2.1.1-Face-to-face interviews

To avoid biased interviews, the interview guide was elaborated in "funnel", in two parts (Kling-éveillard et al., 2012). The first one was general. The actors were asked what composed milk and dairy products quality, its evolution in the past, and the future challenges and perspectives for dairy products quality. Then, they were asked to describe the link they perceived between housing conditions and dairy product quality.
The second part of the interview was dedicated to the INTAQT project's presentation, to which every stakeholder was invited to react and express their expectations and fears. In particular, the initial analyses of the nutritional,

safety and sensorial criteria were presented to them. They expressed their opinions on them, and what they would add or remove.
Furthermore, the different dairy systems were presented to each of the stakeholders. They gave their points of view on the initial choices and whether they would have included other systems that were not already mentioned.
Lastly, the multicriteria scoring tool concept, based on intrinsic quality criteria (nutritional, sensorial, safety) was presented to them. Their reactions were collected.
To conduct the interviews in a concerted way, a hybrid training was organized in France from the 10th of October to the 11th of October, with all the interviewers/referents for the three products.

The interviews were led in presential or with online web conferences and were all recorded. They began in October 2021 and ended in March 2022. Each face-to-face interview lasted from 1 hour to 2.5 hours. The composition of the interviewed people is described in table 1.

*Table 1 : **European stakeholders interviewed***

	Italy	Germany	Ireland	France
Number of interviews (number of people)	12	10	13 (14)	17 (21)
Boards represented	4 farmers 1 consultant 4 processors 3 consumer and citizen NGO	4 farmers 2 processors 2 retailers 1 consumer NGO	5 farmers 4 processors 1 retailer consortium 3 consumer and citizen NGO	4 farmers 7 processors 3 retailers 3 consumers and citizens NGO
Dairy specificities	General channel + slow food	General channel + organic	General channel + organic	General channel + PDO

During every interview, mind maps were elaborated, synthetizing the main actors' sayings on dairy products quality definition and its factors of influence. The whole notetaking added to the script transcription of the most relevant remarks enabled a specific analysis grid to be constructed. The analysis grid included the main thematic and sub-thematic points from the interview guide, completed with those spontaneously expressed during the interviews. Based on this, a deeper thematic analysis was conducted.

2.1.2-National groups

All the interviewed stakeholders were invited to the national groups. The national groups were managed by two persons including the interviews. The national groups objectives were to:

1- Remind the stakeholders of the INTAQT project,
2- Share the whole results: face-to-face interviews, online surveys, consumer's consultations by focus groups, on the:
    a. Criteria and analysis to include
    b. Husbandry systems and practices to consider in the project
    c. Innovative practices (this point was optional)
    d. Expectations and fears on the multicriteria scoring tool concept
3- Get the stakeholders to react to those results, express their points of views
4- Make the stakeholders prioritize their expectations

To facilitate those meetings, Mentimeter was used in online meetings to prioritize the criteria and analysis to recommend, as well as the systems and practices.

To induce an interactive face-to-face meeting, "world cafés" were organized with small groups of actors (sub-groups of 2 to 4 people) reacting and describing their points of view, both arguments pros and cons. Restitutions of those world cafés were made by the sub-groups to the entire group, so as to discuss new comments and ideas. Lastly, the actors prioritized individually the most important points to keep/add in the project.

The national groups gathered the following stakeholders[1]:

[1] In Germany, consumer NGO was invited to the national groups, but refused to participate

*Table 2 : **National groups compositions***

	Italy	Germany	Ireland	France
Day	1st of April 2022	7th of April 2022	23rd of March 2022	15th of March 2022
Number of participants	11	5	5	10
Type of meeting	Online (2,5 hrs)	Online (0,5 day)	Online (0,5 day)	Presential (1,0 day)
Present boards	Farmers, Consultants, Cheesemakers, Citizens NGO	Farmers, Consultant, Federation (German Livestock Association), Dairies, Retailers	Farmers, Processors, Retailer, Consumer NGO	Farmers (PDO + general), Processors (PDO + general), Retailers,
Missing boards	Retailers	Consumer NGO	Animal welfare NGO	Consumer and citizens NGO

2.1.3-European dairy groups and meetings

Two European dairy meetings were held online by web conference, the 3rd of May 2022 and the 4th of July 2022. They respectively lasted 2.5 and 3 hours. The first European dairy meeting aimed at:

1- Giving information about husbandry systems and innovative practices planned to be studied in the project, at the European Level, explaining how the expectations had been considered
2- Giving information on WP2: Presentation of the sampling protocols, the living lab…
3- Informing on the next steps in 2022 and after

The following people attended the 1st European meeting:

*Table 3 : **First dairy European meeting composition (2022-05-03)***

2022-05-03	farmers	Dairy processors	retailers	NGO (citizens, consumers)	Project scientist
number of people	8	5	1	1	12
Countries present	Germany Italy Ireland France	Germany Italy France	Ireland	Italy	Germany Italy Ireland France Switzerland
Work Package involved	1	1	1	1	1, 2, 3 and Coordinator

The second European dairy meeting aimed at:

1- Exchanging about quality criteria, analysis planned to be studied in the project + expectations on implementation at European level,
2- Exchanging about expectations on multicriteria scoring tool at European level,
3- Informing on the next steps in 2022 and after…

The following people attended the 2nd meeting:

*Table 4 : **Second dairy European meeting composition (2022-07-04)***

2022-07-04	farmers	Dairy processors	retailers	NGO (citizens, consumers)	Project scientist
number of people	1	1	1	1	11
Countries present	France	France	Italy	Ireland	Italy Germany Belgium France Switzerland
Work Package involved	1	1	1	1	1, 2, 3, 4 and Coordinator

3-Dairy results

3.1-Husbandry practices

3.1.1-Initial systems to be studied

The following systems were initially included in the scientific dispositive to be studied and was presented to each of the interviewed stakeholder. Those systems were meant to be representative of each country's main systems. Every stakeholder had to react to those systems and, in some cases, were invited to propose systems to include in the study, respectively 1, 2 and 3 for Germany, Switzerland and France.

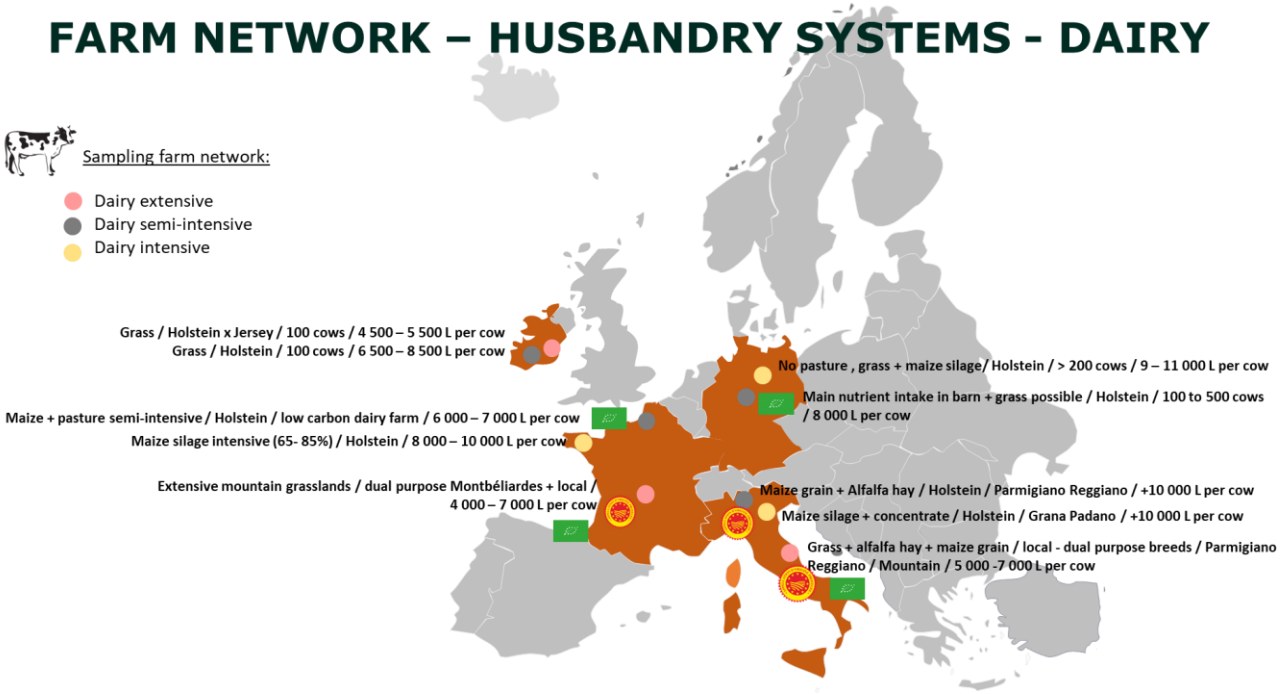


Figure 2: Initial systems included in INTAQT, presented to the dairy stakeholders

3.1.2-Comments and expectations on systems to study

As a whole, the stakeholders were satisfied with the initial systems presented, as they were representative of their countries. Some expectations were common to all the national groups:

- Including practices improving farms' self-autonomy and reducing external inputs (might be explained by economical challenge),
- Including systems using grazing (might be explained by both technical interest, economical stake and growing societal demand),
- Considering animal welfare and environmental issues (might be explained by increased societal demand),
- Considering circular economy (might be explained by increased societal demand).

Some remarks were common to some countries. Italy, Switzerland and Germany, were interested in studying the use of crossbreed, and dual-purpose breeds. Irish and French stakeholders were interested in studying different milk systems, in particular systems including robotic milking. In France, the interest for including robotic milking might be explained by their increased used and less knowledge.

Other expectations were specific to each country. They are concerned with feeding, social aspect, herd structure and management, breeds and genetics, animal welfare, and raw milk study (cf. figure 3). For the latter, we'll note this expectation comes from PDO actors in France.

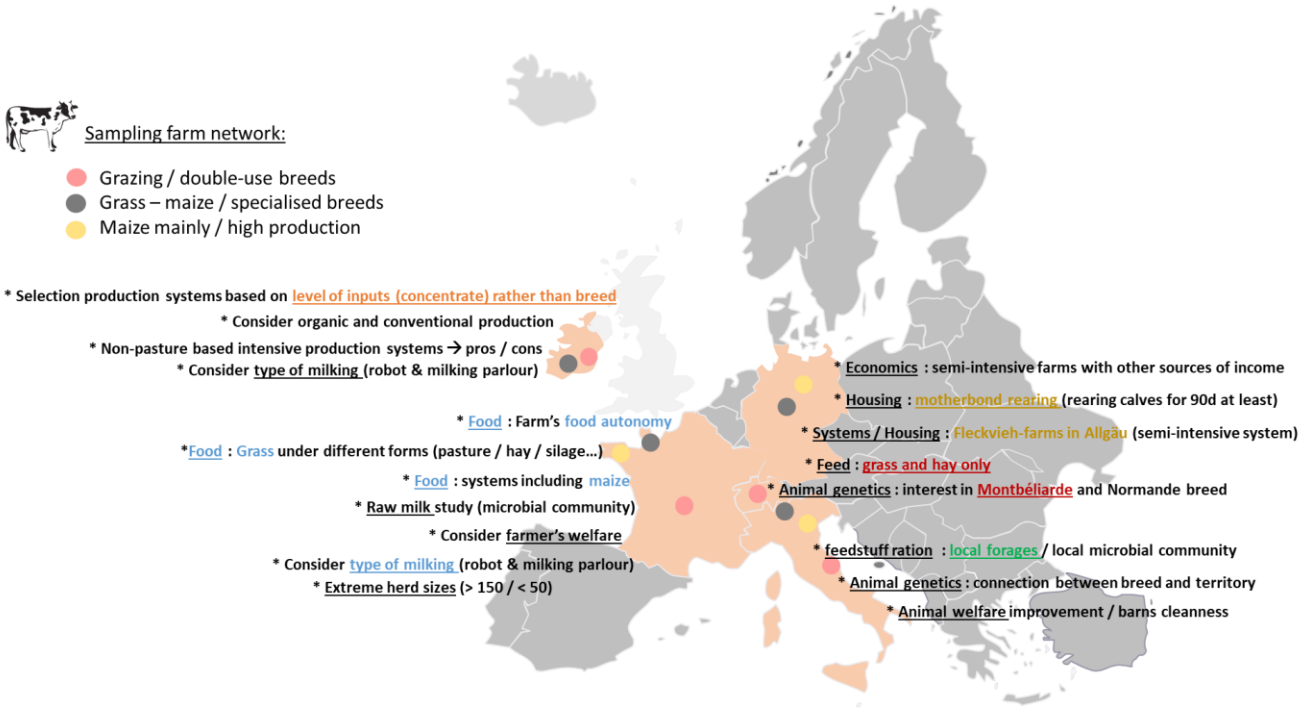


Figure 3: Main specific expectations on husbandry systems by country

The systems to be included and studied in the project were proposed during the European group, to meet the stakeholders' expectations and discuss them. In particular, 6 out of the 16 systems were designed after the face-to-face interviews and national groups, to consider stakeholder's specific expectations (framed boxes in figure 4).

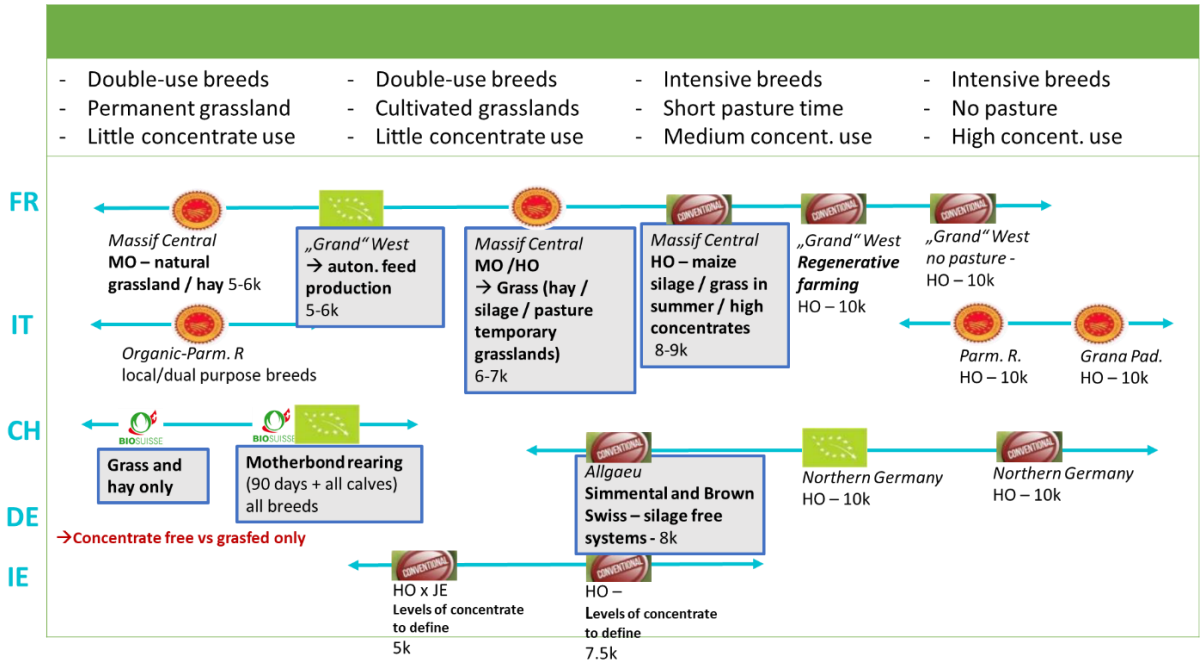


Figure 4: Main husbandry systems proposed to study in INTAQT (NB: 8k = 8 000 liters per cow)

During the first European dairy meeting, the stakeholders had few things to add. The proposals complied with their expectations. Some of them asked to indicate the number of animals per farm, noting that there is no upper limit for the number of cows to consider in the farm network.

Another remark was to indicate the castration methods amongst the animal welfare practices. We'll note that WP2 considers environment and animal welfare in farms enquiries.

Italian stakeholders explained the interest for local breeds producing low amounts of milk but characterized by resistance to disease, in the perspective of a selection strategy towards the reduction of antibiotics use (genetics being a strong tool).

Irish stakeholders specified that the choices of systems would be more relevant to the level of production per cow rather than the levels of concentrates.

3.2-Innovative practices

Many innovative practices were addressed spontaneously by the stakeholders during the face-to-face interviews and national groups. Some national groups prioritized the most important innovative practices. Thus, during the European dairy meeting, on the 3rd of May, the main innovative practices and systems were discussed (cf. table 5):

Several remarks were addressed regarding food, genetics and breeds, and husbandry.

*Table 5 : **Main innovative practices presented during the 2022-05-03 European dairy meeting***

Food	Breed	Housing	Other topics
Self-sufficiency at farm and supply-chain level Alternative proteins New species pasture (fodder / resistance to drought)	Crossbreeding	Motherbond rearing (90d with calves) Animal management: longevity of cows / heifers' reproduction	Ecological transition scenario Regenerative farming favouring soil biological activity Extreme herd sizes

Italian stakeholders explained their concern about feedstuff ration, with the arising question of replacing maize by sorghum, in regard of corn importations and the will be self-autonomous with forage, and in regard to safety, in particular, aflatoxin problems with the maize inducing aflatoxin in the dairy products and related potential problems.

A common thematic was identified in the innovative practices regarding forage, among which new species pastures, and other types of forage than grasslands (*e.g.:* forage trees/bushes in Switzerland, sorghum in replacement of maize in Italy).

Italian stakeholders explained, 50% of hay was needed in the rations in certain PDOs. If hay's quality improves, the need for concentrates decreases which induces big technical and economical stake. *«The real success in the farm is when the hay is produced».* Yet, French stakeholders found important to consider all the types of grass, and have a more holistic approach about the grass management, keeping in mind climate conditions that do not enable all the regions to produce hay only.

German stakeholders addressed the importance to consider genetics and breeds amongst the innovative practices, relevant from economical purposes and animal welfare perspective:

- Strategy of high κ-casein selection scheme → would induce + income + yield (higher yield in cheese production by selection for high levels levels of specific casein (less milk per kg cheese would be needed and therefore fewer emissions).
- Sexed semen → in Germany, there is no use for males calves in intense milk production (Holstein breed), problems not solved at the moment
- PP breeding (polled cows) → animal welfare concern and solution to stop dehorning

Motherbond rearing for dairy was discussed. There are concerns about lesser extent of fat composition in those milks, which is a similar thematic to the French Tradition Salers systems.

3.3-Quality criteria and methods

The initial criteria and analyses to be conducted on the milk and dairy products were reminded to the stakeholders during the face-to-face interviews, national and European groups meetings (cf. figure 5).

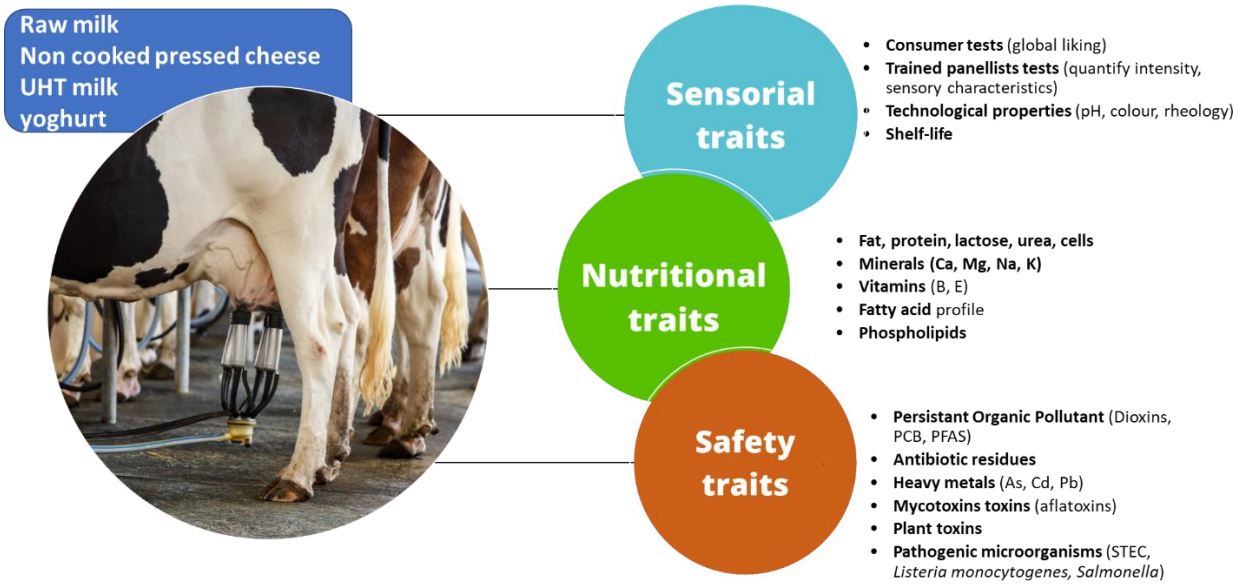


Figure 5: Criteria and analysis initially foreseen in INTAQT

The stakeholders had many expectations and made many remarks concerning:

1. The dairy products to be studied,
2. The analytical tools to develop,
3. The criteria and analysis to include.

We'll note that the project was meant to work exclusively on intrinsic quality. However, one of the strong expectations from the stakeholders is to consider extrinsic quality factors. Thus, this point will be tackled in the results.

3.3.1-General comments on the dairy products to study

The type of processed milk to be studied was a concern according to the countries, as there are different consumption habits across the countries. UHT milk does not correspond to consumers' taste in Ireland and is disliked. In Germany, some consumers like UHT milk, some others dislike it. This might be a point of attention with the panelists' selection. This might impact the results and potentially the multicriteria scoring tool development. Some actors would rather include microfiltered, raw or pasteurized milk in the sensorial analysis, to preserve taste and enhance or observe differences. In Italy and France, UHT milk is also produced. This dairy product was regarded as interesting.

The INTAQT coordinator explained during the 2022-07-04 European meeting that the processed products were still under discussion. Thus, including pasteurized milk and microfiltered milk could be an option discussed.

3.3.2-Remarks and expectations concerning the analytical tools to develop

German and French stakeholders were interested in the portative tools' development, corroborating expectations expressed by the labs through the online survey. They stressed out the big economical advantage it could convey. Developing novel rapid tests for on-farm testing before collecting the milk to assess and detect the presence of antibiotic residues could avoid the waste of whole milk cisterns if positive milk would be detected on the farm. There was no discussion on this in Irish and Italian national groups.

Furthermore, French stakeholders were interested in portative tools on the farm to evaluate the total fat content and the protein total content too.

3.3.3-Expectations on criteria and analysis to include in the scientific dispositive

Some criteria to include were common to all the stakeholders in each country. Some were asked specifically (cf. figure 6).

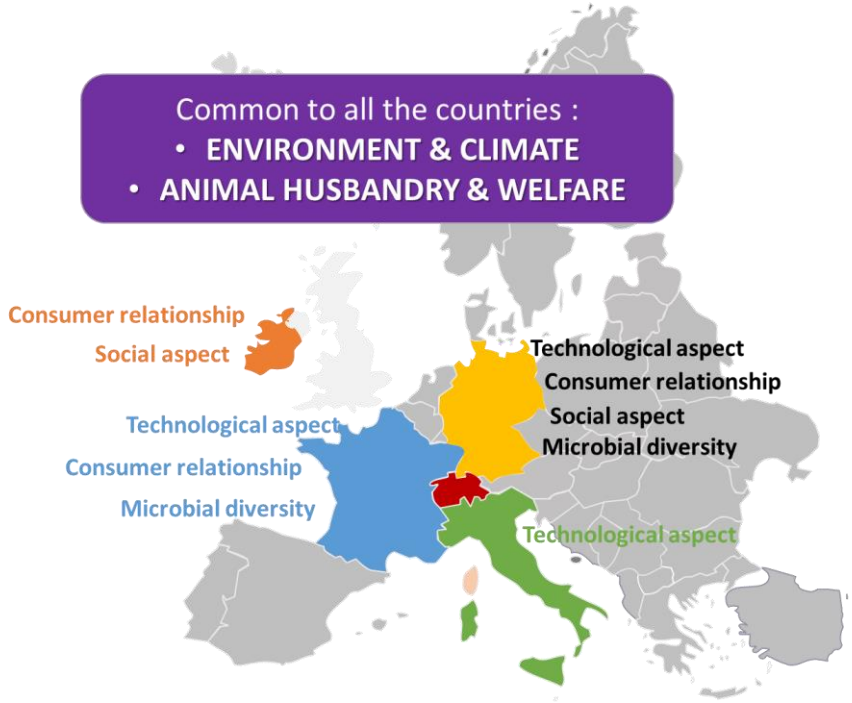


Figure 6: Stakeholders' expectations on the criteria to add in INTAQT

Even if some expected criteria were common to different countries, the analysis related to a criteria could be different. It is the case for technological / technical criteria, and the safety analysis (cf. table 6).

Criteria	Which measure / analysis / observations?	DE-SW	IE	IT	FR
ORGANOLEPTIC	Cell count, germ count taste	✓		✓ ✓	
SANITARY	Antibiotic residues Chlorates, detergent residues Anthelmintic/thermoduric residues Pesticides residues	✓ ✓ ✓	✓ ✓ ✓	✓	✓ ✓
NUTRITIONAL	Product digestibility		✓		
ENVIRONMENT *(emissions…)*	Environmental diagnostics: life cycle analysis Carbon footprint Cap2'ER, ecosystem services	✓	✓	✓	✓ ✓ ✓
ANIMAL WELFARE	Milk indicators on animal welfare Diagnostics (eg : Boviwell) Calf mortality, Udder health	○ ✓	○	✓	✓ ✓
TECHNOLOGICAL / TECHNICAL ASPECT	Milk payment criteria : Total fat and protein content Cell count, bacterial count Cryospcopy, lipolysis, Inhibitors Colour Packaging Humidity content	✓ ✓ ✓ ✓		✓ ✓	✓ ✓ ✓ ✓
CONSUMER RELATIONSHIP	Consumer willingness to include product in diet Price Origin	✓ ✓	✓ ✓		
MICROBIAL DIVERSITY	Ohmic methods PCR multiplex high frequency	✓ ✓			✓ ✓
SOCIAL ASPECTS	Working conditions, salary	✓	✓		

Table 6: Stakeholders' expectations on analysis, measures, and observations to add in INTAQT

During the second European meeting, the stakeholders' expectations were discussed with the work package leaders 2 and 3, to precise 1/ their expectations, 2/what could be done or not, 3/ what was under discussion (cf. table 7).

Criteria	Which measures, analyses, observations?	Answer from Work Package leaders on feasibility, point under discussion…
ORGANOLEPTIC	Somatic cell count (SCC), total bacterial count (TBC) microbial composition	→SCC included →TBC included
SAFETY	Antibiotic residues Chlorates, detergent residues Anthelmintic / thermoduric residues Pesticides residues	→global test for antibiotic residues and other inhibitors included →chlorates and detergent residues depend on the hygienic conditions and milking machine rather than the farming system: point to be discussed →pesticides and other residues generally possible (multi methods). Question about the costs: point to be discussed
NUTRITIONAL	Product digestibility (lactose tolerance related question + protein allergies)	→lactose included[2] →casein variants (αs1, β, κ, αs2): point to be discussed (still possible to do it, even if expensive. a compromise could be to select a sub-sample) interest for the technological criteria too. →The morphogenetic variant of β-casein (alleles A2-A2) were discussed, but are very expensive, and non-scientific based approach. →the fatty acids are planned, among which the omega 3 and phospholipids.
ENVIRONMENT	Environmental diagnostics : Life cycle analysis Carbon footprint	→many points included in the questionnaire from work package 2 (WP2): Feeding, land use, pasture management, herd management, production of milk and meat →Indicators calculated in INTAQT: CO_2 emissions, water usage on the farms, ammoniac emissions Remark: a recent life cycle analysis was made on the PDO butter Charentes-Poitou. The methodology used could be interesting for the INTAQT project.
ANIMAL WELFARE	Milk indicators on animal welfare Diagnostics (eg: Boviwell) Calf mortality, udder health	→milk indicators on animal welfare are not known from now, need more research, we can try to work with Infra-Red spectra but not sure it will work →diagnostic included in WP2 = "Assure Wel": observations on bedding, floor cleanliness, lameness, BCS, cleanliness, swellings, lesions, hairless patches, →calf mortality can be numbers asked to the farmers: to be discussed →udder health: included, assessed by the somatic cell count
TECHNOLOGICAL / TECHNICAL ASPECT	Milk payment criteria: Total fat and protein content, Cell count, bacterial count, cryospcopy, lipolysis, Inhibitors Colour Packaging Water content	→total fat and total protein content included →somatic cell count and total bacterial count included →cryoscopy, lipolysis, inhibitors included →colour included →packaging was stated by stakeholders as it can impact the taste (glass bottle vs. tetrapack), and it represents an environmental issue: this point will not be included →Water content included

[2] the lactose content is regarded as very constant because the lactose content controls the amount of milk. Only sick cows have lower lactose values (usually the amount of milk simply decreases)

CONSUMER RELATIONSHIP	Consumer willingness to include the product in the diet Price Origin	→consumer willingness and the price are beyond the scope of INTAQT. However, collecting milk price paid at the farm is feasible and somewhat comparable in the 5 countries: point to be discussed → the origin (authenticity) is covered by work package 4 with OMICS methods
MICROBIAL DIVERSITY	Ohmic methods, PCR multiplex high frequency	→A French project (TANDEM) plans to study the microbial diversity on the same samples as INTAQT for France. This approach interests Italian and German stakeholders too, this is not certain for Ireland.
SOCIAL ASPECT	Working conditions, salary	→included in WP2 questionnaires: qualitative questions to farmers (owners only) on wellbeing, income and workload and land ownership →point to be discussed in the second round of questionnaires: include qualitative questions to employees, not only owners

Table 7: Exchange with Work Package leaders on feasibility

In conclusion, the following points expected to be included by the stakeholders need to be discussed by the INTAQT scientists:

- chlorates, detergent residues, pesticides residues,
- casein variants(αs1, β, κ, αs2),
- animal welfare milk indicators by IR spectra, calf mortality,
- milk price paid at the farm,
- microbial composition (interest from Italy, Germany and France)
- the social aspect to be more investigated (employees wellbeing)

3.4-Multicriteria scoring tools

The concept of a multicriteria scoring tool (cf. figure 7) was presented to the stakeholders during the face-to-face interviews, national and European meetings.

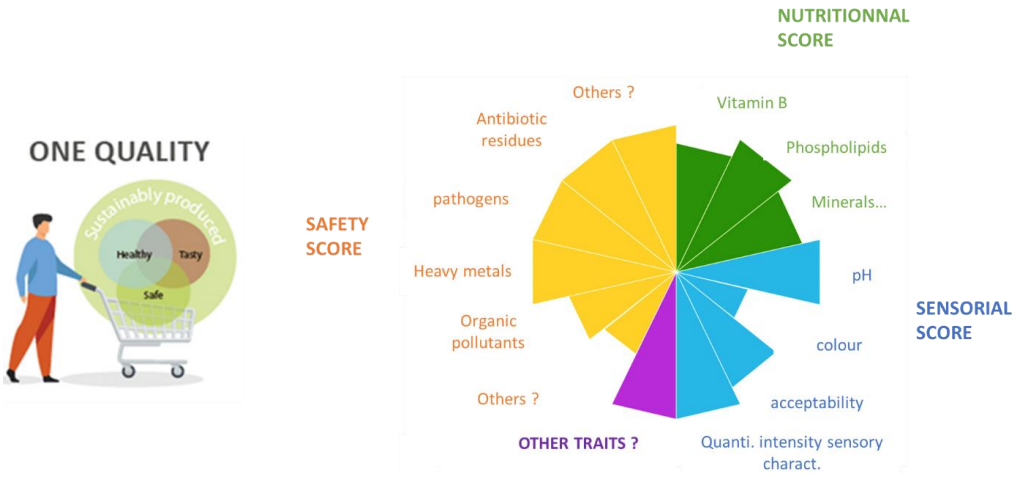


Figure 7: Example of multicriteria scoring tool conception

In every European country, stakeholders considered positive and negative points with respect to this tool (cf. table 8).

Positive points	Negative points
• Useful for processors and distributors (supply chain): • Marketing tool • Benchmarking within and between systems	• Complexity/understanding for the consumer • Too many existing tools/scores → confusing for the consumer • Price-oriented consumers • Reliability: validation of tool and data? • Weightings applied?

• Useful for consumers → identify high-quality products • Can be a tool for producers • Useful to temper Nutriscore	• Masking information through a single score • Comparison across the countries • Potential to manipulate the scores to get a "good mark" (e.g.: inclusion of additives…) • How to obtain co-benefits with its use, for producers and processors? (if none the multicriteria scoring tool will soon be abandoned) • Safety criteria are a source of anguish for consumers • Sustainability does not appear in the tool as such

Table 8: Positive and Negative points addressed to the multicriteria scoring tool

Those comments corroborated the consumers' opinions.

Overall, the need to clearly define the target and explain the tool was important to the stakeholders. Moreover, the stakeholders expected to include extrinsic criteria in this tool, *i.e.* sustainability, environment and animal welfare criteria. French stakeholders would add microbial diversity. Lastly, European stakeholders agreed on recommending the inclusion of antibiotic residues in a reassuring strategy, within the safety criteria.

Conclusion

European stakeholders were satisfied with the 16 systems proposed to be studied since they were representative of the diversity each country involved. Some expectations were common to all the national groups: self-autonomy, external input reduction, graze use, animal welfare and environmental consideration, and circular economy.

The European dairy group worked on the innovative practices to test in the project, which was not initially expected from the stakeholders. The main innovative practices of interest concern food, genetics and breeds, housing, and agro-ecological practices and scenario.

All the European stakeholders agreed on the interest to include the extrinsic criteria of animal welfare, environment and husbandry. Some specific interests in technological aspects, microbial diversity, consumer relationships and social aspects need to be discussed within the project. In particular, the following points will be under discussion:

- chlorates, detergent residues, pesticides residues analyses,
- casein variants($\alpha s1$, β, κ, $\alpha s2$) analyses,
- animal welfare milk indicators by IR spectra, calf mortality,
- microbial composition analysis (interest from Italy, Germany and France),
- employees wellbeing indicators,
- milk price paid at the farm.

Lastly, the concept of multicriteria scoring tool divides the stakeholders, within each country. Several positive and negative points will need to be considered for its appropriation by the stakeholders. We have noted that a strong expectation is to define clearly the target, adapt the content and explain the tool. A common expectation from the stakeholders in the different countries is to include the extrinsic criteria of sustainability, environment and animal welfare.

Those consultations allowed us to consider the professional and societal expectations as core questions of this European research program. They will enable to bring some implementations to the experimental dispositive, considering its feasibility. Thus, it will bring objectified scientific elements to answer those expectations.

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ANNEX 4

Interview guide

Make an appointment:

Example of what could be in the email/phone call:
INTAQT project is a European project with scientific investigations in the field of product quality of milk, chicken and beef. We are making interviews of producers, processors, retailers and other actors. We need your expert's point of view to co-construct part of the project and make sure that it is answering the needs of the food chain. We interview 15 actors per country and product.
It will take 1 to 1 and half hour.
Preferably Face-to-face or video-based interviews.

Introduction of the interview:

- Thank you for taking time for this conversation.
- My name is X. I work at.
- I am not here as an expert. I am here to hear from you. You are the one who knows.
- Can I record? Only for me, to be sure that I have all the important elements because I might forget sth in my notes. I will delete it when I am done with the analysis. I am making 15 interviews and will make a report based on those 15 interviews in the field of dairy/beef/chicken in X (your country)
- RGPD…signing
- First I will ask you questions about your experience and later I will present you for the project and let you react on it.

Interview guide

1- General

- Can you briefly present yourself and your job?
- Can you briefly present your organisation?
  (if he/she says sth about quality, start exploring it)
- Behind quality, what will you put in your professional environment?
  (remember to keep on meat/dairy/chicken quality – let them speak about carcass for example in a start if it is important for them and then redirect towards product quality)
- What is quality in your position/daily professional life? ? How do you work with it?
  (explore for each criteria: how to define it? Eventually how do you qualify/measure it?)
  (Remember the chair. You can eventually draw it.)
  (remember feedback where you summarize, what you understood. Check if the interviewee is OK with this summary.)
  (if processors, there might be different criteria in order to meet consumer expectations, but important to explore also the criteria they use towards farmers/producers)
- Who are your buyers/customers? What are the quality criteria, they expect from you?
- If you are buying from another actor in the food chain, what are your quality criteria to your suppliers?
- Are there trends/changes in terms of how you consider quality?
- Why? Who/what is driving these evolutions?
- What do you see for the future? Where are we going to in term of quality?
- How is "dairy/chicken/beef meat product" made in your country? What kind of production system delivers to you/ exist in our region?

2- Quality and production systems

- Do you think, there is a link between how the product is produced and its quality?
- Could you elaborate on that?

(funnel question – we are interested in knowing if they spontaneously talk about farming practices. If they don't, we take note of it and follow up with the next question)

- Are there links between production systems (poultry) / husbandry systems (beef and dairy) and product quality?
- And on which criteria, topic, aspect?

3- INTAQT

Presentation of the project, its intentions (chose only few slides – very light presentation!) (big opportunity – we rarely have EU large projects on product quality)

- What is your opinion?
- Do you feel concerned by this question? If so, what in particular?

Quality criteria chosen in the project and how they will be studied.

- What's your opinion?
- Are you surprised by some elements?
- Would you add other traits or analysis?

Production systems chosen in the project (clarify that we don't want to compare production systems, but rather improve the quality of products for each system)

- What's your opinion?
- What would you add?

The multi-criteria scoring tool

- What do you think about this tool?
- Is it usefull?
- Which interests do you see in it?
- What are your fears? Which risks do you identify?

4- Getting involved in the project

Explain the national groups meeting, the role of the national groups and the benefits one can get from participating to the national groups:

- To have information in priority
- To impact on the project
- To share with others
- Good lunch!

Are you or some of your colleagues interested in being part of the national groups? (if yes, collect contact information)

5. Characterisation of the organisation

If missing parts from the part 1, ask complementary questions
Description of the organisation the person, number of animals; market share… speciality..;
If processors, ask for production.
What are the objectives of the organisation?
Number of members if coop or association….

Contact details of the person: phone number and mail address