ASSESSING THE SUSTAINABILITY OF GEOGRAPHICAL INDICATIONS IN THE DAIRY AND CHEESE SECTORS

The consolidation of the Qualimentaire Sustainability Assessment Tool throughout a Participatory Action Research within the PDO Maroilles cheese

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Abstract

The actual contribution of Geographical Indications (GIs) to sustainable development (SD) is a topic that is gaining increasing attention in the context of growing societal and political pressures. While empirical knowledge is still subject, there is evidence that GIs should assess their sustainability performances to communicate the inherent sustainable attributes of their products to consumers. However, measuring the sustainability of any system is a “wicked” issue and would require soft-system approaches, which are often missing in the current literature.
These limitations pointed out, the present work aimed to consolidate the Qualimentaire Sustainability Assessment Tool (QSAT) in order to design a tool that is easy to use, robust, holistic, inclusive and action-oriented, and applicable to all dairy and cheese GI in France and beyond. To this end, Participatory Action Research was conducted with the Maroilles PDO.
It resulted in an innovative evaluation framework, composed of 241 indicators based on the five dimensions of Economy, Environment, Social, but also Governance and Territory, and taking into account all GI stakeholders.
The discussion underlines the importance of a bottom-up participatory approach as an essential prerequisite for the applicability of the results on the field and the appropriation of the tool by local actors. Results of this study showed that the QSAT functions as a catalyst for exchanges among GI actors and collective learning about SD and thus goes far beyond a simple evaluation grid. However, a number of trade-offs were observed regarding the initial research objectives, which called for the need to not only develop an evaluation grid but a whole methodology drew on the stepwise and participatory process presented here.

Keywords: Geographical Indications (GIs); sustainability; Sustainable Development (SD); dairy and cheese sector; assessment; indicators; participatory; action research

Résumé

La contribution réelle des Indication Géographiques (IG) au développement durable (DD) est un sujet remporte une attention grandissante dans un contexte de pressions sociétales et politiques croissantes. Si les connaissances empiriques sont encore pauvres sur le sujet, il apparaît évident que les IG doivent désormais être en mesure d’évaluer leurs performances en matière de durabilité afin de communiquer aux consommateurs la valeur-ajoutée de leurs produits. Cependant, mesurer la durabilité de tout système est un processus complexe et nécessiterait une approche *Soft-System*, approche faisant souvent défaut dans la littérature actuelle.
Ces limites mises en évidence, le présent travail a visé à consolider l'outil d'évaluation de la durabilité (QSAT) conçu par l’organisme Qualimenaire afin de concevoir une grille d’évaluation à la fois simple d’utilisation, robuste, holistique, inclusive, orientée vers l'action et applicable à l’ensemble des filières AOP laitières et fromagères de France et au-delà. Pour ce faire, une recherche-action participative a été menée avec l’AOP Maroilles.
Il en est résulté un cadre d’évaluation innovant, composé de 241 indicateurs articulés autour des cinq dimensions de la durabilité: l’économie, l’environnement, le social mais aussi la gouvernance et le territoire et prenant en compte l’ensemble des acteurs de l’IG.
La discussion souligne l'importance des approches participatives *bottom-up* comme prérequis essentiel à l’applicabilité des résultats sur le terrain et de son appropriation par les acteurs locaux. L’outil QSAT fonctionne ainsi comme un catalyseur d’échanges et d’apprentissage collectif sur la notion de DD, et va donc bien au-delà d’une simple grille d’évaluation. Cependant, un certain nombre de compromis ont été observés par rapport aux objectifs de recherche initiaux, ce qui a nécessité de développer non seulement une grille d'évaluation mais toute une méthodologie s'inspirant du processus progressif et participatif présenté ici.

Mots-clés : Indications géographiques (IG) ; durabilité ; développement durable (DD) ; secteur laitier et fromager ; évaluation ; indicateurs ; participatif ; recherche-action.

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CONTENT

Abbreviations and Acronyms

AREPO: Association of European Regions for Products of Origin
CAP: Common Agricultural Policy
CNAOL: Conseil National des Appellations d'Origine Laitières
CoP: Code of Practices
CREDA: Center for Agro-Food Economics and Development
DD: Dévelopement durable
DRAAF: Direction Régionale de l'Alimentation, de l'Agriculture et de la Forêt.
EC: European Commission
EU: European Union
FAO: Food and Agriculture Organization
FQS: Food Quality Schemes
GHG: Greenhouse gas emissions
GI: Geographical Indication
HEV: High Environmental Value
IDEA: Indicateurs de durabilité des exploitations agricoles
IG: Identification Géographique
IP: Intellectual property
INAO: Institut national de l'origine et de la qualité
INRAE: Institut national de recherche pour l'agriculture, l'alimentation et l'environnement
IRQUALIM: Institut Régional de la Qualité Alimentaire d'Occitanie
ODG: Organisme de défense et de gestion
OFB: Office français de la biodiversité
PDO: Protected Designation of Origin
PG: Public Good
PGI: Protected Geographical Indication
QSAT: Qualimentaire Sustainability Assessment Tool
RMT: Réseau mixte technologique
S2F: Strenght2Food
SAFA: Sustainability Assessment of Food and Agriculture systems
SD: Sustainable Development
TRIPS: Trade-Related Aspects of Intellectual Property Rights
TSG: Traditional Speciality Guaranteed
UN: United Nation
WCED: World Commission for Environment and Development
WTO: World Trade Organization

General introduction

Today's food and farming systems are facing environmental, social, and health challenges. While peasant farmers applied nature and ecological principles for millennia, agriculture, pushed forward by the Green Revolution over the last century, became increasingly industrialized and modern. The resulting agricultural practices have incurred costs related to widespread degradation of land and water, high greenhouse gas (GHG) emission, loss of biodiversity, the emergence of pathogens, persistent hunger and micro-nutrient deficiencies alongside the rapid rise of obesity diet-related diseases. Profound transformation to overcome these major challenges is needed, calling for more holistic and nature-inclusive approaches.

These considerations made, Geographical Indications (GIs), could be part of the solution to achieve more sustainable and resilient agri-food systems. A GI is defined as a sign applied to products that benefit from a specific geographical origin, thus holding qualities due to human and natural factors present in that origin. According to the FAO, GIs could contribute to sustainability in farming and food systems if inclusively established and well managed. However, GIs effective contribution to sustainability is difficult to establish and often not directly visible to consumers neither economically valued. In addition, GIs are currently facing profound structural, regulatory and cultural changes, questioning their auto-justified contribution to SD. Hence, engaging GIs in a sustainability strategy by assessing their sustainable performances could help GIs producers maximizing their contributions to SD and communicate them to the consummers and political authorities.

Aware of both the potential and challenges regarding the contributions of GIs to sustainability, the Qualimentaire organization based in Lille, Northern France has developed since 2018 the Qualimentaire Sustainability Assessment Framework (QSAT). This tool is an assessment grid that aims to evaluate one given GI's sustainability performances and monitor this evaluation over time. Since its creation, the QSAT has already been tested on a diverse range of GIs from various sectors (dairy, poultry and legumes). However, this tool has never been consolidated what hampers to position it as an assessment framework for GIs in France and beyond.

Therefore, the present study aimed to consolidate the QSAT, using an original participatory approach, engaging the Maroilles cheese PDO.

PART 1: Geographical indications and sustainable development, state of the art and identified issues

1 GIs definition

A Geographical Indication (GI) is a label that applies to products originating from a specific territory that confer their unique characteristics. Given this territorial anchoring, GI products are the outcome of technical, social, environmental, cultural, and economic interactions, including the mobilization of local specific resources, both physical (local breeds and varieties, soil specificities, microclimate conditions, etc.) and human ones (contextual know-how, history, cultural traditions, gastronomy, etc.) (FAO-OriGIn et al., 2017). These specific characteristics result in an acknowledged quality, which contributes in turn to the strong reputation of the GI product associated with the region of origin.

For that reason, GIs are protected as collective intellectual property (IP) rights, according to the World Trade Organization (WTO) agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and the Geneva Act (FAO, 2019). Consequently, GIs are often designated as collective marketing tools that can be used to both protect and promote specific products (FAO et al., 2018).

The European Union (EU) oversees two Food Quality Schemes (FQS) seeking to protect GIs; specifically, the Protected Designation of Origin (PDO) and the Protected Geographical Indication (PGI) (Figure 1). Both are part of the European Union's quality policy, which aims at "protecting the names of specific products to promote their unique characteristics, linked to their geographical origin as traditional know-how" (European Commission, 2021a).

Figure 1: PDO and PGI Quality schemes labels (European Commission, 2021a)

The main difference between PDO and PGI products is the degree to which the raw materials and the different processing stages are linked to a region of origin (European Commission, 2021a). Products under PDO schemes have the strongest link to the region they come from. This label indicates that every stage of the production, processing and preparation must occur in the referred region. In the PGI case, only at least one stage has to take place in the region of origin (European Commission, 2021a).

Researchers and non-governmental organizations showed over the recent years a growing interest to better draw linkages between GI and SD in order to showcase the multiple benefits of GIs. Among them, we can refer to the FAO, which brought significant contributions over the past years (FAO, 2012, 2014; FAO-OriGIn et al., 2017; FAO et al., 2017, 2018; FAO, 2019; FAO and OriGIn, 2020; FAO, 2021), as well as researchers such as Barjolle and Sylvander (2003b), Vandecandelaere et al. (2009, 2018, 2021), Casabianca and Touzard (2009); Arfini and Bellassen, (2019).

2 The need to find out to which extend GIs can contribute to sustainable agri-food systems

2.1 GIs contributions to sustainability and generation of Public Goods

GIs can exert positive economic effects (on revenues, fair distribution of value-added, economic resilience, etc.), social effects (on employment, social cohesion, collective action, gender issues, local knowledge, etc.), and environmental effects (support to multifunctional agriculture, management of specific local resources, landscape, agro-biodiversity preservation, etc.). Based on these three dimensions, a non-exhaustive literature review was conducted to explore the assumed GIs contribution to sustainability, especially based on FAO postulates (see Appendix 1).

In addition, GI processes enable to preserve and to reproduce local resources, which activates the so-called “GI virtuous circle”, which encompasses: the identification of potential qualification of products, the remuneration through marketing, the reproduction of local resources and the role of public policies (Vandecandelaere et al., 2009) (see

Figure 2).

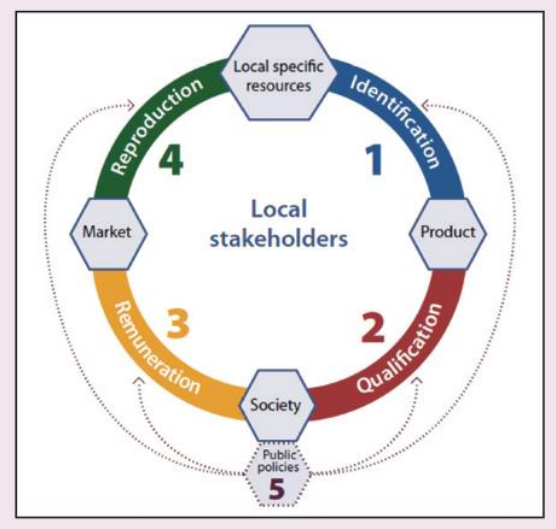

Figure 2: The GI virtuous cycle (Vandecandelaere et al., 2009)

Recent studies have adopted a new approach to look at GIs contribution to sustainability by considering GI systems as providers of Public Goods (PGs), as highlighted in the special issue "Geographical Indications, Public Goods, and Sustainable Development" (Belletti et al., 2021). Indeed, GIs provide a foundation to support various local PGs, including territorial reputation, landscape, natural and food heritage, local culture and know-how, and economic and social effects on the territory (i.e., job creation, income, social cohesion). Effects on the environment are receiving better emphasis, especially concerning the resilience of agri-food systems in light of climate change (Marescotti et al., 2020; Millet et al., 2020; Owen et al., 2020). Most of these studies are based in Europe, where GIs have been established for quite a long time (Arfini and Bellassen, 2019; Marescotti et al., 2020; Owen et al., 2020). Related to the environmental component, GI producers' willingness and capacity to preserve and enhance local biodiversity is also increasingly studied (Bérard and Marchenay, 2006; Boisvert, 2006; Garcia et al., 2007; Larson, 2007; Thévenod-Mottet, 2009; Bowen and Valenzuela-Zapata, 2009).

Another PG that is gaining attention is the potential positive effect of GI on health and nutrition (FAO, 2021). The link between GI and healthy diets is particularly relevant regarding the contribution of fermented products to health (Nicklaus et al., 2019) and the importance of traditional origin-based diets as a tool against malnutrition (FAO-Biodiversity et al., 2012; Mason and Lang, 2017). The recent emergence of labels such as the NOVA and the Nutri-score that attempt to classify products according to their degree of industrial processing and nutritional value respectively, encourages to deeper study GIs' contribution to health and nutrition (Monteiro et al., 2018).

2.2 GIs contribution to sustainability in the French PDO-cheese sector

In France, numerous studies have been carried out over the last decade showcasing the implication of GIs on SD, especially concerning the dairy and cheese sectors. Some forty studies were indeed identified by the "Network of Terroir Cheeses" (Réseau Fromages de Terroir[1]), which have been compiled in a literature review (Forray et al., 2010). It highlights several positive externalities regarding the economic dimension (creation of added value, equitable distribution of added value throughout the sector), the social aspect (creation of jobs, dynamism of territories, enhancement of difficult areas) and the environmental dimension (link to grazing, fodder autonomy, enhancement of local breeds, preservation of biodiversity etc.) (Forray et al., 2010).

2.3 Current identified limitations

2.3.1 Limitation of GI contribution to sustainability

Still, GI is not a magical tool to reach sustainability as such systems are not conceived to be sustainable by definition (FAO and OriGIn, 2020). This is why it should be pointed out that whether and to what extent these potential advantages are achieved depends mainly on the social, political, economic (market) and ecological contexts. Therefore, these benefits should not be generalizable to all GI situations but instead cautiously observed on a case-by-case study (FAO, 2021). Moreover, GI producers are often not aware of their system's potential to contribute to SD or usually lack the capacities to integrate more sustainable elements or to make them visible if already existings (FAO and OriGIn, 2020).
Finally, GI processes may also have, in some cases, negative externalities for the territory (Bowen and Valenzuela-Zapata, 2009), especially when the local producers are not part of the local governance (Samper and Quiñones-Ruiz, 2017).

2.3.2 Limitations in GI literature

Analysis of the contribution of GIs to sustainability reveals further issues. Current empirical evidence for certain GI effects is either scare or debated, which hampers drawing on linkages between the described contributions (FAO, 2021). To date, most studies exploring the link between GIs and sustainable or rural development have focused on the economic dimensions (Kimura and Rigolot, 2021). Indeed, even if the environmental dimension of SD is gaining

[1] The *Réseau Fromage deTerroir* (RMT) is a partnership modality introduced by the Agricultural Orientation Law of 5 January 2006. It aims at facilitating exchanges and developing projects between researchers, and local actors from the French dairy sector. The RMT is therefore a centre of resources and expertise producing scientific and technical synthesis, technical tools and manuals, accessible to all.

increased attention, it is still considered a background element because often not directly assessed (Kimura and Rigolot, 2021). For instance, Vandecandelaere et al. assume that GIs commonly have positive environmental effects, as they are based on local resources and traditions (Vandecandelaere et al., 2018). However, as shown by Baritaux et al. (2016), the relationship between localized food systems and environmental performances is more complex than it may seem, depending on the multiple possible configurations of "ecological embeddedness".

Likewise, considering the French literature mentioned above, similar limitations can be outlined. Even if this overview of existing results highlights positive externalities of the GI cheese sector, some knowledge gaps can be identified. First, most of the studies are one-dimensional when considering SD, which does not provide a transversal approach nor an appreciation of the trade-offs that may exist between SD dimensions (Forray et al., 2010; Reboul, 2010). Secondly, few studies consider the diversity of situations in the different GI sectors, which may appear as a limitation in assessing the representativeness of the final results (Forray et al., 2010). Finally, for the social dimension of SD, often the one most difficult to grasp by scientists, still very few analytical elements do exist (Reboul, 2010; Lebacq et al., 2013).

Regarding these issues, some recent GIs studies have attempted to fill the knowledge gap and demonstrate the net benefits of GIs using holistic evaluation frameworks.

2.4 Evaluation of GI impacts – quantitative evidence

Studies assessing the impact of GIs are either diachronic (i.e., evaluating the impact before and after GI registration) or synchronic (i.e., comparing the GI product against its similar standard product). This latest option was taken up by the H2020 Project "Strengthening European Food Chain Sustainability by Quality and Procurement Policy" (Strength2Food). This five-year extensive research aimed to investigate some 29 value chains based on different FQS from 14 different countries (Arfini and Bellassen, 2019). The study provided quantitative evidence that environmentally, GI products perform well in lower GHG emissions per hectare and fewer food miles due to the shorter distance travelled by the products during the production and processing stages. Concerning the social dimension, the study showed that GI schemes ensure greater employment per tonne of the product while providing a higher turnover per unit of work and better bargaining power along the value chain (Mattas et al., 2019).

However, Bonanno et al. (2019) nuance the often given success of the GI tool. In a book with worldwide case studies, they indicate that GIs might have rather mixed effects, depending on local contexts, especially when considering issues of social equity and power relationships (Bonanno et al., 2019). Again, it is difficult to generalize results that differ significantly between cases due to the variability of GI systems in their contexts, their modes of establishment, their governance models and power of local institutions and, especially, the commitment of their involved stakeholders (FAO and OriGIn, 2020).

A commonly identified limitation regardless of the GI evaluated is the difficulty in establishing a clear "chain of causality" to draw obvious linkages between the evaluated GI and its effects (Belletti and Marescotti, 2011) and to separate these effects from enabling factors such as technological or advisory services or policy support (Bramley, 2011).

Reassessing the potential of GI to contribute to SD is nevertheless a current priority, especially regarding the current societal and political inflexions at the European level.

3 GI context and current inflexions

The GI sector is currently subject to profound structural, regulatory and cultural changes, where their effective contribution to sustainability is increasingly questioned by consumers, producers and researchers (Casabianca and Touzard, 2009; Marescotti et al., 2020). Therefore, the perspective opened up by SD calls into question the well-established 'virtuous circle' of GI systems (Vandecandelaere et al., 2009) (Figure 2) and implies moving away from the self-centred and self-justified capacity of GIs to accommodate sustainability.

3.1 External pressures leading to exogenous dynamics

3.1.1 External issues in light of the Farm to Fork Strategy

Recently, the European Commission (EC), in line with the priorities set by the Green Deal, presented the *Farm to Fork strategy*, a comprehensive and ambitious action plan targeting 2030. The overall objective is to engage in a transition of our food system to make "the EU food system a global standard for sustainability" (European Commission, 2020a) (Appendix 2).

To achieve this ambitious objective, the EC fully recognizes the contribution of GIs to promote sustainable rural development and contribute to biodiversity protection (AREPO, 2020a). Indeed, among the 27 actions proposed in the strategy, the EC seeks to reinforce the legislative framework on GIs and, where appropriate, to include specific sustainability criteria (European Commission, 2020). This may act as a lever to further recognize and support GIs implication to environmental, social and economic sustainability (AREPO, 2020a).

3.1.2 In light of the upcoming CAP

Likewise, the ongoing debate on the future of the Common Agricultural Policy (CAP) shows a strong demand for a renewed agricultural policy that considers the pursuit of environmental, social and economic objectives.
In this context, the EC has carried out various public consultations to get feedback on the understanding and public opinion on EU quality labels. It resulted in several guidelines and measures tailored to help GI producers to better integrate sustainability requirements and thus to increase consumer awareness of GIs (Appendix 3).

3.1.3 External pressures at the French territory level

Environmental concerns also drive regulatory changes in France. In 2017, the National Institute of Quality and Origin[2] (INAO) has established a Territorial Observatory of Official Signs of Quality and Origin grouping together French GIs (INAO, 2017). The Observatory aimed to build a common place for mutual exchange and information to study the positive externalities generated by these labels.
In October 2018, the introduction of the Egalim Law from the French National Food Conference accelerated the integration of sustainability criteria into the GIs' Code of Practices[3] (CoP) for national GI products[4]. In response to this law, the INAO published a set of three guidelines for the GI organizations to cope with the Egalim law (Appendix 4).
Finally, in line with these announcements, the INAO signed in February 2021 a partnership agreement with the French Biodiversity Office (OFB), to which French national parks are

[2] English translation of *Institut National de l'Origine et de la Qualité*
[3] English translation of *Cahiers de Charges*
[4] LOI n° 2018-938 du 30 octobre 2018 pour l'équilibre des relations commerciales dans le secteur agricole et alimentaire et une alimentation saine, durable et accessible à tous (1), (2018)

attached. This agreement aims to reinforce synergies between the two organisms, especially in promoting agroecology practices in the GI territories (INAO, 2021).

In response to these external regulatory and societal pressures, another dynamic can be observed, also called “endogenous strategy”, reflecting the will of GI actors themselves to cope with sustainability.

3.2 Endogenous dynamics among GIs

Considering the external pressures mentioned above, there is a clear trend of the need for GIs to engage with its members on sustainability topics (Casabianca and Touzard, 2009). However, one can observe a great diversity of situations from GIs that have anticipated these issues, to GIs that have almost everything to rethink (Casabianca and Touzard, 2009).
As concrete examples, many wine and spirits GIs, like Scotch Whiskey Association, Italian Wines or Champagne, have developed initiatives that focus on environmental practices, reducing waste and their impact on the environment. Comte Cheese and the dairy sector in France or Fromarte (cheese in Switzerland) are also good cases of organizations much concerned with sustainability issues (OriGIn and FAO, 2017).

3.2.1 At the French territory level

To tackle these sustainability challenges, governmental institutions themselves are engaged in the topic. For instance, the INAO in France is helping GIs to define and adopt their sustainability strategies with the development of agro-ecological guides involving together producers and experts (INAO and IFV, 2017).

Zoom on the dairy and cheese PDO-sector

With 51 PDO products, the PDO-cheese sector is the biggest sector gathering French quality schemes and is undeniably subject to these current changes.
In response to this regulatory evolution, the National Coucil of dairy PDO[5] (CNAOL), the French body grouping all the cheese-PDO consortia, is setting a program called “Sustainable Dairy PDOs”[6]. The overall objective of this program is to adapt the “Farm to Fork” ambitions to local realities and respond to the Egalim law and CAP eco schemes requirements.
To this purpose, the CNAOL has conducted since 2019 a long process of public consultations with its dairy PDO members, which resulted in the creation of the “CNAOL common Charter of commitment”[7], a framework commonly agreed upon the 51 PDO and where each of the consortium of GI producers should take sustainable commitments. The CNAOL Charter of commitments and related explanations can be found in Appendix 5.

3.3 Summary of the findings

As observed, GI products have strong and inherent positive externalities, also known as “Public Goods”. However, despite their multiple benefits, positive externalities are often not directly visible to consumers neither economically valued (Strengh2Food et al., 2021). Next to this, the GI sector is currently facing profound structural, regulatory and cultural changes, questioning its auto-justified contribution to SD. This current evolution should not be seen as a threat but rather an opportunity for GI systems to assert their sustainable performances.

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[5] Engilsh translation of *Conseil National des Appellations d’Origine laitières*
[6] English translation of *AOP laitières durables*
[7] English translation of *Cadre commun d’engagement*

However, GI members still lack concrete elements to understand and grasp the concept of SD, which makes it difficult to explicitly communicate it to the consumer (Casabianca and Touzard, 2009). Other obstacles to the mobilization of the concept of SD should be outlined: the involvement and lack of time of the consortium coordinators as well as the lack of tools adapted to concretely deploy the SD concept in the sectors (Forrey, 2010). This last point shows that evaluating economic, social, territorial and environmental performance is a priority for GIs that can take the form of well-chosen methodological frameworks (Lairez et al., 2017).

4 The generic challenge of defining, assessing and working towards sustainability

4.1 Defining sustainability

Since its official definition in 1987 in the Brundtland Report (WCED, 1987), the word sustainability has become a universal and mainstream concept that has been applied to each sector, agriculture included (Appendix 6). Today, the 'three pillars paradigm' is the most popular way to look at SD, illustrating an equilibrium between trade-offs related to the economic, environmental and social 'dimensions' of a defined system (Purvis et al., 2019). Although this conceptual approach is widely used, defining sustainability remains a much used and misused concept, thus often considered as an "a wicked issue" (Bell and Morse, 2008).
Nevertheless, researchers have tried to overcome this challenge by operationalizing this broad concept through the development of multi-criteria assessment frameworks in order to measure sustainability in food and farming systems.

4.2 Methodological paradigm

The literature on sustainability multi-criteria assessment frameworks reveals two broad methodological paradigms (Bell and Morse, 2001; Rey-Valette et al., 2008a): one that is expert-led or *top-down*, and one that is community-driven or *bottom-up*. The first approach finds its epistemological roots in scientific reductionism and is based on quantitative indicators to measure the complexity of the system. Hence, it does not consider the various perspectives of the stakeholders constituting this evaluated system (Reed et al., 2006).
The second paradigm is grounded in a *bottom-up*, participatory approach (referred to as the "conversational" approach by (Bell and Morse, 2008)). It draws on the importance of understanding the local context before conducting the evaluation and engaging local actors to gain meaningful perspectives on the local issues and thus to develop indicators suitable to the local context. In this regard, assessing and monitoring sustainability becomes an ongoing learning process for both communities and researchers (Freebairn and King, 2003).
A comparative table synthetizing the key characteristics of both approaches can be found in Appendix 7. Applied to the scope of food and farming systems, this latter approach is rather sparse in the literature as the top-down model is often privileged (Rey-Valette et al., 2008a).

4.3 Top-down sustainability assessment frameworks

The FAO distinguishes two approaches to evaluate the contribution of GIs to SD, depending on the focus of the study and expected finalities (FAO and OriGIn, 2020). The first approach is to develop a set of indicators designed for a specific system in order to monitor internal progress over time (Peano et al., 2014). The second option is to develop a generic grid of meaningful indicators so that the tool can be applied to different GI systems and enable comparison. The

FAO used the second approach when developing the SAFA (Sustainability Assessment of Food and Agriculture systems) tool (FAO, 2014).

4.3.1 At the international level: the SAFA tool

4.3.1.1 Presentation of the tool

Although a plethora of analytical frameworks designed to assess sustainability in farming- and food systems exist to date, only the FAO has put forward a holistic methodology for addressing this complexity at the value chain level (FAO, 2014).
SAFA evaluates sustainability along the entire value chain (production, processing, distribution and marketing of goods) according to the four components of sustainability, i.e., environment, social, economy and governance (Arfini and Bellassen, 2019). By providing a transparent and aggregated framework for assessing sustainability, SAFA seeks to become an international reference for sustainability methodologies within the food value chain and encourage good practices for GI producers (Arfini and Bellassen, 2019).
Among the more recent and contributing research using SAFA indicators, we can again refer to the Strength2Food (S2F) project, which analyzed the sustainability of 29 GIs based on 23 shared indicators (Arfini and Bellassen, 2019). Results are presented in radar charts for each evaluated product compared with their reference product (corresponding to the zero level) (Figure 3).

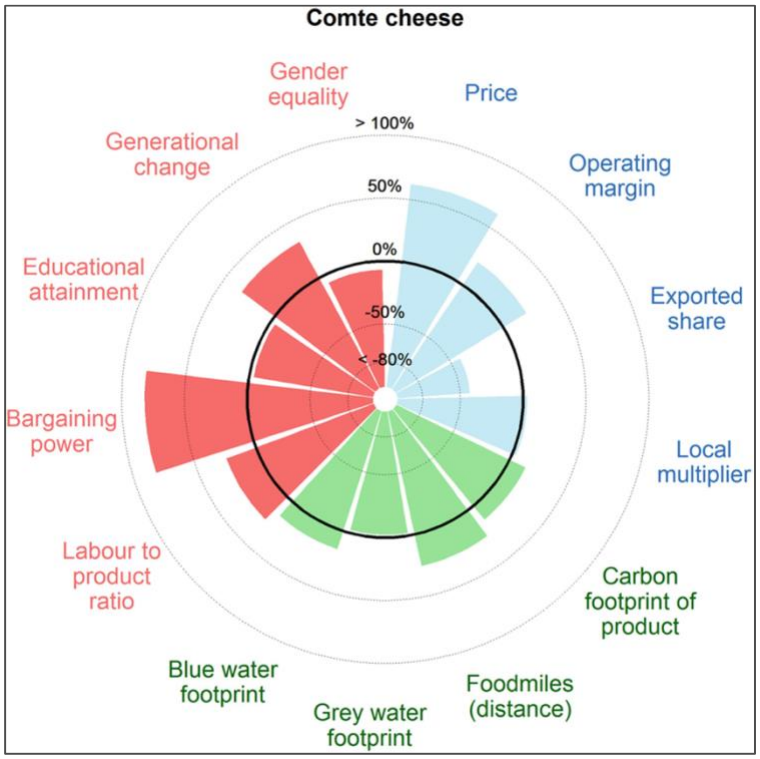

Figure 3: Sustainability performance of Comté PDO cheese according to SAFA indicators within the Strenght2Food project (Arfini and Bellassen, 2019)

4.3.1.2 Identified limitations

Any papers to date approach SAFA limitations, probably because most of the literature describing the tool are written by the FAO. As a result, an interview was conducted with Chema GIL, director of the Center for Agro-Food Economics and Development (CREDA), a private research foundation providing services to governments, public and private sectors. Chema GIL participated in the Strenght2Food project and thus was directly confronted to use the SAFA tool.

Therefore, gathering its point of view about the tool enabled it to grasp valuable insights. Its complete interview can be found in Appendix 8.
According to him, the biggest limitation of SAFA resides in its difficulty to be implemented and, in particular, to get access to the required data. With some 120 indicators, “it took two years to collect data”. With such a tool, monitoring the evaluated GI over the years is not easy because the system's current state may have evolved between the data collection and the publication of results. In addition, SAFA also requires a large amount of money due to the time needed for its implementation, which may hamper its utilization for any GIs. According to Chema GIL, when one seeks to build an evaluation framework with the ambition to be replicable to any GIs, one should keep in mind the two principles (1) to require a maximum of secondary data (already published) and minimize secondary data and surveys although “they complement information”; and (2) to have an easy monitoring tool allowing to replicate the evaluation “every year or every two years”. Indeed, “what is important is not the absolute values but changes over time”.

4.3.2 At the French level - the IDEA tool

4.3.2.1 Presentation of the tool

In France, the IDEA tool (Indicateurs de Durabilité des Exploitations Agricoles) is often presented as the framework of reference for normative and transparent farming systems sustainability assessments (Zahm et al., 2018). As its name indicates and unlike the SAFA tool, IDEA was conceived to analyze sustainability performances at the farm level solely. It is structured as a self-assessment grid with 53 indicators, covering the three dimensions of SD in agriculture: agroecological, socio-territorial and economic (Zahm et al., 2018). The tool has been built with a double objective: firstly, to serve educational purposes by teaching students agricultural sustainability in an operational way and secondly, to be used as a monitoring and decision making tool for farmers and advisors (Zahm et al., 2018).

4.3.2.2 Identified limitations

The most significant limitation that may appear when considering the evaluation of GIs is that IDEA is not adapted to the value chain perspective as the tool was simply not conceived for this purpose. Hence, the IDEA tool does not reflect the relationships between the agricultural practices, the products and the territory, yet characteristic of GI schemes (Jacquot, 2019).

4.4 Summary of current knowledge limitations and suggested orientations

Additional frameworks could be advanced, but most of them present the same limitations: they have been designed for the plot or the farm level only, thus not considering the value-chain and territory perspectives, key elements of any GI system.
To date, only the SAFA framework can draw a holistic analysis at the value chain level, but there is little consideration to the link to the territory. Besides, the inherent complexity of the tool hampers the appropriation by the local actors and thus its deployment. Finally, a general limitation to each attempt to develop an impact-assessment framework is the constant evolution of the system as soon as it has been studied (FAO and OriGIn, 2020). This represents an obstacle to the effective montoring of sustainability over time of one given GI.
All these considerations made, Qualimentaire, an organization supporting and promoting GIs in the Hauts-de-France Region (Northern France), is involved in this current situation and wish to bring its own contribution to the topic. Indeed, since 2018 Qualimentaire has been developing a sustainability assessment tool (QSAT) to propose a simple but holistic tool for evaluating GIs in France and beyond.

5 The Qualimentaire Sustainability Assessment Tool

5.1 Presentation of the Qualimentaire organization

Located in the metropole of Lille, Norther France, Qualimentaire is an association created in 1985 that brings together professionals from the agri-food sector, policy makers and organizations of consumers with the overall objective to increase the number of GI products in the Hauts-de-France Region. The guiding motivation of the group is “to support the agricultural and food sectors in the Hauts-de-France by enabling them to create value through the implementation of official quality signs, namely PDO, PGI and Label Rouge products” (Qualimentaire, 2021)

Hence, Qualimenaire concentrates its expertise on three main groups of action:

(1) To develop and structure the offer of GI products in the Hauts-de-France Region by promoting their specificities, supporting the agrifood sector for the implementation of new CoP and supporting GIs in the management and animation of the label once it has been set up.

(2) To produce reliable resources, in particular through the economic Observatory, and to carry out specific studies.

(3) To disseminate these resources to better inform and raise consumer awareness on the benefits of official quality labelled products and consequently enhance their consumption.

After over 30 years of expertise, Qualimentaire is, to date, a recognized structure at the region level and an undeniable intermediary for accessing to GI label for any kind of production.

5.2 Presentation of the Qualimentaire Sustainability Assessment Tool

5.2.1 Context of creation: the Economic Observatory of the SIQO food-chains

In order to reaffirm its role as a centre of resources and expertise on GI issues, Qualimentaire launched in 2017 an economic Observatory for the GI products in the Hauts- de-France Region in partnership with six other structures: the Regional Chamber of Agriculture, the Direction régionale de l'alimentation, de l'agriculture et de la forêt (DRAAF), the INAO, the Hauts-de-France region, as well as Bio en Hauts-de-France and Aprobio, the structures in charge of the national economic Observatory of organic agriculture (Figure 4)

Figure 4: The different organizations involved in the creation of the Economic Observatory of GIs in the Hauts-de-France Region in 2018 (Villegas, 2018)

This initiative was motivated by the will to benefit from reliable data on the annual economic situation of each GIs’ value chain in the region, data which were missing beforehand. Hence, this Observatory aimed to pool the economic data of the various involved partners (Figure 4) and thus to better grasp and communicate the effective contribution of GIs to the regional economy.

Jointly to the creation of this economic Observatory, a reflection was initiated by Qualimentaire to go beyond the sole economic dimension when looking at the added value of GIs by also looking at the environmental, societal and territorial dimensions. These considerations resulted in the creation of the Qualimentaire Sustainability Assessment Tool (QSAT), an original

framework designed to measure GIs sustainability performances integrating a multidimensional perspective of SD.

5.2.2 Preliminary objectives and characteristics of the QSAT

5.2.2.1 Overall objectives of the QSAT

The QSAT was designed to provide the different GIs with a simple but holistic tool in order to 1) evaluate the degree of sustainability at the GI level 2) identify the margin of progress, thus inducing concrete actions 3) monitor this progress over time by re-evaluating the GI sustainability on a regular basis (two to five years).
The QSAT is innovative as it is the first one that seeks to be applicable to every French GIs and directly accessible to local actors. Indeed, the QSAT, once improved, seeks to be used autonomously by GI actors as a self-assessment tool and thus to become a reference framework for GI sustainability assessment at the national scale.

5.2.2.2 Overall characteristics of the QSAT

Unlike the IDEA tool, the QSAT does not only focus on the farm level but take a systemic approach, i.e. considering the farm level, the value chain level (from the production to the processing stages) and the territory level. In addition, the QSAT seeks to be holistic, grounded on a multidimensional definition of sustainability considering the Economic, Environmental, Social and Territorial dimensions, the latter missing in the SAFA framework.
Each of these SD dimensions is characterized by criteria, in turn, declined in indicators, which are measured through quantitative and qualitative questions.
In 2020, the grid was constructed around 76 indicators distributed as follows (Table 1):

Table 1: Distribution of the 76 indicators included in the last version of QSAT (implementation on the Epoisses sector (Nussbaum, 2020))

Dimensions	Criteria	Number of indicators
Economic	Characteristics of the agricultural production	6
	Marketing aspects	8
Social	Valorization of the agricultural profession	4
	Governance and related dynamics	7
	Key elements of the heritage	7
	Animal welfare	1
	Quality of life and human well-being	6
Environmental	Ecosystem and human health	6
	Functional diversity	5
	Search for autonomy	5
	Environmental dynamics of actors	3
Territorial	The attractiveness of the production area	7
	Territorial synergies linked to the SIQO	7
	Maintaining agricultural activity and landscape preservation	4

The creation of the QSAT was built essentially on the IDEA tool, where a large proportion of indicators were selected or adapted from this framework. However, contrary to IDEA, three

different levels of scale were distinguished to adapt the scope no longer to the farming system but to the GI level.

- Indicators at the farm level

The first level of analysis enables to collect data on the characteristics and profiles of the actors (age, well-being at the workplace, involvement in the sector, etc.) and on the characteristics of their farming system (size of the farm, percentage of the GI activity in the total farming activity etc.).

- Indicators at the value chain level

This broader scale enables to collect information at a sub-system level by taking a transversal approach, considering the GI actors as connected value chains from the production stage to the processing stage of the product. Hence, indicators related to this level is, e.g. the fair distribution added value (Economic dimension) and the degree of interactions among the different actors (Social dimensions).

- Indicators at the territory level

The territory level constitutes the supra level of the evaluation. Indicators belonging to this category evaluate the impacts (positives and negatives) of the GI in its designated territory as well as the degree of anchoring and support by the local organization.

Each of the indicators, regardless of their qualitative or quantitative nature, are measured with a Likert scale scoring method, *viz*. a rating scale from 1 to 10 points divided into three gradients of sustainability: *insufficient sustainability*, *intermediate sustainability*, *good sustainability*.

5.2.2.3 The overall application method of the QSAT

Data collection

Any statistical sampling method is generally used, given the high amount of GI producers and time required for each interview. Thus a small but representative sample, i.e. including the different categories of GI actors, is often preferred.

The responsible person in charge of the evaluation (e.g. Qualimentaire practitioner) is in charge of collecting the information required by the QSAT. In doing so, semi-structured interviews are conducted based on the grid indicators.

Data processing

After the interviews, the practitioner usually processes the information by allocating a score from 1 to 10 for each indicator, according to the scoring method detailed above. Scores are then aggregated at the “criteria” and “dimension” levels, leading to an average score for each of the SD dimensions and criteria

Results presentation

The presentation of the results is also very much inspired by the IDEA tool as it is based on the traffic light approach (Figure 5). As already mentioned, the QSAT scoring method distinguishes three sustainability thresholds: *insufficient sustainability*, *intermediate sustainability*, *good sustainability,* corresponding respectively to the red, orange and green colour.

5.2.3 First applications of the QSAT

First applications of the methodology were carried out on two fields located in the Hauts-de-France region: the Label-Rouge Endives de pleines terres and the PGI-Volailles de Licques sectors in 2019. Results of these two evaluations were published by the economic Observatory (Groupement Régional pour la Qualité Alimentaire, 2019).

These works generated great interest from the INAO, which in turn wanted to test the tool in another territory: the Epoisses PDO cheese in Bourgogne Franche-Comté Region (Nussbaum, 2020). Finally, the QSAT framework was taken up by the French Research Institute INRAE in 2021 to measure the sustainability performances on the PGI-Volailles de l'Orléanais in the Centre-Val de Loire Region (Table2).

Table 2: Summary of the different QSAT applications and contexts since its creation in 2018

Date	**GI of implementation**	**Corresponding region**	**Responsible organization**
2019	Label Rouge Endives de pleines terres PGI Volailles de Licques	Hauts-de-France	Qualimentaire
2020	PDO *Epoisses* in Bourgogne Franche-Comté	Bourgogne Franche-Comté	INAO
2020	PGI Volailles de l'Orléanais	Centre-Val de Loire Region	INRAE

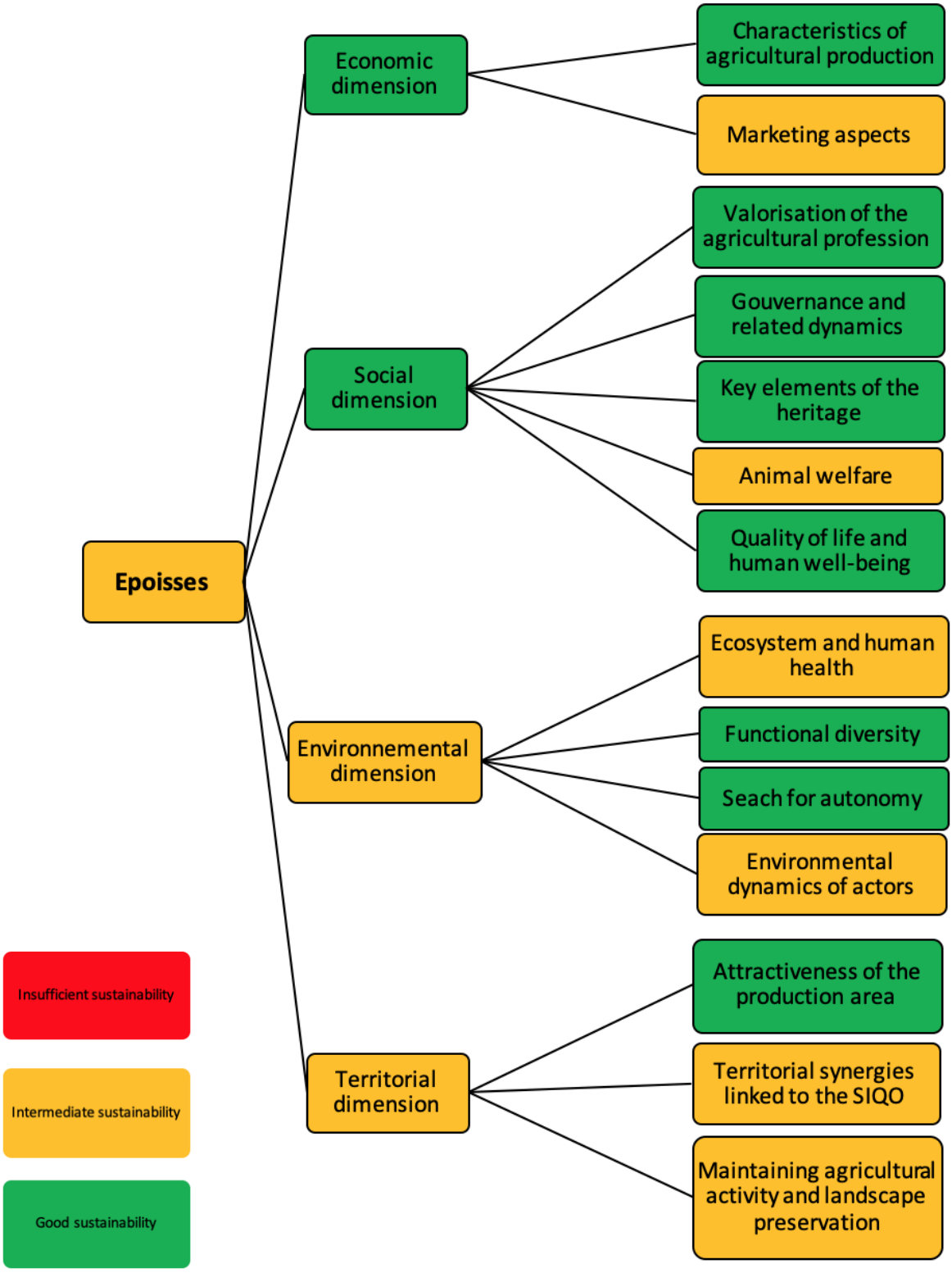

Figure 5: Sustainability assessment with the QSAT tool on the PDO-Epoisses cheese value chain (Nussbaum, 2020)

5.2.4 Limitations of the QSAT framework

The previous fieldworks (Table 2) enabled to test and ensure the *feasibility*, *validity* and *relevance* (Binder et al., 2010) of the QSAT on a diverse range of sectors and different quality schemes. Results showed that the methodology responds well to the first objective Qualimentaire objective, i.e. to generate a snapshot of the sustainability performances of the assessed GI, which enabled to identify margins of progress.
However, several limitations were pointed out by the Qualimentaire organization regarding the content of the tool as well as its application within the different stages described in Section 5.2.2.3.

5.2.4.1 Limitations of the content of the QSAT

Concerning the content of the tool, limitations are the following:

(1) The indicators used for now are mainly subjective, based on the opinion of the interviewees. This allows grasping stakeholders' perspectives on core issues of the GI sector (Bell and Morse, 2008). However, having too many subjective indicators may limit the robustness of the tool as different operators may have different perspectives on the same issues.
(2) The upper limitation goes together with the scoring method, only based on the Likert scale, which weakens the tool.
(3) Concerning the structure of the QSAT, many overlaps were observed, especially regarding indicators belonging to the Social and Territorial dimensions. In addition, governance aspects are integrated into the Social dimension as criteria. This dimension is gaining increased attention, especially within GIs systems, where it is considered a key element (FAO and OriGIn, 2020). Governance should thus be considered as a whole dimension as such.

5.2.4.2 Limitations of the application of the QSAT

Regarding the application of the tool, identified deficiencies were as follow:

(1) The collection of data is conducted in a somewhat "handicraft" manner: without any questionnaire, the practitioner in charge of the interview has to transcribe all the conversations what seems to be an exhaustive, time-consuming process. In addition, indicator scoring is handled in the following stage by the interviewer and not by the interviewee. Again, this leads to a complex data collection process and may result in a gap between the interviewee's perspective and the practitioner's one.
(2) Concerning data processing, no informatic tool does currently exist to automatize the process. This leads to complex calculations to aggregate scores and thus again a very time-consuming stage. This may hamper the appropriation of the tool by local actors as well as its dissemination in other territories.
(3) As a general note, any guiding manual for the application of the QSAT has been formalized until now, which impede the good understanding of the indicators and the appropriation of the tool difficult for potential new users.

5.2.4.3 General limitations of the QSAT

As a general comment, it is wise to acknowledge that even if the tool was several times reused by different organizations, the structure of the grid and well the application modalities have not been questioned since its creation in 2018. Another related challenge is the lack of a solid and clear procedure to select new indicators to increment the grid. Indeed, over the previous QSAT applications, new indicators were spontaneously added, based on the empirical experiences

and the practitioner's judgment, thus without well-defined guidelines. As stated by Dale and Beyeler (2001, p. 6) observe, the "lack of robust procedures for selecting indicators makes it difficult to validate the information provided by those indicators." Hence, this calls for the development of a more rigorous and transparent indicator selection process that will increase both the relevance and credibility of the tool. (Dale and Beyeler, 2001; de Olde et al., 2017b).
Finally, the QSAT is, to date, not able to fulfil its primary objective that is to become a sustainable assessment framework of reference for GIs. Indeed, any bank of indicators does currently exist, which could directly establish a diagnosis of one given GI, regardless of its sector.
These limitations pointed out, prompts for some needs for improvement.

6 Research objectives, guiding principles and chosen method

6.1 Research objectives

Following the demand of Qualimentaire, the present research aimed to consolidate the QSAT framework to overcome the limitations identified in Section 5.2.4. Given that it was too ambitious to develop a generic tool for each GI, all agricultural sector confounded, the work focused on developing a tool of reference for the dairy and cheese GIs at the French national scale and beyond.
In line with the Qualimetnaire requirements, the new QSAT should therefore fulfil the following objectives:

1. Be a user-friendly tool, i.e. simple in its application (regarding the data collection and processing stages), thus ensuring good monitoring;
2. Integrate more objective and quantitative indicators, scientifically validated to ensure the robustness of the grid;
3. Be holistic;
4. Be context-specific;
5. Be inclusive by considering each of the different actors constituting the GI and implying for the tool to be accessible to all GIs;e
6. Be action-oriented by driving management responses to the identified margin of progress.

Derived on these six objectives and inspired from the literature, especially from Bell- and Morse's and FAO postulates, six fundamental guiding principles were developed to guide the QSAT consolidation process.

6.2 Guiding principles for the research process

Principle 1: ***A user-friendly framework, simple to apply and to monitor***
In a fast-evolving world where new sustainability challenges arise constantly, the priorities may change (FAO and OriGIn, 2020). Therefore, it constituted an important objective to develop a user-friendly tool that is easy to apply and monitor to obtain a rapid diagnosis that can be reproduced regularly. With this regard, the QSAT framework should ensure that the initiatives undertaken towards sustainability are effective and correspond to the reality of the field over the years.

Principle 2: ***A scientifically robust framework***
As already stated, many sustainability frameworks already exist where some are even well recognized. Thus, the QSAT aimed to benefit from these indicators' datasets and capitalize on previous research and experiences. This process ensured the robustness and scientific validity of the new grid but also allowed to draw connections with reputed frameworks. This should

facilitate the appropriation of the QSAT by the actors external to the process and provide a common ground for dialogue and, eventually, for the design of new policies and initiatives.

Principle 3: ***A holistic framework***
As mentioned, many sustainability frameworks have focused on single dimensions of sustainability, thus not reflecting the complexity of the system evaluated. Thus, the new consolidated QSAT should embrace a holistic representation of the SD tailored for PDO systems and integrate the Governance component, considered a key dimension in GI systems (FAO-OriGIn et al., 2017).

Principle 4: ***A framework adapted to the specific context of the GI***
It was essential for the new QSAT to consider the intrinsic characteristic of the GI to be evaluated. This principle implied developing a set of indicators fitting the specific context of the assessed GI while being generalizable to all dairy and cheese GIs.

Principle 5: ***An inclusive framework***
This principle has a twofold purpose. First, it implied that all GI organizations should be able to engage in such a sustainability strategy, regardless of the degree of maturity of the GI and resource capacity. Thus, it is required for the framework to support GIs to undertake their sustainability analysis without incurring significant expenses and without facing barriers related to capacity or resources. Regarding possible limits to access to information that may occur very often, the QSAT aimed to be simple in its utilization, requiring minimum data collection and thus finding a good equilibrium between objective- and self-assessment indicators. Second, the inclusive approach ensured that each type of stakeholder constituting the GI organization was represented in the evaluation process.

Principle 6: ***A framework designed for action***
Finally, the QSAT was not only conceived to be an evaluation framework but one to go beyond the diagnosis and initiate a real change in the GI sector. Therefore, it aimed to encourage the producers to move from the diagnosis towards concrete actions to improve the current situation and construct a collectively desired future. This principle will thus have to be tested in the research design.

Therefore, the research question addressed in the present study was:

To what extend is it possible to consolidate and adapt the QSAT to the dairy and cheese GIs while applying these six principles requirements?

6.3 Choice of the method: an Action Research on the Maroilles PDO cheese

As identified in Section 4.2, two approaches are generally found when creating an assessment framework: the *top-down* and *bottom-up* approaches. Even if the two methods seem fundamentally opposite, it is possible and even advised to combine a participatory process with scientific background (Reed et al., 2006; Rey-Valette et al., 2008b).
This is the approach I went for by using an innovative “hybrid methodology”, mixing stakeholders’ and local concerns with scientific knowledge and support. This choice was motivated by the postulate that a good sustainability assessment framework is a framework that is used (Rey-Valette et al., 2010). Indeed, the new QSAT should make sense to the dairy and cheese GIs’ actors to ensure their understanding of the new grid indicators and their appropriation of the tool. This echoes Bell- and Morse’s discourse who state that to develop

multi-criteria indicators reflecting the multi-stakeholders individual perceptions, a participatory and soft system thinking should be privileged (Bell and Morse, 2008)

As a result, the present study was conducted on the research field of the **PDO Maroilles cheese** (Northern France) with Maroilles' actors.

Hence, the study had two intertwined objectives:

(1) First, to provide the Maroilles' actor with a sustainable diagnosis and while fostering collective and organisational learning on sustainability (1).

(2) Second, to use the Maroilles' field of research to develop and improve the QSAT to make it generic and transferable to every dairy and cheese GI while applying the six defined principles (see Section 6.1) (2).

This research drew on the Participatory Action Research methodology. Participatory action research or *engaged research* defines praxis where the researcher actively engages in a field and tends to solve local issues with the stakeholders (*Action* part) while generating scientific knowledge from this field inquiry (*Research* part) (Levin and Ravn, 2007). Hence, the first objective addressed the *Action* part while the second objective constituted the *Research* part of the Participatory Action Research.

As the action researcher of the present study, I was thus in charge of facilitating the participatory process of consolidating the QSAT and implementing it on the PDO Maroilles and simultaneously collecting and analysing data to meet the research objectives and answer the research question.

PART 2: Material and methods

In line with the guiding principles defined in Section 6.2, I opted for an **innovative stepwise methodology**. It required a total of five phases distributed in fourteen chronological steps.
Each step was the result of work carried out either individually by myself in the role of the *Researcher* or in the role of the *GI-practitioner* (or *facilitator*), where I collaborated with the Maroilles' actors. This step-by-step process is illustrated in Figure 6. Table 3 gives further details on the methods and tools engaged.

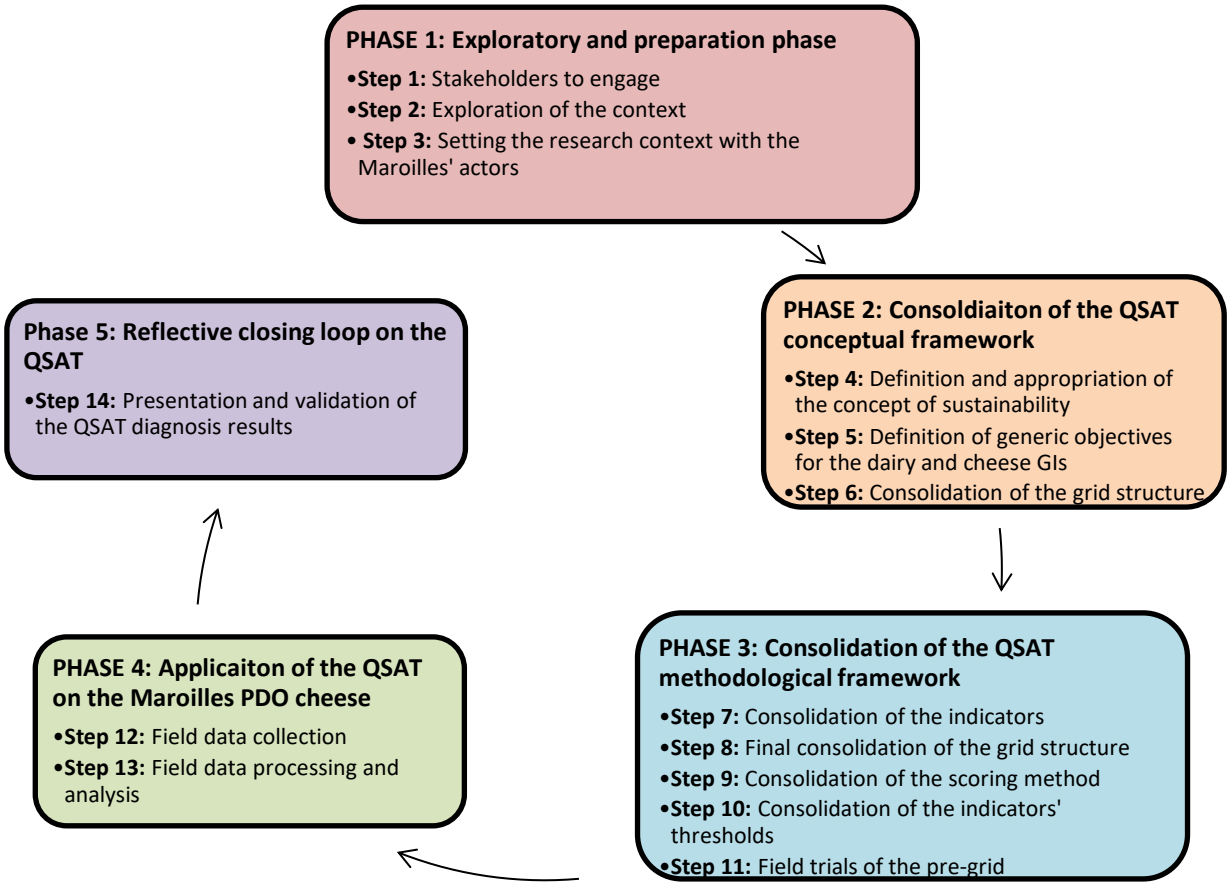

Figure 6: Methodological research design, adjusted from (de Olde et al., 2017a)

During **Phase 1**, I identified the stakeholders to engage in the process, conducted preliminary research on the Maroilles context, and set up the context of the study with the Maroilles' actor. This latter step was conducted within a first participatory workshop.
Within **Phase 2,** I aimed to consolidate the conceptual framework of the QSAT. The starting point was to collectively define the concept of sustainability applied to GI. From this definition, sustainability objectives and related themes were defined, addressing the specific issues of the dairy and cheese GIs.
Phase 3 was designed to consolidate the methodological framework of the QSAT, namely each methodological step leading to the elaboration of the sustainability diagnosis. Hence I designed two additional workshop to collectively review the indicators, scoring method and thresholds. I then tested the pre-consolidated QSAT on the Maroilles field of study.
In **Phase 4** the applicability the consolidated QSAT through its implementation on the Maroilles' field. Based on the new QSAT indicators, data were collected to generate the sustainability diagnosis of the Maroilles PDO cheese.
Phase 5 was expected to gather constructive feedback from the Maroilles' actors on the grid in presenting them the sustainability diagnosis during a final participatory workshop.

Table 3: Methodological research design illustrating the methods, tools and persons engaged

TIME LINE	***RESEARCH PROCESS***		***METHODS, TOOLS OR PERSONS ENGAGED***
FEBRUARY	**PHASE 1** – Exploratory and preparation phase	**Step 1** - Identification of stakeholders to engage	Contact resource persons
		Step 2 – Exploration of the context of the Maroilles system	Literature review Semi-structured interviews
		Step 3 – Setting out the context of the research with the Maroilles' actors	First participatory workshop
		***Expected results*:** **- Background information to prepare for the grid consolidation phase - The mobilization of a pioneer group made of Maroilles's actors and the mobilization of other actors for the scientific knowledge and support**	
MARCH	**PHASE 2** – Consolidation of the conceptual framework of the QSAT	**Step 4** – Definition and appropriation of the concept of sustainability	First participatory workshop
		Step 5 – Identification of generic objectives for the dairy and cheese GIs	GI-practitioner and group of GI-experts
		Step 6 – Consolidation of the grid structure	GI-practitionner
		Expected results: **A reviewed conceptual framework grounded in a collectively agreed definition of sustainability from which derived generic objectives and themes for the dairy and cheese GIs.**	
APRIL	**PHASE 3** – Consolidation of the methodological framework of the QSAT	**Step 7** – Consolidation of the indicators	Second participatory workshop
		Step 8 – Final consolidation of the grid structure	GI-practitioner and group of GI-experts
		Step 9 – Consolidation of the scoring method	GI-practitioner and group of GI-experts
		Step 10 – Consolidation of the indicators' thresholds	Second participatory workshop
		Step 11 – Field trials of the pre-grid	On-farm structured interviews
		Expected results: **A depth-reviewed grid, ready to be implemented on the field of the Maroilles PDO cheese to generate the sustainability diagnosis**	
MAY - JUNE	**PHASE 4** – Applicaiton of the QSAT on the Maroilles PDO cheese	**Step 12** – Field data collection	On-farm structured interviews
		Step 13 – Data processing and analysis	Excel processing
		Expected results: **SA holistic and systemic sustainability diagnosis based on the QSAT indicators and ready to be discussed with the Maroilles' actors**	
JULY	**PHASE 5** – Reflective closing loop on the QSAT with the Maroilles PDO actors	**Step 14** – Presentation and validation of the QSAT diagnosis results by the Maroilles actors	Final participatory workshop
		Expected results **- Pro-active discussion and the reflection on the results and the development of the QSAT - Prioritized objectives and drafted concrete actions towards these objectives**	

1 Phase 1: Exploratory and preparation phase

Within Phase 1 I aimed to take first sounded decisions (also referred to as preliminary choices by Bockstaller et al. (2008)) regarding the stakeholders to engage (Binder et al., 2010; Reed et al., 2006). I then expored the field of study, i.e. the Maroilles PDO, essential prerequisite before starting the QSAT consolidation process.

1.1 Step 1: Identification of stakeholders to engage

1.1.1 Mobilization of the productive sphere: the Maroilles' actors

Through consultation with the Maroilles' coordinator, I identified Maroilles' actors willing to be part of the research. This was done is a somewhat informal fashion as a group was already formed by the Maroilles' Board to deal with sustainability topics. This group was called the *Maroilles Sustainability Committee*[8] , and it thus appeared judicious to collaborate with this newly created group

The Maroilles Sustainability Committee was created in July 2020 to respond to societal and regulatory pressures by defining concrete actions to better integrate SD in the sector. This group comprised board members and representses all categories of operators present in the governance model of the Maroilles, bringing together three milk producers, one farmer's cheese maker, and one industrial cheese maker. It is supervised and facilitated by the Maroilles' coordinator (Table 4).

Table 4: Members of the Maroilles Sustainability Committee

Consortium representative	The coordinator of the Maroilles' consortium
College of cheese makers	One industrial cheese maker
	One farmer's cheese maker
College of milk producers	Three milk producers

I thus involved this group of Maroilles operators in the grid consolidation process through a series of three workshops along the research process (Table 5). In addition, a final workshop expended to all Maroilles' members was organized at the end of the study to discuss the final results.

[8] English translation of *Groupe Durabilité Maroilles*

Table 5: Detail of the participatory workshops during the whole research process

Organized workshops and corresponding timeline	Participants	Main objectives	Secondary objectives
First workshop - early March 2021	Maroilles' Sustainability Committee	**Consolidation of the QSAT conceptual framework:** - Definition and appropriation of a shared vision of what is sustainability adapted to PDO. - Identification of issues related to the Maroilles' sector to build sustainability objectives, generic to all the dairy and cheese GIs.	Setting the context of the research with the actors (presentation of the scope of the study and identification of enabling conditions to make the research successful)
Second workshop – mid-March 2021	Maroilles' Sustainability Committee	**Consolidation of the QSAT methodological framework** - Co-construction of new indicators	Addition of targets' categories of actors
Third workshop – April 2021	Maroilles' Sustainability Committee	**Consolidation of the QSAT methodological framework** - Consolidation of the indicators' thresholds - Indicators' weighting	Define criteria for selecting a comprehensive sample of Maroilles' actors to be interviewed (anticipation of the data collection step).
Final workshop – July 2021	All the Maroilles' operators invited	**Reflective closing loop on the QSAT** Presentation of the generated sustainability diagnosis for discussing the results and the QSAT consolidation process as well as drafting concrete actions.	

1.1.2 Mobilization of the cognitive and institutional spheres: the group of GI-experts

Next to the Maroilles group, I created a transdisciplinary group of GI experts in order to bring scientific expertise and external knowledge to the research process. This group gathered various experts from France and abroad, mixing research and academic institutions (INRAE, the Engineering School of Purpan), organizations defending and promoting GIs (FAO-OriGIn, AREPO Quality), as well as political and administrative institutions (INAO, CNAOL and the Hauts de France Region) (see Figure 7). A detailed list presenting each organization is provided in Appendix 9.

Researchers and academia were legitimate partners to include because of their technical skills, particularly for selecting new measurable indicators. They could indeed provide solid support and, therefore, scientific validity to the construction of the new grid. The political institutions had a political legitimacy to intervene in the process as their association might lead to the replicability if not the institutionalization of the QSAT.
This group of GI-experts never interacted with the Maroilles actors apart in Phase 5. Two representatives from the CNAOL and the INAO institutions were present during the final workshop. Finally, the group of GI-experts did not have an executive decision-making role, but rather a consultative function for my work when essential decisions needed to be made or points to be discussed.

Figure 7: Members of the group of GI-experts

1.1.3 Summary of the different actors engaged

Hence, this process led to the mobilization of transdisciplinary experts, internal or external to the Maroilles sector, who all had interests in the research and contributions to bring. These stakeholders could be differentiated into three different spheres of knowledge:

- *The productive sphere,* represented by Maroilles GI members;
- *The cognitive sphere,* represented by research and academic institution as well as other associations promoting and defending GI systems;
- *The institutional sphere,* represented by political and administrative organizations.

The figure below illustrates well these tripartite interests (see Figure 8).

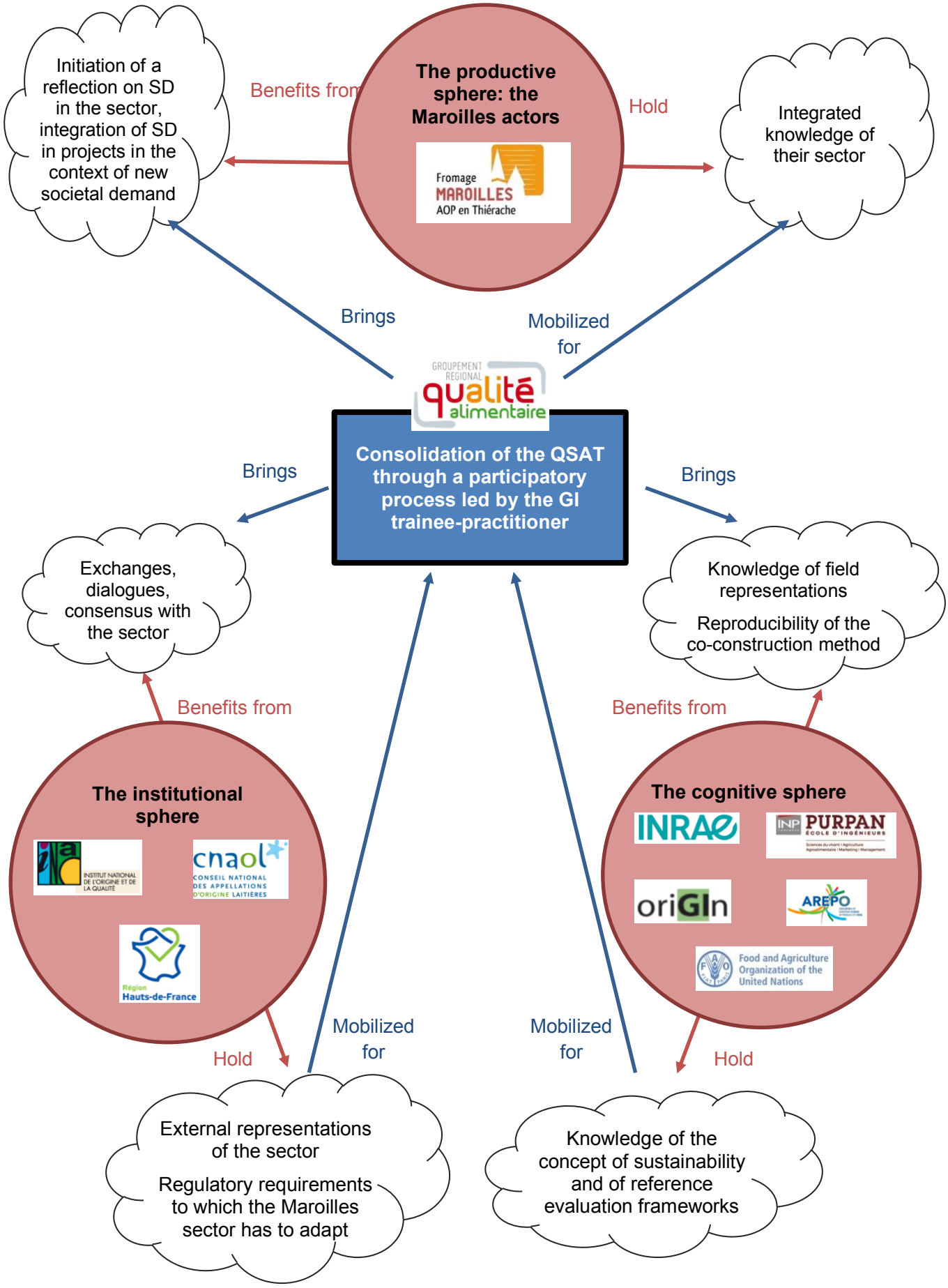

Figure 8: Scheme of the tripartite interests

1.2 Step 2: Exploration of the context of the Maroilles system

During the first month (February), I carried out a prospection phase on the Maroilles PDO in order to grasp a good overview of the current context and thus to gain pre-knowledge before initiating the QSAT consolidation process. I thus collected background information, mainly based on internal documentation and conversations.
I first conducted a semi-structured interview was conducted with the Maroilles' coordinator and the current president (Appendix 10), which aimed to cover key topics such as the history of the Maroilles' sector, its mode of governance, marketing aspects, communication strategy, involved partners, as well identified strengths and weaknesses. I then performed a detailed review of the CoP in order to understand the Maroilles specifications. Particularly, this step aimed also to apprehend where the sector might stand on the topic of SD, i.e. if it was a nascent issue for the actors, if they already understood the value *etc*.
Finally, a conducted a first participatory workshop to explore these questions deeply. A first session was set to better know where the initiative to create the Sustainability Committee came from and how the members understood the concept of sustainability. We then performed a collective analysis of the Maroilles CoP through a SWOT analysis, which enabled to identify the Maroilles PDO's strengths, weaknesses, opportunities, and threats.

1.3 Step 3: Setting out the context of the research with the Maroilles' actors

1.3.1 Presentation of the scope of the QSAT assessment

The final step of Phase 1 aimed to set out the research context with the Maroilles' actors. To this purpose, I allocated time to present the QSAT grid and the intended objectives the grid should fulfil. I used a visual representation allowing the actors to grasp the scope of the assessment tool.

1.3.2 Identification of the enabling conditions to make the project successful

Finally, the last session of the first workshop was designed to identify key conditions for enabling and maintaining good group dynamics among the actors. This final step was considered essential as the actors were not used to work together on a topic they were not familiar with, such as sustainability. Besides, it was the first time that Qualimentaire collaborated with the Maroilles sector what justified this step. To this end, I asked the participants to reflect on the following question:
"According to you, what are the key factors driving the success of such a study? "
Answers were collectively shared and I simultaneously clustered them into word clouds allowing a visual representation.

2 Phase 2: Consolidation of the conceptual framework of the QSAT

The second Phase aimed to review the conceptual framework of the grid, in other terms to operationalize the broad concept of SD into tangible sustainability objectives specific to the dairy and cheese GIs. , the first participatory workshop was thus designed to identify the representations of Maroilles' actors to build concrete objectives tailored for the cheese and dairy GIs. This collective consultation ensured the clear and transparent consolidation of the conceptual framework, which would, in turn, guarantee the good appropriation of the grid (Lairez et al., 2017).

2.1 Step 4: Definition and appropriation of the concept of sustainability

In order to review the conceptual framework, the first step was to share a common language and vision of what is SD and what does it mean applied to a PDO sector such as the Maorilles PDO.

This step was especially of importance as the Maroilles' actors might not be familiar with the concept.
I thus started facilitating the workshop by presentating a diagram of SD which represented the three familiar dimensions of sustainability (economy, environment and social) but also the governance and the territory dimensions (Figure 9). This visual graph enabled the actors to discuss the meaning of each dimension applied to the scope of a PDO system and thus to appropriate the concept of sustainability.

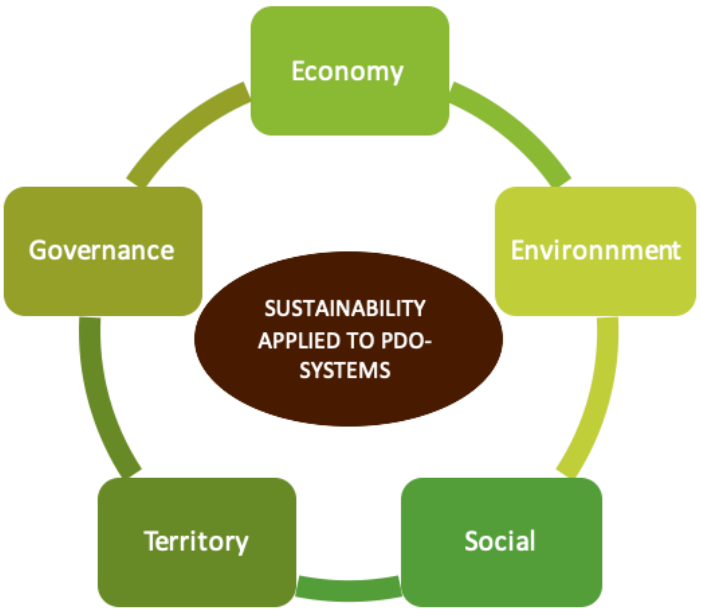

Figure 9: Diagram of the 5 dimension of SD adapted to the PDO-systems and presented during the first workshop

2.2 Step 5: Identification of generic objectives for the dairy and cheese GIs

2.2.1 Identification of sustainability objectives specific to the Maroilles PDO

Once the group agreed upon the collective vision of SD, I facilitated another aiming to make identify the major issues encountered by the Maroilles' actors regarding these five dimensions of sustainability. The expected result of this session was to translate these issues into tangible objectives to be implemented into the new QSAT.
To this purpose, I used the "critical method loop" (CASDAR, 2014). Based on the framework of SD adopted by the group beforehand (see Figure 9), each participant received a coloured sheet of paper corresponding to one dimension of the SD, i.e. either the "Economy-", "Social-", "Environment-", "Governance" or "Territory-" sheet of paper.
I then invited the participants to reflect on the five following questions:
"What do you think is important to take into account for the sector, for its activity and its future, considering the:

- Economy;
- environmental relations and impacts;
- social aspects;
- organizational (internal and external), which corresponds to governance;
- and the Territory?"

For fifteen minutes, the participants had to write down their ideas on the assigned paper. Afterwards, the sheets rotated, and another reflection time was given. This process was repeated

four times so that each participant could tackle each SD dimension. They could add to the previously written ideas and formulate new ones but in no case delete some.

Figure 10: Maroilles Sustainability Committee stakeholders during the critical loop activity - first workshop

At the end of the activity, a collective reflection time was set, allowing each participant to freely share their thoughts and to react to each other perceptions. This inclusive approach enabled me to collect participants' issues from the paper sheets but also from the discussions.
After the workshop, I translated the collected information once again into word clouds. Five world clouds were thus created, according to the five dimensions of SD defined in the conceptual framework of the QSAT.

2.2.2 Scaling up the Maroilles' objectives to fit all the dairy and cheese GIs

Finally, I compared the 18 objectives from the CNAOL Charter of Commitments (refer to Appendix 5) which are general to all the cheese GIs, with the Maroilles' specific objectives from the word clouds. This cross-analysis enabled to scale up the Maroilles' objectives in order to obtain a set of generic (thus transferable) and holistic (i.e. based on five sustainability dimensions) objectives. This set of objectives constituted the foundation of the new QSAT grid.

2.3 Step 6: Consolidation of the grid structure

In order to draw bridges between similar frameworks (see *Principle 1* from Section 6.2), the whole structure of the previous QSAT was re-organized to fit the same semantic as the CNAOL's grid (refer to Appendix 5). Given that the CNAOL framework was going to be taken up by a large number of PDO operators throughout France, it seemed indeed judicious to build correspondences with the QSAT to be consolidated. This decision was agreed on with the GI group of experts and was motivated by the objective to avoid any confusion by the PDO-actors when using the two frameworks. Therefore, the I carried out a reorganization of the previsous QSAT to fit the same structure as the CNAOL's grid, i.e. according to *SD dimensions – themes – objectives – criteria* and finally *measurable indicators*. It resulted in a new structure based on different levels (Table 6):

- 1st level: The **dimension** (or pillar) corresponds to one of the SD pillars from the validated framework.
- 2nd level: The **theme** breaks down the general dimension into more concrete units.

- 3rd level: The **objective** corresponds to the big issues raised by the Maroilles-PDO stakeholders cross analyzed with the CNAOL's grid as presented above.
- 4th level: The **criterion** is a sub-decomposition of the objective.
- 5th level: The **indicator** makes it possible to measure the criterion; it can be quantitative or qualitative, subjective (based on the interviewee's perception), or objective.

Table 6: QSAT new structuration model adjusted from the CNAOL's grid

SD dimension level	Themes level	Objectives level	Criteria level	Indicators level
One sustainability Dimension	Theme X	Objective 1.	Criterion 1. A.	Indicator 1.A.a.
				Indicator 1.A.b.
				Indicator 1.A.c.
			Criterion 1.B.	Indicator 1.B.a
				Indicator 1.B.b.
				Indicator 1.B.c.
				Indicator 1. B.d.
				Indicator 1. B.e.
		Objective 2.	Criterion 2.A.	Indicator 2.A.a.
				Indicator 2.A.b.

In the meantime, I also re-formulated themes, again in line with the CNAOL ones and according to the the objectives just defined. I also operated for an overall reclassification of the previous QSAT criteria, especially regarding the territorial and social dimensions where several overlaps occurred.

3 Phase 3: Consolidation of the methodological framework of the QSAT

Phase 3 targeted the consolidation of the methodological framework of the previous grid, i.e. all the essential methodological choices that enables to move from the available collected data to a final sustainability diagnosis. It thus aimed to review the chosen indicators, the final grid structure, as well as the scoring method and the indicators' thresholds.

3.1 Step 7: Consolidation of the indicators

From the defined objectives common to every dairy and cheese GIs, derived the consolidation of indicators. Following the Qualimentaire requirements, I elaborated a procedure to review and select new indicators. The newly formed or selected indicators should have to:

- be holistic (i.e. considering the five dimensions of the sustainability concept defined in Phase 1);
- be systemic (i.e. addressing the different levels of the evaluated system)
- be context-specific (i.e. fitting the local context but at the same time responding to the generic objectives defined in Phase 2);
- integrate a wise equilibrium between quantitative and qualitative indicators;

- be inclusive (i.e. considering all categories of the GI members constituting the governance model).

3.1.1 Capitalization of existing relevant indicators

First of all, I conducted a review of sustainability indicators on recognized evaluation frameworks in the area of agriculture and food sustainability. In addition to the 2020-version of the QSAT, I thus analyzed seven recognized SD databases to select relevant indicators for compilation.
In order of importance, these database were:

- The IRQUALIM (Institut Régional de la Qualité Alimentaire d'Occitanie) assessment grid, developed in the context of a master thesis in 2018 and tailored for origin and quality linked sectors[9] ;
- The *Diagagroeco* tool, a framework co-developed by the French Ministry of Agriculture to assess the agroecological performances at the farmer scale;
- The FAO-OriGIn framework, a meta-analysis of sustainability indicators tailored for GI systems[10] ;
- The "INRAE grid", an updated version of the Qualimentaire grid developed at the same time as the present study by the INRAE and implemented on the *Volailles de l'Orléanais* PGI (Centre-Val de Loire region);
- The *Diagagroeco* tool, a framework co-developed by the French Ministry of Food and Agriculture to assess the agroecological performances at the farmer scale;
- The CNAOL Charter of Commitment;
- The current framework of indicators used to label HVE (High Environmental Value) farms in France[11].

Some indicators were directly sourced, whereas others were adapted or inspired by these frameworks. Some indicators were directly sourced, whereas others were adapted or inspired by these frameworks. What is more, I added two extra columns to address the indicators typology, i.e., whether the selected indicators are *qualitative* or *quantitative* and *subjective* or *objective*. According to the FAO and OriGIn, *quantitative* indicators require the collection of numeric data or data derived from a mathematical formula conversely to the *qualitative* indicators. *Objective* indicators, in turn, imply collecting information resulting from a third-party source or obtained internally but with an ensured rigour; conversely to the *subjective* indicator, which corresponds to perceptions, thus not reflecting a large or representative sample (FAO and OriGIn, 2020).

3.1.2 Co-construction of new indicators

I then facilitated a second participatory workshop with the Maroilles' Sustainability Committee to collectively validate the extracted indicators from the aforementioned databases.
We thus performed a collective review of the whole grid, throughout each indicator was screened one by one. The Sustainability Committee was in charge to add new indicators to further enrich the QSAT grid. In accordance with Principle 5 - *An inclusive framework* -, we selected indicators to cover each of the categories of Maroilles' actors to be interviewed, i.e. the milk producers, the cheese makers and the organization's representatives. The second workshop was thus also the opportunity to discuss which target one given indicator was best suited.
Conversely to the first participatory workshop, I deliberatively chose to use any specific facilitation activity to let a good flow for discussion and consensus decision-making.

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[9] Bevan, (2018)
[10] Vandecandelaere et al., (2021)
[11] Ministère de l'Agriculture et de l'Alimentation, (2019)

3.1.3 Indicators weighting

The final stage of the consolidation of the indicators consisted in weighting them. This was an innovative step as it was the first time that weightings with the QSAT. Several weighting methods can be found in the literature (Rey-Valette et al., 2008a; Bell and Morse, 2008; Gasparatos, 2010) when designing multi-criteria assessment methods. For participatory approaches like in the present study, weightings are commonly based on "intuitive assessment of experts" (Bossel, 2002, p.2), experts being, in the present case, the Maroilles' stakeholders.
Therefore, I organized a third participatory workshop involving the Sustainability Committee where the main objective was to defined weightings. I thus asked participants to attribute 1 to 3 points per indicator, each point corresponding to a multiplier coefficient for the future indicator score. Again, I used the collective discussion and decision-making process.
Question about the replication of the indicator's weight at the other grid levels, i.e. the *SD dimensions – themes - objectives criteria,* was raised with the GI experts. Hence, a test comparing both methods (with replication and no replication of weightings) was performed. It resulted in very similar sustainability scores regardless of the method used. Consequently, it was decided with the group of GI experts to keep the easiest method, thus the weightings at the indicators' level only.

3.2 Step 8: Final consolidation of the grid structure

After the formulation of tangible objectives (Step 5: Identification of generic objectives for the dairy and cheese GIs) and the selection of relevant indicators fitting the Qualimentaire requirements (Step 7: Consolidation of the indicators), I re-organized these added indicators according to the grid structure defined in **Step 6: Consolidation of the grid structure**. I created new themes and criteria derived from the consolidated indicators and grid objectives. A final review of the grid structure was then performed by the GI experts to ensure that each element was well-placed in its respective grid category and that any overlaps between the indicators occurred.

3.3 Step 9: Consolidation of the scoring method

As already mentioned, the previous data conversion model of the QSAT was only based on a Likert scale, i.e. using a rating scale ranging from 1 to 10 points, divided into three thresholds of sustainability (red, orange and green traffic lights). As this approach was deemed too simplistic to reflect the reality of the field, it was decided by the group of GI experts to review this model in order to get a finer sustainability diagnosis.

3.4 Step 10: Consolidation of the indicators thresholds

In addition to the weightings, I tailored the third workshop to consolidate the indicators' thresholds also. I thus used the same process than for the indicators' consolidation which occurred in Step 7: Consolidation of the indicators: we screened the entire grid, with this time a focus on the thresholds. This step allowed to validate the already existing thresholds, adapt some to the local context or create new ones from scratch while bearing in mind the new scoring method defined in Step 9: Consolidation of the scoring method.

3.5 Step 11: Field trials of the pre-grid

The ultimate step of Phase 2 was to test the "pre-grid" under real conditions with on-farm interviews trials. The main purpose of these field trials was to validate the indicators, i.e., to verify their relevance (e.g. are the indicators and the corresponding thresholds fitting the reality of the sector?) and to verify the operationality of the grid, also referred to as "feasibility" by Binder et al., (2010)

(e.g. is there the available data on the field required by the indicators ?). Finally, this last step was designed to help me to the next phase – *Phase 4: Implementation of the QSAT on the Maroilles PDO cheese*– especially regarding the time management for the interviews and the good understanding of the questions by the interviewees.
Consequently, I conducted three individuals on-farm direct interviews with members of the Maroilles Sustainability Committee belonging to the three representative categories of actors: one milk producer, one farmer's cheese producer and one cheese manufacturer.

4 Phase 4: Implementation of the QSAT on the Maroilles PDO cheese

Once the conceptual and methodological frameworks were consolidated and the pre-grid tested under real conditions, the QSAT was ready to be tested on the Maroilles-PDO at a larger scale.

4.1 Step 12: Field data collection

4.1.1 Sampling method

Before going into the field, the question of the representativeness of the surveys was addressed. According to Rey-Valette et al. (2008), there are generally two types of methodologies used to determine a sample; the statistical and comprehensive approaches. Due to time constraints to use a statistical representative sample and because it appeared more consistent with the participatory and inclusive process, I decided to use the comprehensive method.
Henceforth, several conditions were agreed upon during the third participatory workshop in order to define a diverse sample of Maroilles' actors to be interviewed.
The formulated conditions were:

- To have a good balance between each category of operators, i.e. milk producers, farmer cheese producers and manufacturers, as much as possible proportional to their weight (in number) in the GI organization.
- To have a good equilibrium between the milk producers belonging to different dairy companies, as much as possible proportional to the weight (in number) of these companies regarding the GI organization.
- To have good representativeness in the ages of the interviewee as well as their degree of seniority in the GI organization.
- To have a good equilibrium between operators coming from the two regions constituting the Maroilles territory (Nord and Aisne departments).

4.1.2 Data collection method

In order to collect data on the field through the consolidated QSAT, I converted indicators from the QSAT into online questionnaires using the *Google Form* software.
The choice to not use the initial *Excel* file where the QSAT grid originated from was motivated by the following reasons:

- For the me as the interviewer, it enabled to make the data entry easier and thus to minimize input errors;
- For the interviewee, it enabled to read the questions and to have an overview of the answers modalities throughout the interview and thus to better appropriate the questions.
- Finally, it also made it easier for the data processing next phase, as all the collected could be compiled into a same online file and could be automatically converted into an *Excel* file for analysis.

Consequently, I created three different questionnaires according to the three target categories of actors to be interviewed identified in Step 7: Consolidation of the indicators, namely the cheese

makers (including the manufacturers, farm cheese producers and ripeners) – the milk producers – and the representatives of the Maroilles' consortium (referring to the coordinator and president) (Figure 11). A snap-shot of the *Milk producers questionnaire* for the questions of the "Social part " can be found in Appendix 11.

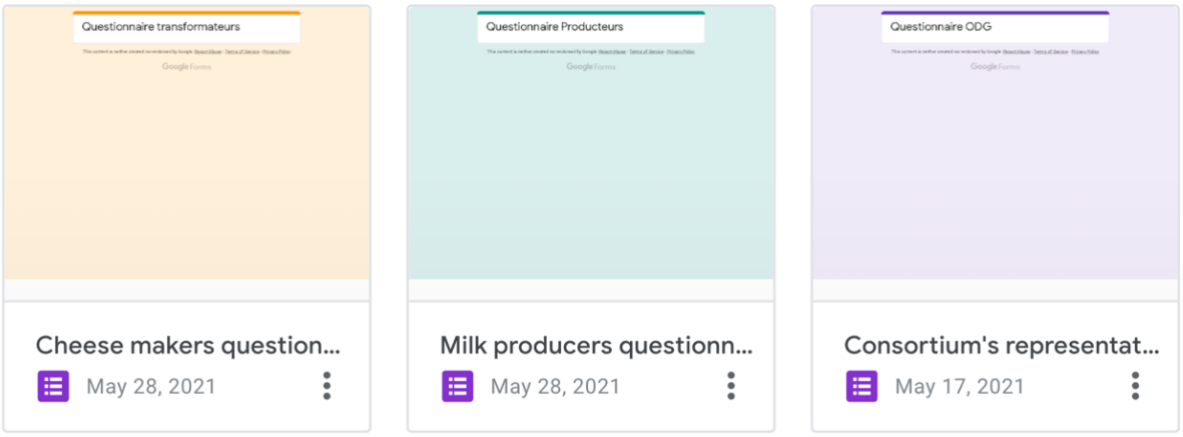

Figure 11: Google forms per category of Maroilles' actors and used for data collection

Likewise the pre-grid field testing, I conducted individual direct interviews based on the QSAT questions.

4.2 Step 13: Data processing and analysis towards the sustainability diagnosis

This step consisted in analysing the collected data in order to generate the Maroilles sustainability diagnosis.

Data from the three administrated questionnaires were first analysed individually according to the methodological choices detailed above, i.e., converting tem into sustainability scores and weighting. The scores of each indicators were then compiled and aggregated to obtain an average score of all categories of actors combined. For this aggregation process, the question of the weight of the actors' categories was raised. It was agreed on with the GI-experts to give the same importance to each group, regardless of the sample size, as each of the actors had the same weight in the governance model of the Maroilles.

Scores were not only calculated at the indicators' level but also at each of the different grid structural levels (*SD dimension*, *themes*, *objectives*, *criteria*) to allow for zooming in or out in the diagnosis.

To allow for a more visual representation of the results and for the purpose of the following next Phase, I also created spider graphs and keept the traffic-light approach as likewise in the previsous QSAT version.

The spider-graph mode of representation allows good visualization of the situation by comparing different axes of sustainability, which makes it possible to quickly identify margins for progress (Rey-Valette et al., 2008). Although this type of representation is common, it is not necessarily usual for the actors concerned. Consequently, I consulted the group of GI experts and the Maroilles Board for validation before starting Phase 5.

5 Phase 5: Reflective closing loop with the Maroilles PDO actors

5.1 Step 14: Final participatory workshop

Phase 5 aimed to present the sustainability diagnosis to the Maroilles' actors in order to discuss the results and the application of the tool. To this end, I organized a final participatory workshop not only designed for the Maroilles Sustainability Committee but involving all the Maroilles' producers willing to participate. Representatives from the group of GI experts were also invited.
The workshop was planned to last four hours and had the two main purposes:

(1) to collectively discuss the diagnosis results in order to validate the accuracy of the QSAT and simultaneously to reflect on the application of the QSAT.

(2) to induce an action-oriented process by moving from the diagnosis towards feasible concrete actions.

Inspired by the Multi-Stakeholder Partnership Tool Guide (Wageningen Centre for Development Innovation, 2012), I structured the workshop around a particular series of six stages as illustrated in Figure 12 and summarized in the following parts.
The planning of the workshop can be found in Appendix 12 and the detailed description of each session op in Appendix 13.

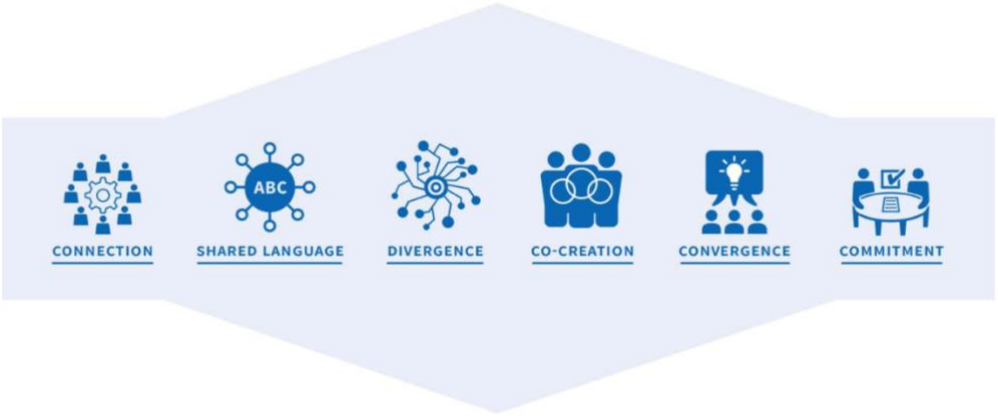

Figure 12: The stepwise process for the final participatory workshop (Wageningen Centre for Development Innovation, 2012)

5.1.1 The connection stage: a short Icebreaker

Before getting into the substance, I set an informal session designed to get to know each other, create a friendly atmosphere, and energize the participants. To this purpose, I addressed three casual questions to the participants, which required moving away in a specific room's corners depending on their responses.

5.1.2 The shared language stage: the setting out of the context

This part aimed to provide to the participant's elements of context, especially by addressing the questions: "Why this study?" – "How was this study conducted?" – "Why this workshop?". I thus introducted the workshop with a short presentation of the research pocess and let the floor to the members of the Sustainability Committee to share their feedback on the process. This was followed by short presentations of the INAO and CNAOL representatives which explained their roles and missions. Finally, I presented the issue of the workshop and expected finalities through the *Visual theory of Change* (adapted from the Wageningen Centre for Development Innovation (2012)) (Figure 12).

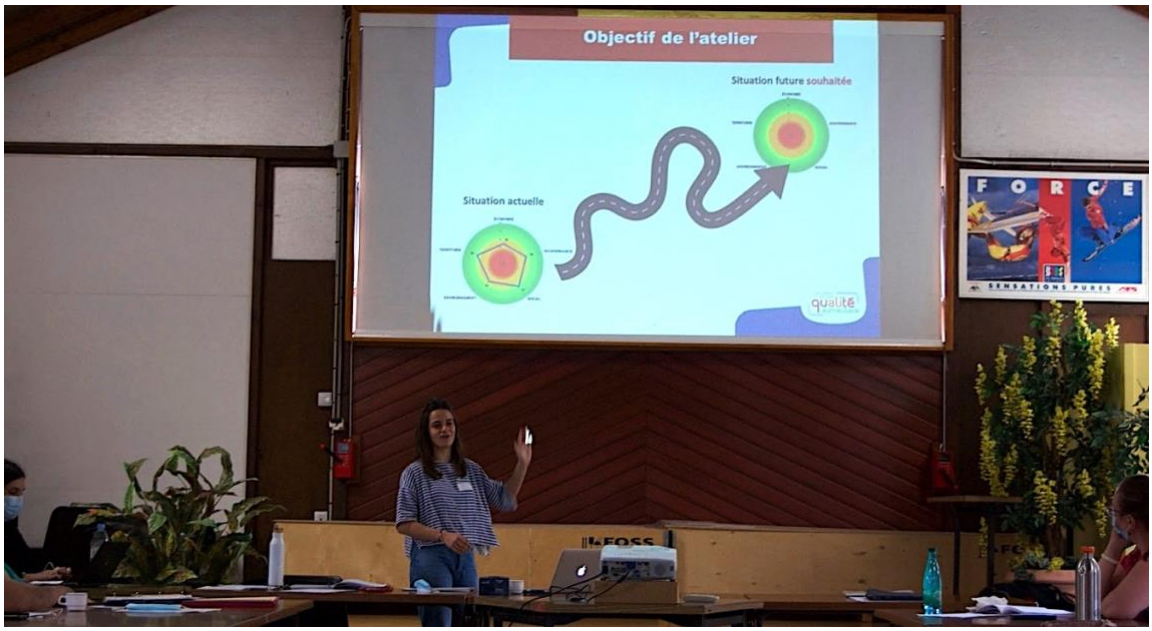

Figure 13: Presentation of the objective of the workshop through the Visual Theory of Change,

5.1.3 *The divergence stage*: presentation of the diagnosis and discussion of the results

Then, I presented the core topic of the workshop: the sustainability diagnosis generated trough the QSAT within the on-farm interviews that I carried out. I starting providing the results at the more global level, i.e. by providing the five scores obtained for each of the five SD dimensions.
Then, I took a longer time to present the diagnosis at the objective level, level that was agreed upon by the Maroilles' Board during the consultation during Step 13: Data processing and analysis towards the sustainability diagnosis. Hence, the QSAT diagnosis at the "Economic objectives level" – at the "Governance objective level" – at the "Social objective level" at the Environmental level" and at the "Territory level" were successively presented, allocating time in-between for the participants to react on the results.

5.1.4 *The convergence stage:* prioritization of objectives towards concrete actions

I then asked participants to individually vote for the two objectives in each SD dimension they found the most important to work on. The Economic, Social, Environmental, Governance and Territorial spider graphs were thus printed on flipcharts and participants were given ten stickers to realize the activity (Figure 14).
The next step was to move on from the ten prioritized objectives to concrete actions towards the desired future situation. Five focus groups were expected to be created (one for each dimension), work on prioritized objectives. At the end of this stage, I expected each focus group to present their formulated ideas in a plenary session

5.1.5 *The commitment stage*: a final reflective stage to close the workshop

Finally, a reflection session should happen to enable the participants to share their thoughts. To this end, I planned to use "the nugget and the stone" method (Scicabulle, 2019). The nugget refers to one striking element during the workshop the participant enjoyed. The pebble is like a stone is

the shoe, an issue that has still not been removed and that the actors would have appreciated discussing deeper (Scicabulle, 2019).

Figure 14: Voting stickers activity to prioritize sustainability objectives

PART 3: Results

1 Phase 1: Exploratory and preparation phase

1.1 Exploration of the context of the Maroilles' system

The internal documentation on the Maroilles' PDO resulted in a overview of the context of evaluation. Below are presented the key findings of the review.

1.1.1 A PDO cheese well anchored in its territory

1.1.1.1 Specificities of the product

The "Maroilles" or "Marolles" is a washed-rind, soft, fermented cheese with a square shape of 12.5 to 13 cm on each side. It can also be presented in different formats: Sorbais, Mignon, and Quart corresponding to different sizes and thus maturing periods. They are also protected under the "Maroilles" denomination of origin (INAO, 2015).
The Maroilles' cheese is characterized by a homogeneous orange-red rind, a soft paste to the touch and a strong and characteristic smell, slightly ammonia. These characteristics become more pronounced and typical with a longer maturing period (INAO, 2015).

1.1.1.2 Specificities of the geographical area

The geographical is located in the two departments of the Nord and the Aisne and is delimited by the south of Avesnes (Nord department) and the north of Vervins (Aisne department). The Maroilles' Syndicate head office is located in the village of La Capelle (Figure 15).

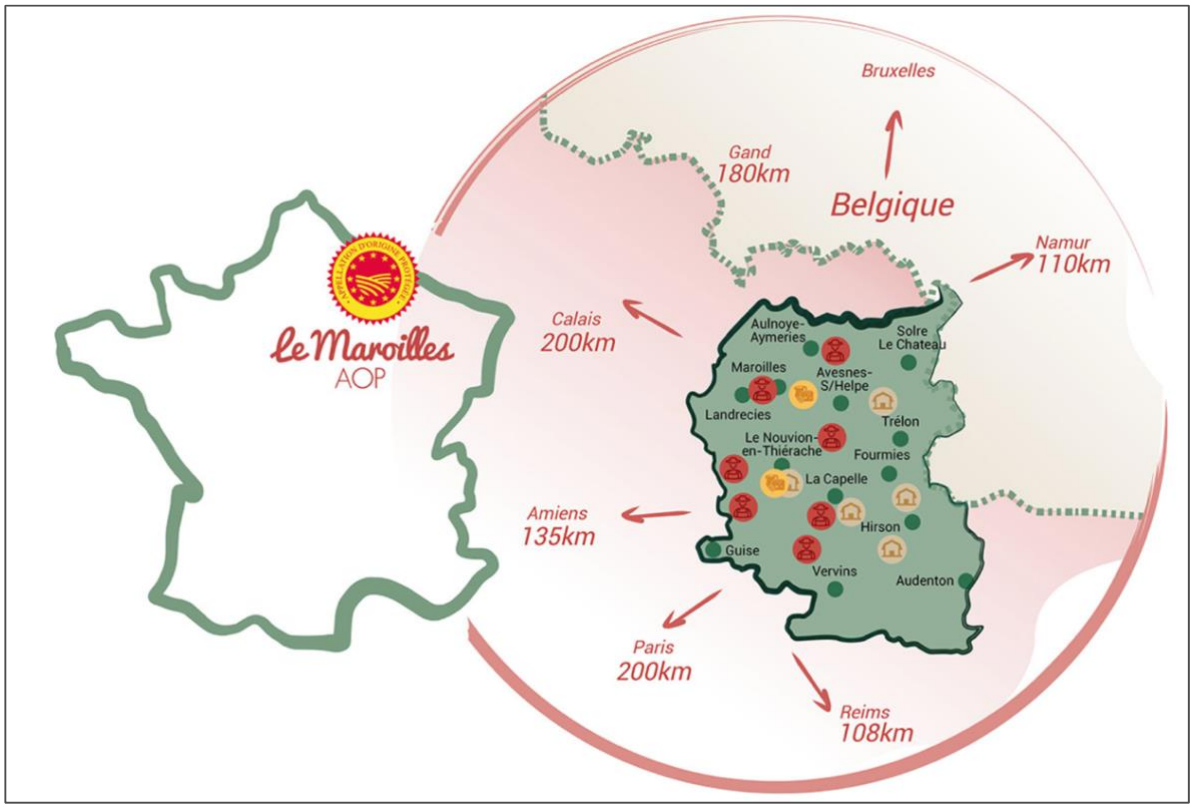

Figure 15: Localisation of the Maroilles PDO (Maroilles-AOP, 2021)

Natural factors

This area of origin is commonly referred to as the natural country of Thiérache. The landscape of the Thiérache region is very particular, characterized by *bocage* or wetlands between the plain of the North and the chalky plateau of Picardy. The identity of the Thiérache is closely linked to the grasslands with their hedges, thus favouring grazing systems (INAO, 2015) (Figure 16).

Figure 16: Thiérache bocage typical landscape

Credits to Syndicat du Maroilles (2021)

Human factors

The origin of "Maroilles" is undeniably linked to the Abbey of Saint-Humbert de Maroilles, founded in the 7th century and whose possessions were mainly located in the villages of Avesnes and Vervins. The production of "Maroilles" was originally exclusively farm-based, and the farms were equipped with brick cellars. These conditions were favourable to the development of the red ferment on the cheeses made on the farm. Today, the “Maroilles farming system” still corresponds to these characteristics (INAO, 2015) (Figure 17).

Figure 17: Traditional Maroilles' ripening processes still applied nowadays

Credits to Syndicat du Maroilles (2021)

1.1.1.3 Causal links between the specificities of the product and the specificities of the geographical environment.

The natural factors of the geographical area explain the permanence of the pastures, even in the summer, but also the difficulty of grazing the grass. Indeed, the regular and abundant rainfalls lead to difficulties to preserve the pastures and then harvest the grass. In addition, the summers can be really dry as well what also impeds the fields' productivity. Despite these constraints, the Thiérache remains a region dedicated to dairy products as the bocage is ideally suited to fodder production and grazing. Hedgerows protect from sudden temperature changes and help to conserve moisture. They also increase the richness of the flora of the meadows and thus influence the quality of the cheese.

The characteristic square shape of Maroilles is the result of the traditional square moulds, which were made from the hard wood of the trees in the geographical area (beech, ash, etc.), which do not bend easily, unlike species used in other cheese-making regions, where round cheeses have developed.

Concerning the cheese processing stage, the humid climate of the geographical area, which makes it possible to maintain a particular atmosphere in the maturing cellars, combined with the know-how of the ripeners in caring for the cheeses, favor the production of a homogeneous orange-red rind. It is due to the red ferment, which contributes to the development of the characteristic taste and smell. The Maroilles cheese is therefore a real cheese linked to its territory.

1.1.2 A productive and well-structured PDO organization

In 2008, the Maroilles' Syndicate[12] was created to enable its members to promote their economic, industrial, and commercial interests collectively. The Maroilles' cheese benefits indeed of certain notoriety in the Hauts-de-France Region, which has to be continuously pursued over time. In 2008, the movie "Bienvenue chez les Ch'tis" led to a 30% increase Maroilles commercialized and widely contributed to spreading this cheese beyond the Hauts-de-France Region. Volumes marketed are stabilized for some years at around 4,100 and 4,200 tonnes per year, although a light decrease in milk producers and cheese makers over time (Figure 18).

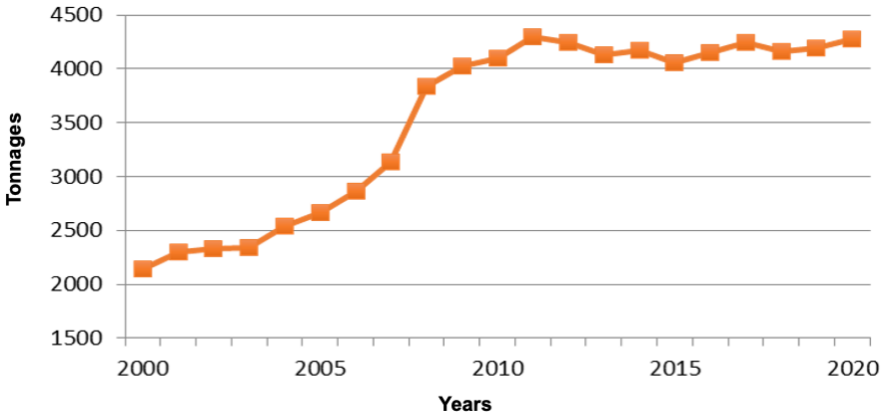

Figure 18: Evolution of Maroilles tonnages since the 2000' (Syndicat du Maroilles, 2020)

[12] More specifically, we refer to ODG in French, meaning « Organisme de Défense et de Gestion ». The "ODG" was previously named "Syndicate" and one still usually refers to it.

In 2020, the Maroilles PDO was constituted of 126 operators, distributed as follow:

- 115 milk producers;
- 5 industrial cheese makers (more commonly referred to as manufacturers);
- 6 farmers' cheese makers;
- 2 ripeners.

Regarding governance aspects, the Maroilles PDO comprises two colleges: the milk producers and the cheese makers, grouping together the manufacturers, farmers' cheese makers and ripeners (see Figure 19). The presidency changes every three years and alternates from one college to the other.

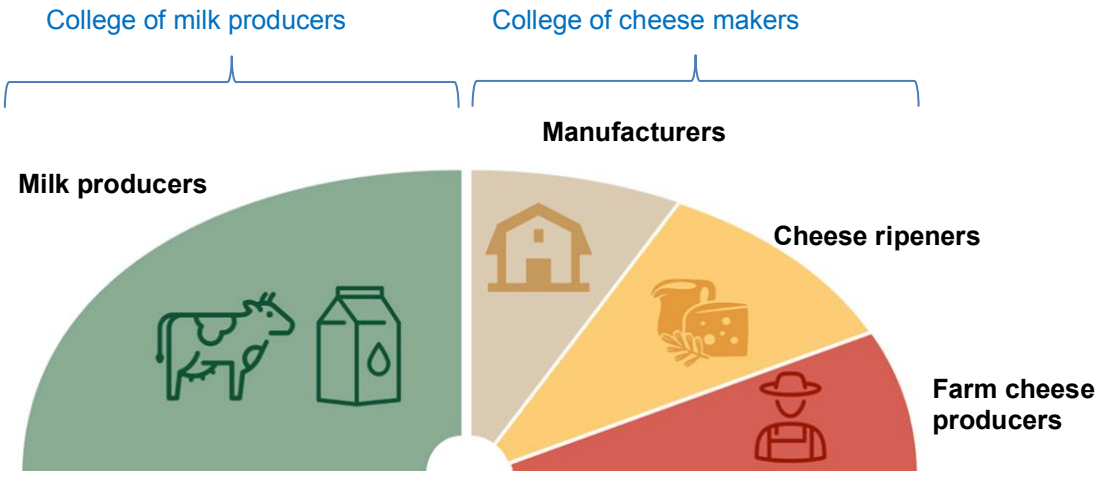

Figure 19: Governance model of the Maorilles PDO with its constitutive operators, adapted from the official website of the Maroilles' Syndicates (Maroilles-AOP, 2021)

1.1.3 A PDO cheese concerned with sustainability topic

The current Maroilles' CoP was reviewed and discussed with the Sustainability Committee during the first workshop. It resulted in a SWOT analysis, enabling the identification of the current Strengths, Weaknesses, Opportunities and Threats of the sector (Table 7).

Table 7: Strengths-, Weaknesses-, Opportunities- and Threats- analysis of the curent Maroilles Code of Practices

STRENGTHS	**WEAKNESSES**
• Production secured through the Protected Denomination of Origin • Presence of a minimum of 90 meters of edges per hectare • Grazing over a minimum of 170 days a year • During the grazing period, a minimum of 65% of grass in the ration • Food autonomy: minimum of 80% on-farm produced	• GMO still tolerated in the CoP

OPPORTUNITIES	THREATS
• a GMO-free alimentation with the relocation of locally produced proteins • To increase the proportion of grass in the ration • The increased consumers' demand for unpasteurized cheeses, thus valorising traditional methods and grass resources	• The rise of different labels, charters questioning the self-established sustainability of the Maroilles' production • Climate change

The operators are triggered by societal demand, which pushed them to create the Maroilles Sustainability Committee. The still allowed GMO-feed is the current burning question, and the GMO-free sectors that are being formed in the relatively close environment of the Maroilles organization are seen as a threat. Another important issue raised is the impact of climate change, which frequently leads to dry summers and thus derogations for grass provision.
Therefore, actors seek to know if the current CoP is well adapted to the ground's realities and consumers' expectations. The actors are convinced by the potential of the PDO tool and the sustainability of the Maroilles' production. Through the creation of this Committee, the members seek therefore to demonstrate to the consumers that they take into account both the environment and their expectations and that they are able to respond to them.
Concerning the governance process, the group depends on the Maroilles' Board, thus requiring feedback from the Maroilles' Board for any decision to be made. The coordinator is the representative of the Committee.

1.2 Setting out the context of the research with the Maroilles' actors

One of my main objectives when designing this first workshop was to provide the Maroilles' actors with a clear understanding of the QSAT purposes so that they could grasp the scope of the present research they were engaged in.

1.2.1 Presentation of the scope of the QSAT

The scope of the QSAT was presented to the members according to the following table (Table 8). It enabled to provide the actors with a clear and transparent representation of the QSAT objectives.

Table 8: Presentation of the QSAT purposes to the Sustainability Committee during the first workshop

The QSAT DOES NOT :	The QSAT DOES :
Call into question the current sustainability of the cheese and dairy GIs	Address the current need expressed by the cheese GIs and is in line with the reflections and work carried out in the reflections by the Maroiilles Sustainability Committee and the CNAOL.
Impose change to the local actors	Aim to initiate change for and with the local actors and to enhance learning about sustainability issues.
Aim to compare the GI sectors with each other	Aim to measure the internal sustainability performances of the GI and monitor it over time

Measures sustainability at the farm level only	Measures sustainability across the whole GI's structure, thus considering the farm-level but also the value chain and the GI territory
Aim to obtain individual recommendations	Aim to obtain management responses to the diagnosis at the GI level

1.2.2 Identification of enabling conditions to make the research successful

Finally, we identified key factors deemed to ensure the smooth process of such a study (Figure 20).

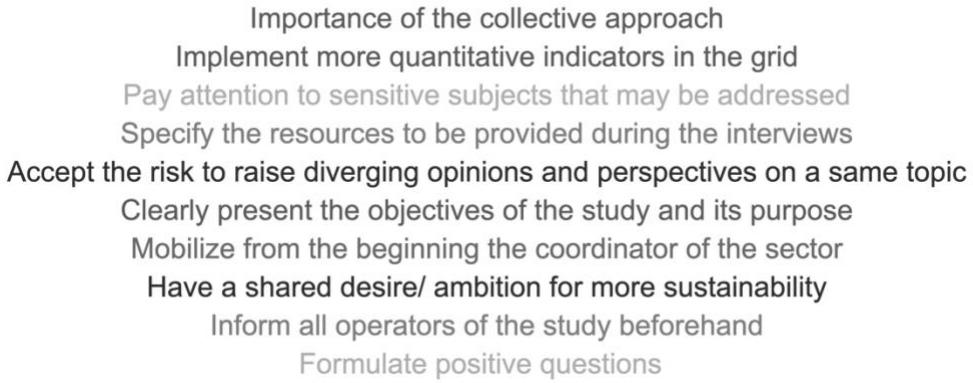

Figure 20: Word cloud of the enabling conditions defined during the first workshop

Looking at the different perspectives on the world cloud, one can note that the collective approach I went for is in accordance with the actors' expectations as well as the research objectives. Indeed, the Maroilles' actors wish for the QSAT consolidation process to "implement more quantitative indicators in the grid". In addition, members give significant importance to communication aspects: "inform all operators of the study beforehand", "clearly present the objectives of the study and its purpose", "specify the resources to be provided during the interviews" which is a key topic in any kind of GI organization. They also pay significant attention to the formulation of the questions for the new grid ("formulate positive questions", "pay attention to sensitive subjects that may be addressed"). As a result, I will have to consider all these considerations throughout the whole process.

One output from this workshop was also the formalization of a partnership agreement co-signed by Qualimenaire and the Maroilles Board Appendix 14. In addition to the formal aspect of this agreement, it was a way to commit the GI members around the same mission.

2 Phase 2: Consolidation of the conceptual framework

2.1 Definition and appropriation of the concept of sustainability

The first workshop was conducted to consolidate the conceptual framework of the grid, based on the stakeholder's vision and understanding of sustainability applied to PDO systems.
To this end, the Maroilles' actors exchanged on the meaning of each dimension applied to a PDO-systems. It resulted in the following definitions synthetized in the diagram Figure 21.

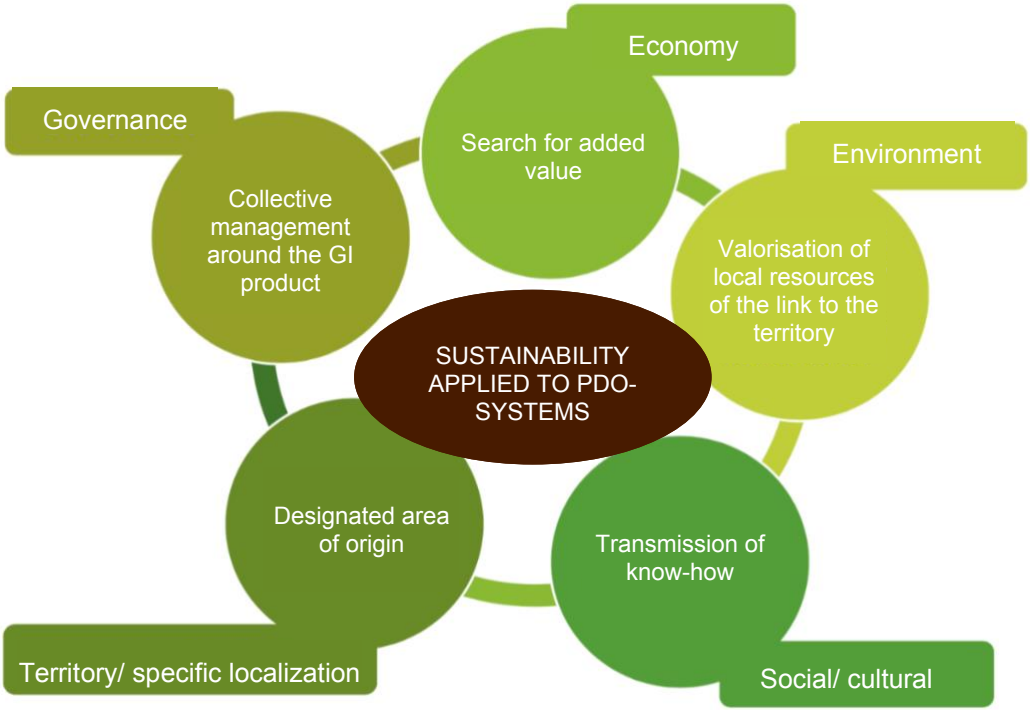

Figure 21: Conceptual framework collectively agreed upon during the first workshop

The governance dimension that did not exist in the previous grid version was added to the conceptual framework. Figure 21 represented the conceptual framework of the QSAT, foundation for the related objectives, criteria and indicators to be consolidated.

2.2 Identification of generic objectives for the dairy and cheese GIs

2.2.1 Specific sustainability objectives of the Maroilles PDO

The critical loop activity collected participants' representations on sustainability issues regarding the Maroilles' current state. The following world clouds illustrate the collected data according to the five SD dimensions.

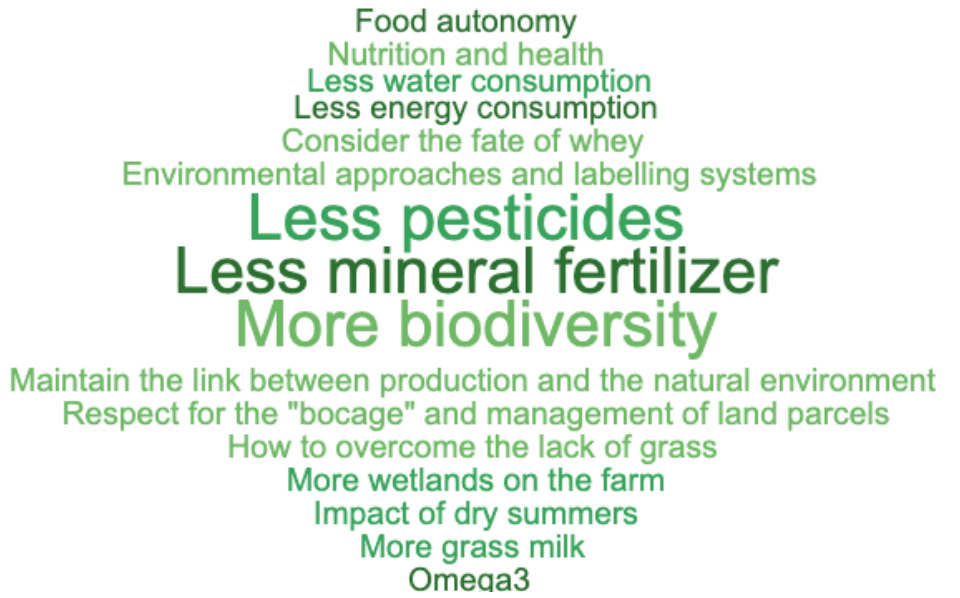

Figure 22: Word cloud of the Environmental issues identified by the Sustainability Committee

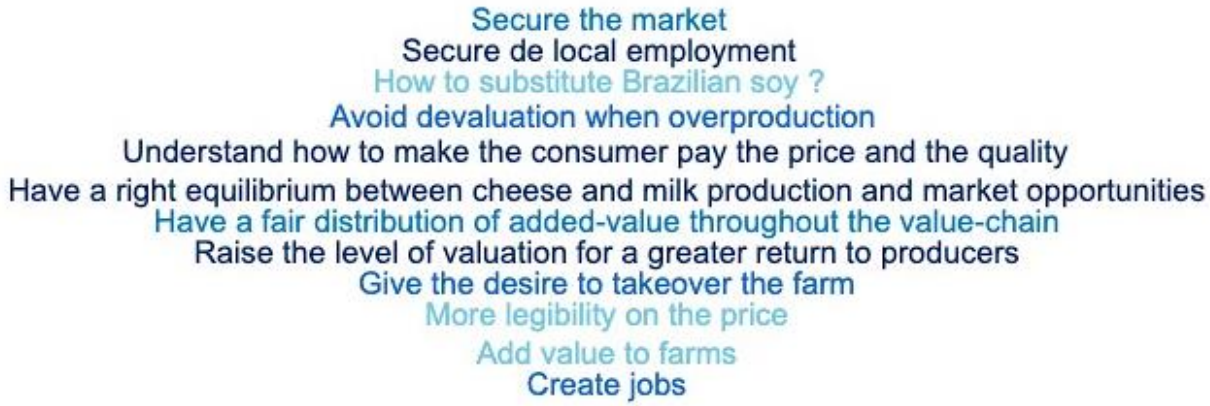

Figure 23: Word cloud of the Economic representations identified by the Sustainability Committee

Figure 24: Word cloud of the Governance representations identified by the Sustainability Committee

Figure 25: Word cloud of the Social representations identified by the Sustainability Committee

Figure 26: Word cloud of the Territorial issues identified by the Sustainability Committee

2.2.2 Generic sustainability objectives for the dairy and cheese GIs

The cross-analysis of the CNAOL's 18 objectives and the objectives identified by the Sustainable Committee resulted in the formulation of 34 big objectives, generalizable to every dairy and cheese GI sector (Table 9). This was significantly more than the 18 objectives of the CNAOL because the QSAT also integrated the Governance and the Territory dimensions, not considered in the CNAOL's grid.

Table 9 : 34 sustainability objectives generic to the dairy and cheese GIs

ECONOMIC objectives
1. To ensure the attractiveness of the sector and its duration over time
2. To improve the economic value of the product
3. To improve and secure income
4. To ensure a fair distribution of the added-value throughout the sector
5. To ensure a production adapted to markets
6. To preserve the economic diversity
7. To improve the visibility of the product on the market

GOVERNANCE objectives
8. To strengthen the consideration of governance in the functioning of the sector
9. To promote a better knowledge of the sector by all its actors
10. To strengthen the integration and involvement of the collective
11. To strengthen equity between actors

SOCIAL objectives
12. To ensure the animation of the sector and the support of its operators
13. To promote cohesion and mutual support between operators
14. To reinforce the feeling of belonging to the sector by all the operators
15. To strengthen the feeling of pride and recognition of the profession
16. To ensure job satisfaction
17. To maintain the taste and typicality of the product
18. To maintain and pass on traditional know-how
19. To ensure the adaptation of the sector to societal expectations

ENVIRONMENTAL objectives
20. To strengthen the consideration of sustainable development
21. To adapt to climate change
22. To ensure animal welfare and health
23. To maintain traditional farming methods
24. To valorise grassland resources
25. To contribute to plant and animal diversity
26. To preserve and develop biodiversity
27. To limit the use of external inputs
28. To preserve soil health
29. To recycle materials produced
30. To save resources

TERRITORIAL objectives
31. To promote the product on its territory and beyond
32. To preserve the landscape
33. To contribute to local employment
34. To facilitate the anchoring and development of the sector in its territory

3 PHASE 3: Consolidation of the methodological framework

3.1 Consolidation of the indicators

3.1.1 A sound and scientifically validated framework

The procedural indicator review resulted in a database aligned with the 34 objectives defined in Phase 1. A total of 195 indicators deemed technically robust and relevant to dairy-PDO systems were screened and classified according to 5 sustainability dimensions. A total of 45 indicators out of the 73 were kept from the 2020 QSAT version, and new indicators were sourced from other relevant frameworks (Table 10).

Table 10: Sourced indicators from scientific databases according to the five sustainability dimensions

Sourced or adapted from	Economic	Governance	Social	Environmental	Territorial	Total
Qualimentaire 2020	13	2	16	4	10	45
IRQUALIM, 2019	13	6	18	3	14	54
Diagagro	0	0	0	33	0	34
FAO-ORIGIN	0	9	1	10	0	20
GI-experts	0	3	4	3	0	10
Author (GI-practitioner)	0	3	1	3	3	10
INRAE, 2021	0	0	3	6	0	9
CNAOL, 2021	0	0	7	0	0	7
HEV, 2018	0	0	0	5	0	5
Other sources	0	0	1	0	1	2
Total	**26**	**23**	**51**	**67**	**28**	**195**

3.1.2 A framework adapted to the specific context of the Maroilles GI

A total of 16 indicators was reformulated, either because the group did not understand its meaning, the scope was deemed not precise enough or not adapted to the Maroilles context. Next, a process of indicators co-construction occurred, based on dialogue and consensus decision-making process. It resulted in 46 new indicators created by the Maroilles Sustainability Committee, which complemented the 195 review sourced indicators (Table 11).

Table 11: Co-constructed indicators by the Maroilles Sustainability Committee during the second participatory workshop

Created by	Economic	Governance	Social	Environmental	Territorial	Total
The Maroilles Sustainability Committee	15	2	4	23	2	**46**

3.1.3 A holistic framework, considering the multidimensionality of sustainability

The two complementary processes of literature review and co-construction of indicators led to the formulation of a total 241 indicators collectively validated by the Maroilles' actors and the GI-experts (Table 12).

Table 12: Distribution of the consolidated indicators according to the five sustainability dimensions

Sourced, adapted or created indicators	**Economic**	**Governance**	**Social**	**Environmental**	**Territorial**	**Total**
Total number	41	25	55	90	30	**241**
Total percentage	*17%*	*10%*	*23%*	*37%*	*12%*	***100%***

As shown in Table 12, the new QSAT was built on multi-dimensional indicators, integrating the dimension of Governance missing in the previous grid. The indicators were distributed in a somewhat balanced proportion, though with a slightly larger proportion of environmental and social indicators.

3.1.4 An inclusive framework considering the various actors constituting the GI

Following Principle 5 - *An inclusive framework* -, the 241 indicators were also selected to cover each category of Maroilles' actors present in the organisation's governance model, i.e. the milk producers, cheese makers, and head of the Syndicate (coordinator and president). The target-identification process performed during the second workshop led to the following distribution of the 241 indicators (Table 13).

Table 13: Distribution of the indicators according to the target categories of Maroilles' actors

Target of the indicator	Milk producers	Cheese makers	Milk producers and cheese makers	Representative member of the organization	All categories combined	**Total**
Number of corresponding indicators	79	23	69	59	11	**241**

3.1.5 Integration of objective and quantitative indicators

In accordance with Principle 2 - *A scientifically robust framework* - and line with the Maroilles' actors' expectations, a large proportion of objective and quantitative indicators was added, respectively 73% and 25% out of the total percentage of indicators (Table 14).
Two extra columns were added on the grid to inform about the typology of the considered indicator, i.e. if it is objective or subjective and quantitative or qualitative.

Table 14: Distribution of the indicators according to their typology

Type of indicator	Objective indicators	Subjective indicators	Quantitative indicators	Qualitative indicators	**Total**
Number of corresponding indicators	177	64	60	181	**241**
Percentage of corresponding indicators	*73%*	*27%*	*25%*	*75%*	***100%***

3.2 A new structure harmonized with the CNAOL grid

After the formulation of indicators, criteria derived from the indicators were created. This process led to the creation of 21 sustainability themes corresponding to the 34 generic objectives from Table 9. The objectives were then declined into 57 criteria. Consequently, previous Table 6 could be completed with a concrete example illustrating the grid structuration for the Economic dimension (Table 15).

Table 15: QSAT consolidated structure adjusted from the CNAOL's grid, extract from the Economic dimension

SD Dimension	**Themes**	**Objectives**	**Criteria**	**Indicators**
ECONOMY	Productivity of the sector	**Objective 5.** To ensure a production adapted to markets	Productivity	Evolution of PDO milk volumes
				Development of PDO cheese tonnages
				PD0-labelling rate
			Balance between production and markets	Balance between milk production and markets
				Repercussion on prices
				Balance between cheese production and markets
				Repercussion on prices
				Share of cheese downgraded due to lack of market
		Objective 6. To preserve the economic diversity	Regulation of the productivity	Willingness to limit farm size/ implement quotas
				Specifications including production quotas

The presentation of the whole structure of the grid can be found in Appendix 15.

3.3 Consolidation of the scoring method

The different typologies of indicators were then converted into a homogeneous framework with a scale of sustainability, ranging from 0 to 100. Hence, a percentage score of sustainability could be attributed to each measured indicator. The sustainability scale was decomposed into five sustainability thresholds (compared to three in the initial version) in order to get a more refined diagnosis. We kept the traffic light approach from the initial QSAT version.
Consequently, the consolidation of the scoring method resulted in five thresholds ordered gradually from the score of 0% to 100%:

- the dark red threshold, corresponding to a score of 0% to 20%
- the light-red threshold, corresponding to a score of 20% to 40%
- the orange threshold, corresponding to a score of 40% to 60%
- the light-green threshold, corresponding to a grade of 60% to 80%
- the dark green threshold, corresponding to a score of 80% to 100%.

An illustration of this data conversion model can be seen below (Table 16):

Table 16: Grid snapshot to illustrate the different thresholds of sustainability classes, using a traffic light approach

Indicators	Questions	Target	0% to 20% of sustainability	20% to 40% of sustainability	40% to 60% of sustainability	60%to 80% of sustainability	80% to 100% of sustainability

3.4 Consolidation of the indicators thresholds

During the third workshop, the 241 indicators were once again screened one by one but this with a focus on the thresholds consolidation. The latter were indeed validate, reformulate or created by scratch by the Sustainability Committee.
The Likert scale approach was conserved for subjective indicators, but different modalities of answer were added, in addition to the 1 to 10 Likert scale only used in the original QSAT.
As a result, the most common modalities of answers were based on:

- A rating scale from *1 to 10* for subjective quantification;
- *Yes* or *No* responses or a more nuanced degree of responses: *Disagree* - *Tend to disagree* - *Tend to agree* – *Agree* for expressing opinion or agreement;
- *Never* – *Rarely* – *Sometimes* – *Often* - *Very often* responses for expressing a frequency

Concrete examples were extracted from the QSAT to illustrate these thresholds based on the new scoring method (Table 17).

Table 17: Grid snapshot to illustrate the different thresholds of sustainability classes, using a traffic light approach

Questions	0% to 20% of sustainability	20% to 40% of sustainability	40% to 60% of sustainability	60%to 80% of sustainability	80% to 100% of sustainability
On a scale of 1 to 10, how would you rate the cohesion and mutual support between the different actors in the sector?	1 to 2	3 to 4	5 to 6	7 to 8	9 to 10

Do you recycle the wood produced from your hedges?	No		Under consideration		Yes
In curative care, I do limit the use of antibiotics as much as possible	Disagree	Tend to disagree	Under consideration	Tend to agree	Agree
How often do you attend training courses?	Never	Rarely	Sometimes	Often	Very often

Concerning objective indicators, 19 thresholds were reformulated or created from scratch by the Maroilles Sustainability Committee. This concerned particularly the Environmental dimension where the specific criteria from the Maroilles CoP were often taken as reference values. Table 18 gives an example of designed thresholds by the Maroilles' group.

Table 18: Grid snapshot to illustrate the different thresholds of sustainability classes, using a traffic light approach

Questions	**0% to 20% of sustainability**	**20% to 40% of sustainability**	**40% to 60% of sustainability**	**60%to 80% of sustainability**	**80% to 100% of sustainability**
What is the share of permanent grassland in Utilised Agricultural Land?		Lower than 25%	Between 25% and 50%	Between 50% and 75%	Higher than 75%
How many meters of hedges do you have on average per hectare?			Between 90m and 100m	Between 100m and 110m	Higher than 110m

3.5 Field trial of the pre-grid

This final consolidation step enabled to validate the accuracy of the indicators and the operationality of the QSAT on the field. Thus any indicators were changed.
Some changes, however, occurred in the formulation of the questions. Indeed, some 81 indicators using the Likert scale with the *Disagree - Tend to disagree - Tend to agree – Agree* mode of responses were turned into *Not, at all – Rather no – Rather yes – Yes, of course,* modalities of response (Table 19). The former approach was considered too heavy. Thus, a more direct questioning formulation was chosen, aiming to increase the interviewee's understanding of the questions and save time for the interviewer.

Table 19: New threshold formulation after field trials

In curative care, do you limit the use of antibiotics as much as possible?	Not at all	Rather no	Under consideration	Rather yes	Yes, absolutely

4 Phase 4: Implementation of the QSAT on the Maroilles PDO cheese

4.1 A comprehensive sample of the Maroilles PDO organization

During one month (May), on-farm interviews were realized to collect information based on the QSAT questions. This comprehensive sample aimed to gather each of the Maroilles' actors represented in the governance model of the sector. This step resulted in 34 on-farm interviews according to the following distribution of Maroilles' actors illustrated in Figure 27:

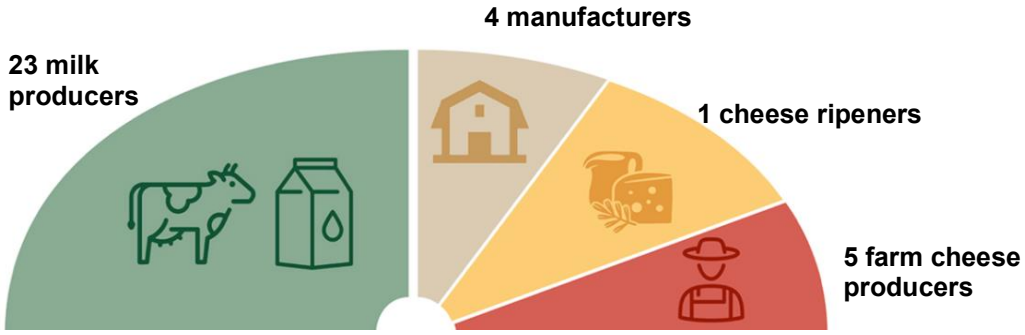

Figure 27: Distribution of the interviews according to the categories of Maroilles' actors,

Source: official website of the Maroilles' Syndicates (Maroilles-AOP, 2021)

Regarding the total number of Maroilles' actors, it represented approximately 25% of the total population with the following distribution:

- c.a 20% of the milk producers
- Two-thirds of the farm cheese producers
- 100% of the cheese manufacturers
- 100% of the cheese ripeners.

4.2 Data processing resulting in the sustainability diagnosis

This final and essential phase resulted in the Maroilles' diagnosis according to the methodological choices detailed in Step 13: Data processing and analysis towards the sustainability diagnosis13.

According to the different levels of evaluation, the Maroilles' current state of sustainability resulted thus in the following diagnosis:

4.2.1 Diagnosis at the dimension level

The diagnosis at the dimension level is the most global level of analysis. It allows getting a global overview of the sector's current situation, i.e. comparing scores obtained at the Economic, Governance, Social, Environmental and Territorial dimensions (Figure 28).

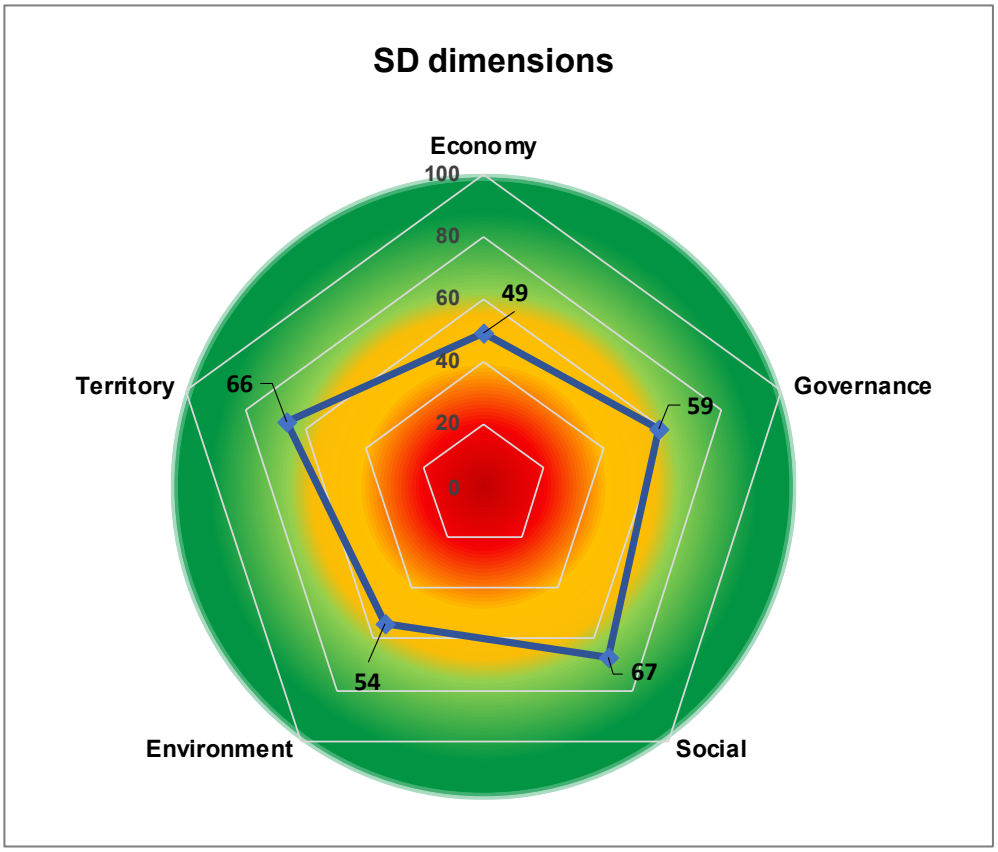

Figure 28: QSAT diagnosis of the Maroilles sector at the dimension level

For the following parts, the diagnosis of the Economic dimension was selected to illustrate the obtained results. The overall diagnosis for the other SD dimensions can be found in Appendix 16.

4.2.2 Diagnosis at the theme level

The theme level is a finer level of analysis that allows to zoom in into the economic dimension. We, therefore, obtain the score attributed to the economic themes, i.e. the sustainability of the sector, profitability of the sector, productivity of the sector and marketing aspects (Table 20 and Figure 29).

Table 20: QSAT diagnosis at the theme level

Themes	Scores	
Economic dimension		**49**
Sustainability of the sector	60	
Profitability of the sector	36	
Productivity of the sector	50	
Marketing aspects	50	

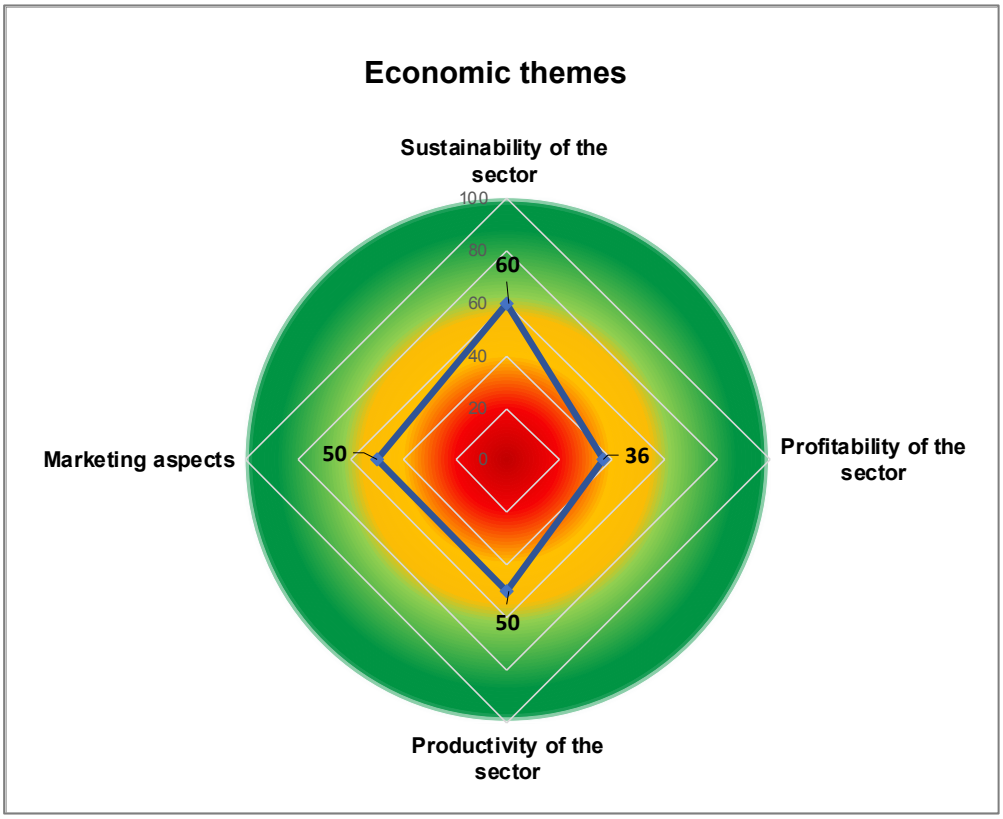

Figure 29: QSAT diagnosis of the Maroilles sector at the theme level

4.2.3 Diagnosis at the objective level

The diagnosis at the objective level represents an even finer degree of analysis, enabling one to zoom in into the Economic dimension. We thus obtained the sustainability scores of the seven objectives constituting the Economic dimension (Table 21 and Figure 30).

Table 21: QSAT diagnosis of the Maroilles sector at the theme level

Themes	Objectives	Scores
Longevity of the sector	**1.** To ensure the attractiveness of the sector and its maintain over time	**60**
Profitability of the sector	**2.** To improve the economic value of the product	22
	3. To improve and secure income	46
	4. To ensure a fair distribution of the added-value throughout the sector	41
	Total	**36**
Productivity of the sector	**5.** To ensure a production adapted to markets	49
	6. To preserve the economic diversity in the sector	52
	Total	**50**
Marketing aspects	**7.** To improve the visibility of the product on the market	**50**

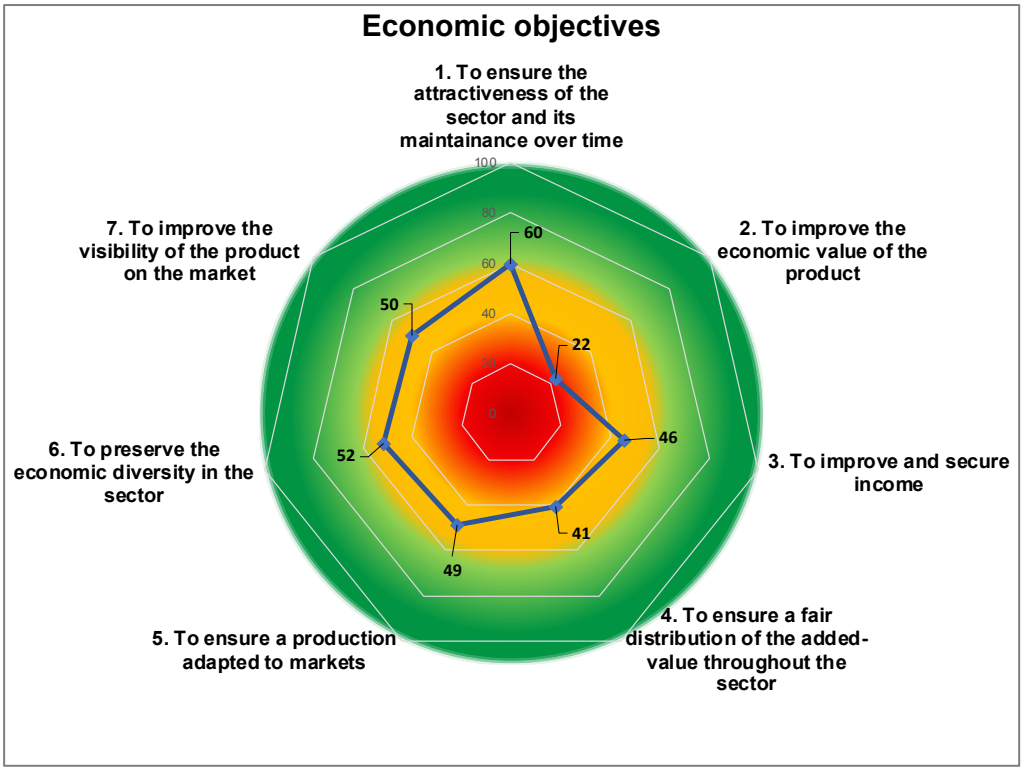

Figure 30: QSAT diagnosis of the Maroilles sector at the objectives level

4.2.4 QSAT diagnosis at the indicators' level

The diagnosis at the indicators' level is the finest level of analysis when seeking to understand the results. This level allows going deeper into the objectives by zooming in on the measured indicators. We thus obtained the different scores attributed to the economic indicators and the mean score for the corresponding criteria (Table 22 and Figure 31).

Table 22: QSAT diagnosis at the criteria and indicators level

Themes	Objectives	Criteria	Indicators	Scores
Sustainability of the sector	**1.** To ensure the attractiveness of the sector and its maintenance over time	Renewal of operators	Follow-up of the pyramid age	0
			Average age of the sector	75
			Level of education	67
			Evolution of the number of operators	0
			Renewal of the operators	75
			Total	**46**
		Maintenance of the activity	Share of disengagements	25
			Follow-up of the disengagement reasons	100
			Level of confidence that the sector will continue in the future	76
			Investment project	85
			Continued commitment to the PDO	87
			Total	**73**
		Transmission of the activity	Identified successor	69
			Desire to install	66
			Ease of installation	50
			Total	**61**

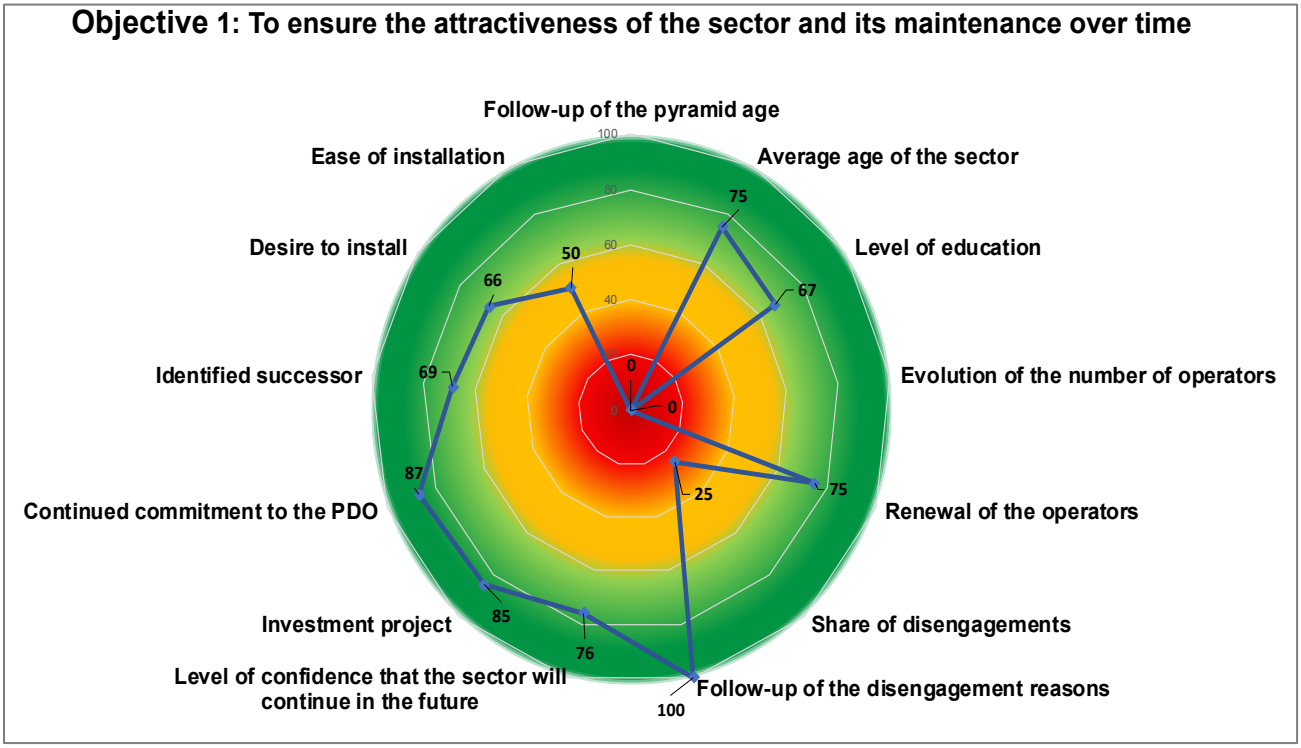

Figure 31: QSAT diagnosis at the criteria and indicators level

5 Phase 5: Reflective closing loop on the QSAT with the Maroilles PDO actors

The final participatory workshop organized on the 8th of July 2021 during a whole afternoon was the opportunity for all the Maroilles' actors to react to the presented results and, to a large extend, to reflect on the whole process of the QSAT application.

5.1 The QSAT as an exchange facilitating tool

The presentation of the spider graphs for each dimension generated important exchanges among the participants, willing to give their opinion on the results and react to each other perceptions. As the issues of the Maroilles' sector were not the veritable scope of the study, I decided to not summarizing them here. Nevertheless, the whole transcription of the exchanges can be found in

As a circumstancial evidence, the QSAT was well-received by all the participants, as showed by the last word of the president "it was a great opportunity for us to have this research conducted in our organization. It was a long time that we did not tackle such topics. It was a real need" (Appendix 17). This indicates that the grid application was perceived as meaningful among the participants.

5.2 The QSAT as an action inducing framework

The second session of the workshop with the voting stickers activity enabled us to move from the diagnosis, thus a concrete state towards actions. Indeed, it enabled the identification of main objectives to work on, according to the Maroilles' actors.

Prioritized objectives for the Environmental dimension

The figure below shows the prioritized objectives for the Environmental dimension (Figure 32).

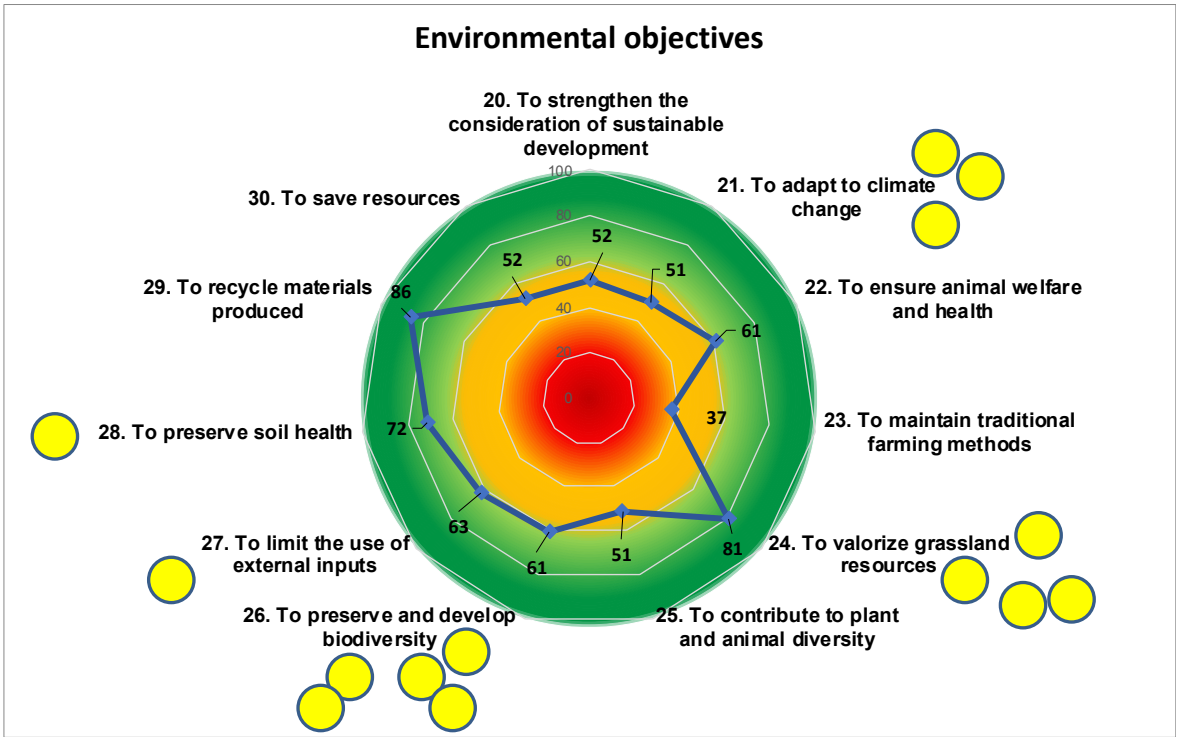

Figure 32: QSAT diagnosis of the Maroilles sector at the objectives level with prioritized objectives through the voting stickers activity

In order of importance, the participants selected the objectives:

- To preserve and develop biodiversity (Objective 26)
- To valorize grassland resources (Objective 24)
- To adapt to climate change (Objective 21).

Following the same process, it resulted in the subsequent prioritized objectives for the other SD dimensions:

Prioritized objectives for the Economic dimension

- To improve the economic value of the product (Objective 2)
- To ensure the attractiveness of the sector and its duration over time (Objective 1);
- To improve and secure income (Objective 3);

For the Governance dimension

- To promote a better knowledge of the sector by all its actors (Objective 9)
- To strengthen the integration and involvement of the collective (Objective 10)
- To strengthen equity between actors (Objective 11)

For the Social dimension

- To ensure the adaptation of the sector to societal expectations (Objective 11)
- To strengthen the feeling of pride and recognition of the profession (Objective 15)
- To ensure job satisfaction (Objective 16)
- To maintain and pass on traditional know-how (Objective 18)

For the Territorial dimension

- To promote the product in its territory and beyond (Objective 31)
- To preserve the landscape (Objective 32)
- To facilitate the anchoring and development of the sector in its territory (Objective 34)

The original pictures of the spider graphs from the workshop after the voting activity and the corresponding prioritized objectives can be found in Appendix 18.

Unfortunately, the next workshops sessions, i.e. focus groups for the creation of concrete actions and reflective final stage could not take place due to time constraints. This will constitute one of the point for the discussion in the following part.

PART 4 : Discussions

This last part discussed the results according to the initial stepwise process, highlighted by relevant literature. It then provides the notable implications of the results in light of the two intertwined objectives, i.e. for the Maroilles PDO and for the subsequent research. Implications of the findings for the Qualimentaire organization are also provided. The discussion ended up with a set of propositions aimed to further achieve the research objectives.

1 Discussion of the results

1.1 PHASE 1 – Exploratory and preparation phase

1.1.1 Step 1: Identification of stakeholders to engage

1.1.1.1 Mobilization of a motivated community of stakeholders

Engaging the Maroilles Sustainability Committee represented a win-win process for the Maroilles PDO to benefit from a reliable study and for me as a researcher to benefit from a field of study with a motivated community of actors. Aline with my bottom-up approach, engaging the stakeholders throughout the whole process was fundamental to make transparent decisions concerning the consolidation of the grid. According to Gasparatos (2010), such a participatory approach prevents distorted assessment results and enhances follow-up actions once the diagnosis is established. One limitation that may appear to this first step was the relatively small number of members constituting the Maroilles Sustainability Committee. The absences of some members exacerbated this limitation during the workshops, which made it challenging for me as the facilitator to make sure that everyone was embarked on the process at the same level. Hence, the Sustainability Committee should have probably enlarged to include further stakeholders' perspectives and ensure the good follow-up of the consolidation process.

1.1.1.2 Mobilization of a transdisciplinary group of GI-experts

In addition to the Maroilles' actors, the mobilization of the transdisciplinary group of GI-experts enabled to complement the community-driven, bottom-up approach with "hybrid knowledge" (Reed et al., 2006). This support was necessary to nuance the understanding of local issues by the Maroilles' actors and to provide a solid scientific background for the grid (Reed et al., 2006). Due to time constraints and the pandemic situation, this group never interacted with the Maroilles actors, rather through the intermediary of the GI-practitioner only. It would have been interesting to combine these different stakeholders' perspectives during the workshops regarding the mutual learning process it could foster (Triste et al., 2014).

1.1.2 Step 2: Exploration of the context of the Maroilles system

Simultaneously, I entered the Maroilles' field to explore the context of the evaluation. Indeed, it is crucial to recognize that any assessment of performances should be placed in its specific context (Mottet et al., 2020), especially for an action researcher, when the field constitutes the starting point of the research. To this purpose, the conducted desk review enabled me to get good pre-knowledge of the Maroilles' sector on a wide range of topics. The semi-structured consultation with the Maroilles' coordinator and president allowed to cross-analyze the collected tangible information from the desk review with subjective perspectives from key actors.
Finally, the discussion with the Sustainability Committee members during the first workshop enabled to move from a macro-level of analysis to a micro-level of data collection, where the emphasis was put on the current state of sustainability of the Maroilles' sector. I deliberatively chose to use the Maroilles' CoP as an entry point for discussing sustainability. It was a common document every producer was familiar with, thus constituting a good means to initiate a reflection on SD.

1.1.3 Step 3: Setting out the context of the research with the Maroilles' actors

The system boundaries of the QSAT and the objectives of the tool were explicitly presented to the Maroilles' stakeholders during the first workshop. According to Bell and Morse, this transparency enhances the feeling of ownership among actors and adds to the results' acceptance and use (Bell and Morse, 2001). Likewise, the participatory definition of enabling conditions was an important step that empowered the Maroilles' actors to freely share their thoughts and let me grasp their values and expectations.

1.2 PHASE 2 – Consolidation of the QSAT conceptual framework: sustainability concept and identification of objectives

1.2.1 Step 4: Definition and appropriation of the concept of sustainability

Discussing and defining the concept of sustainability was important as a wide variety of definitions exist, and actors may have different perspectives on the concept (Bell and Morse, 2008; Binder et al., 2010). Moreover, this step enabled the actors to appropriate this notion and provided a transparent common ground for elaborating the further grid's elements. This procedure of including stakeholders' perspectives to define sustainability is consistent with multi-criteria assessments methods (Woodhouse et al., 2000; Lee, 2006; Hacking and Guthrie, 2008).

1.2.2 Step 5: Identification of generic objectives for the dairy and cheese GIs

From Step 4, were identified multidimensional sustainability objectives, based on the Maroilles' actors perspectives on their issues. This process enabled to reveal a comprehensive picture of the challenges faced by the Maroilles and to go beyond the *weaknesses* and the *threats* identified in Phase 1 related to the Maroilles' CoP, where the focus was essentially put on the Environmental dimension. This collective process was in line with Binder et al., who state that to comprehensively and reliably expose the relevant features of the evaluated system, any sustainability framework must be constructed by including the diversity of viewpoints of the stakeholders constituting this system Binder et al. (2010).
Finally, the cross-analysis of Maroilles' objectives with the CNAOL objectives was a first step towards the achievement of the research's overall goal, namely to scale up the scope of the QSAT in making a tool responding not only to the Maroilles' issues but to the generic issues of the dairy and cheese GIs of France.

1.3 PHASE 3 – Consolidation of the QSAT methodological framework

1.3.1 Step 7: Consolidation of the indicators

1.3.1.1 Selection of existing relevant indicators

In order to respond to the Qualimentaire primary objectives, a set of criteria was defined to select relevant indicators from the different databases. Defining such a clear procedure for indicators' selection represented a crucial step for consolidating the QSAT discussed by Niemeijer and de Groot (2008). The two practitioners indeed state that a rigorous and transparent procedure for selecting indicators criteria is missing in many studies, which "makes it difficult to validate the information provided by those indicators" (Dale and Beyeler, 2001).
The indicators' consolidation was first based on a literature review of seven reputable sustainability frameworks, including the FAO-Origin database tailored specifically for GI systems (FAO and OriGIn, 2020). These different sources were selected to cover various approaches of the SD from the most holistic to the most specialized (i.e. the Diagagroeco framework considering the environmental issue solely through the agroecological prism); and combining different points of view (researchers, academia and policy-makers). Hence, this process

resulted in the creation of a robust grid, made of a maximum of reputable indicators, scientifically validated and/or already tested on the field, thus fulfilling Principle 2 - *A scientifically robust framework.*
Finally, selecting already existing indicators instead of creating new ones from scratch enabled linkages with reputable frameworks. As discussed by De Olde et al., a multiplicity of sustainability assessments does exist nowadays, which generally leads to different conclusions on sustainability performances of farms (De Olde et al., 2006). This statement calls for harmonization between these diverse tools when selecting themes, criteria and indicators. Hence, likewise in Phase 2, a deliberated harmonization with the CNAOL framework occurred, given that the *CNAOL Charter of Commitments* was going to be used by all the French dairy and cheese GIs in the coming months.

1.3.1.2 Co-construction of new indicators

In line with the bottom-up approach, a second complementary process of indicators' consolidation was performed, based on "intuitive assessment of experts" (Bossel, 2002, p.2), experts being, in the present case, the actors of the Maroilles' Sustainability Committee. Hence, the selection of the indicators did not only depend on the researcher but on the actors' contributions during the second workshop (Reed et al., 2006).
However, this participatory process presented the challenge to generate indicators and thresholds fitting the local situation of the Maroilles' sector and thus somewhat difficult to be transferable to other GIs. Indeed, the Maroilles' stakeholders, with their understanding of sustainability, based their contributions automatically on the Maroilles CoP, whose reference values are not the same from one PDO cheese to another one.
As a consequence, involving stakeholders in the development of the QSAT may result in a high applicability of the results to the local context (Binder and Wiek, 2007), thus verifying the Principle 4: *A framework adapted to the specific context of the GI,* but this applicability may also be achieved at the expense of the reproducibility of the QSAT. This obstacle is especially notable for the environmental indicators, where one GI system may significantly differ from another. Nevertheless, the CNAOL framework from which the QSAT objectives and themes were derived guaranteed certain genericity among the cheese and dairy GIs.
This issue requires further attention will be thus deeper discussed in the *3. Propositions.*

1.3.1.3 Identified limitations

When analysing the overall indicator selection procedure, further limitations could be pointed out:
(1) The new QSAT explicitly considered the multidimensionality and multi-functionality of agriculture (e.g. criteria on the biodiversity and natural resources conservation, maintenance of the landscape), thus well responding to Principle 3: *A holistic framework.* Nevertheless*,* it did not consider the interaction between indicators, which may hinder the analysis of trade-offs among them when designing strategies for decision-making (Bell and Morse, 2008).
(2) With a total of 241 indicators distributed among the different categories of Maroilles' actors, the consolidated QSAT appeared to be an exhaustive list of indicators that may hamper the following stage of data collection and thus one of the initial objectives to have an easy operationalizable tool. When selecting indicators, the *parsimony* criterion was not considered, as the initial goal was to reflect the most holistic of the evaluated system. Hence, my initial thought was that the more indicators were selected, the more realistic the assessment would be. These issues are discussed by Binder et al. (2010), who state that generally, the selection of indicators should be based on (i) *parsimony* (i.e. as much as simple as possible) and (ii) *sufficiency* (i.e. as much complex as necessary), both conditions inducing the third one, namely (iii) to consider indicator interactions. The latter means to select any redundant indicators and

thus to reflect the interconnectedness of the constitutive elements of the evaluated system (Binder et al., 2010).

(3) As the last limitation, it appeared to be a trade-off between the initial objective to enhance the amount of objective and quantitative indicators (Principle 2) while having at the same time a user-friendly tool enabling a rapid diagnosis. Hence, it was deliberatively chosen to select a larger proportion of subjective indicators based on the interviewee's perception, even if this led inevitably to a simplification of reality and a loss of information (Bell and Morse, 2008).

1.3.2 Step 11: Field trials of the pre-grid

Field trials of the QSAT constituted a central stage towards the validation of the consolidated QSAT. This approach is consistent with the procedure of Binder et al., who advises that any indicators assessment should be tested with its users to ensure its *feasibility*, *validity* and *relevance* (Binder et al., 2010). Indeed, this step ensured that there was no significant gap between the conceptual level of indicators and the producers' level of knowledge for the interview phase. Such a gap may lead to misunderstandings of the questions and thus to some misappropriation of the results (FAO and OriGIn, 2020). Besides, no indicator was changed or added after the field trials. One limitation that may appear to this result is that the grid was tested with the same actors in charge of its consolidation, namely the Sustainability Committee. Hence, the interviewees were already familiar with the tool. New stakeholders, external to the consolidation process should probably have been selected to ensure the complete relevance of this step.

1.4 PHASE 4 – Validation of the new QSAT on the field through its implementation on the Maroilles PDO cheese

1.4.1 Step 12: Field data collection

The step aimed to collect the information required by using the QSAT. Along with other assessment methods (RISE[13], IDEA etc.), the QSAT grid was transformed into questionnaires. They had to be created from scratch an obsolete data collection process was used beforehand, i.e. based on the interviewer perception and not the interviewee. This process required a large amount of time when translating the grid into the *Google forms* before starting the interviews. However, this limitation was soon compensated as it enabled automating the data collection and retrieving them in an Excel file for the processing following step.

1.4.2 Step 13: Data processing and analysis – zoom on the aggregation process

For the data processing phase, i.e. the translation of the collected data into a sustainability diagnosis, indicators scores from the three questionnaires (milk producers, cheese makers and consortium representatives) were aggregated. Thus, the sustainability performances of each category of individuals could not be evaluated as it was initially the objective. Indeed, due to time constraints and communication purposes, it was decided to operate for such aggregation to keep the final presentation of the results simple for understanding. As pointed out by Gasparatos et al. (2008), aggregation comes at a cost, as information is usually lost during the

[13] The Response-Inducing Sustainability Evaluation (RISE) ((Haeni et al., 2003; Porsche et al., 2006)) is a multi-criteria assessment tool analyzing and comparing a diversity of agricultural production and farming systems. It is characterized by an equilibrium between "the straightforwardness of the analysis, the complexity of the reality, and the transparency of the results" (Häni et al., 2007).

process. Hence, improvement is required for further QSAT evaluations to consider the different groups of actors individually. Indeed, not representing the grade per category of actors can lead to frustration among them and thus to certain disinterest in the final results.
Nevertheless, the aggregation process presented advantages, the major one being that it allows for easy communication of the results, which is appealing for the stakeholders when presenting the diagnosis (Binder et al., 2010).
Another general limitation that appeared during this stage was the complexity and time required to process data. Indeed, the collected data through the questionnaires were again converted into *Excel* for scoring, which required complex measurement calculations for the aggregation process. It is wise to admit that such a long-lasting and complex process can impede the reproducibility of the tool. With this regard, it is wise to acknowledge that Principle 1 - *A user-friendly framework, simple to apply and to monitor* - is not fully completed yet.
Consequently, the ability of new users to appropriate the QSAT framework will heavily depend on its functionality and will thus be determined by the capacity to develop a more automatized-, if not a digital tool. This will constitute one of the propositions for the second part of these discussions.

1.5 PHASE 5 – Reflective closing loop on the QSAT with the Maroilles PDO actors

1.5.1 Step 14: a final participatory workshop

Finally, Phase 5 aimed to reflect collectively on the development and the application of the QSAT through a final participatory workshop, where each Maroilles' actor was invited to participate (thus not only the Sustainability Committee). The presentation of the sustainability diagnosis represented a good starting point for discussing and enhancing learning and awareness of sustainability among actors (De Olde et al., 2016). This was especially of importance as some participants did not take part in the QSAT development process. Hence, the final workshop aimed to reflect on the applicability of the tool, particularly regarding the assessment method, indicators and thresholds used (Triste et al., 2014). According to Binder et al. (2010), the *results' applicability is* an essential aspect when studying the effectiveness of evaluation tools, though still neglected in most studies (Rossing et al., 2007).

1.5.1.1 Identified limitations

It is wise to acknowledge that some deficiencies appeared in achieving this purpose. Indeed, the participants rushed to discuss the results of the sustainability diagnosis rather than the process itself of developing the QSAT. This was mainly due to the stronger interest of the workshop participants' to react to tangible findings (viz. the diagnosis) than discussing something that may appear abstract to them, especially as half of them did not participate in the QSAT development process. Hence, it was for me difficult to follow the workshop schedule as a facilitator, and I had to adapt to the participants. Another reason for this deficiency was the time constraint that limited the workshop's objectives. Thus, the workshop agenda became more oriented towards the development of concrete actions resulting from the diagnosis rather than towards reflection. Finally, presenting concrete results to the participants instead of discussing the tool appeared more appealing when inviting them to the workshop.

1.5.1.2 Identified circumstantial evidence

Nevertheless, the results of this workshop showed evidence that what soft-systems practitioners (e.g. Bell and Morse) consider the main purpose of sustainability analysis, i.e. discussion and exchange of ideas, was met (Bell and Morse, 2008). Based on the participants' feedback, the QSAT grid application was perceived as meaningful as it generated significant discussions.

Finally, putting a larger emphasis on the results through the *Visual Theory of Change* (Wageningen Centre for Development Innovation, 2012) and the prioritization of objectives enabled to generate transformational knowledge among the participants, that is, how to get from the present to a desired, more sustainable situation. As highlighted by de Olde et al., this stage is often neglected in assessment processes, though essential for the implementation of the results (de Olde et al., 2017). This transformational knowledge could have been greater generated if we had finished the workshop with the drafting of an action plan. Though it is wise to acknowledge that the workshop agenda was quite ambitious for only 4 hours of time, and thus discussions were privileged instead of rushing towards the formulation of concrete actions. Hence, achieving the ultimate step of action plan drafting is a long-lasting process that would require at least another workshop (see *3. Propositions*).

As already mentioned, the present study, due to its "action-research" nature, had two intertwined objectives: to provide the Maroilles' actor with a sustainability diagnosis while using this field of research to consolidate the QSAT and to tailor it to every dairy and cheese GIs. Therefore, the findings have different implications, depending on if we look at the study through the lens of the Maroilles' actors or through the lens of the researcher.
These different implications are discussed in the following part. Results' implication for the Qualimentaire organization is also provided

2 Implications of the results

2.1 Implication of the results for the Maroilles's organization

2.1.1 The QSAT as a systemic learning tool

Through the QSAT, Maroilles' members were able to take a fresh and broad look at their issues. This was made possible through the holistic approach of the grid in which the actors were asked to put on the table all the subjects they wanted to deal with. From a commonly perceived SD definition centred only on the dual "economy - environment" dimensions, the QSAT tool enlarged the participants' perception of SD. Extended to five dimensions, the QSAT allowed indeed for the consideration of broader aspects, including internal organizational dynamics (Governance dimension) and the interaction of the GI with its territory (Territorial dimension). By integrating these dimensions in the analysis, the sustainability diagnosis may lead to identifying new fields of action by creating new synergies and spaces for dialogue with local organizations, particularly with the Haut-de-France Region willing to support the Maroilles' sector towards the identified objectives. Hence, the QSAT framework thus acts as a tool for collective learning and progress that goes well beyond a simple evaluation tool (Reed et al., 2006; Bell and Morse, 2008; Triste et al., 2014).

2.1.2 The QSAT as a discussion and reflection tool

Engaging in a discussion through the concept of SD made it possible for the Maroilles' actors to compare their perspectives with each other, to question certain opinions and renew the discourses (Bell and Morse, 2008; Rey-Valette et al., 2008b). As observed during the final participatory workshop, when the subject of the discussions is a common good such as the Maroilles cheese, bringing together several diverse operators, it can often generate strong discussions, if not debates. Both can lead to new ideas if the debate is well framed (Rey-Valette et al., 2008a). As such, the QSAT can be considered as a reflection tool that contributes to the acknowledgement, debate and mutual learning on the operationalisation of the concept of sustainability (de Olde et al., 2017b)

2.1.3 The QSAT tool as an internal communication tool

The diagnosis provided information on multiple aspects of the GI as well as producers' perceptions of the Maroilles organisation, which, if positive and well communicated, could attract new incomings. Using the QSAT could therefore serve as an effective means to communicate the interests of Maroilles producers to work in the GI and encourage young producers to join the sector.

2.1.4 The QSAT as an action-oriented tool

The last workshop showed that the QSAT could induce action- and management responses from the generated diagnosis by identifying objectives to focus on. A first step was thus undertaken towards the formalization of an Action Plan to define concrete actions towards the objectives. The Maroilles' coordinator and the president will ensure this follow-up stage.

In addition, the formalization of a debriefing report of the last workshop and to a alrger extend of the study was essential to disseminate the information to all Maroilles' members and not only to the workshops' participants (see the workshop's report in Appendix 19). This document will ensure to embark everyone in the same progress dynamic and hopefully integrate new members to the Maroilles Sustainability Committee. Furthermore, having this synthetic document enabled to inform external stakeholders of the study, particularly the Haut de France Region, willing to support the GI by providing concrete management responses.

Finally, it is interesting to ask at which level the Qualimentaire diagnosis will impact the GI practices, i.e. if it will lead to modifications of the Maroilles CoP or changes at the individual level solely.

2.2 Implication of the results for the Qualimentaire organization

2.2.1 The QSAT to reassert the support mission of Qualimentaire

This study also provided significant results for the Qualimentaire organisation as it complemented its mission to support GI sectors. The sustainability diagnosis enabled the organisation to grasp the Maorilles PDO's current need better and thus better orientate management responses according to the objectives prioritized by the actors.

Based on the further utilization of the tool, an opened perspective for Qualimentaire to pursue the utilization of the grid would be to implement it on already existing GIs facing important structural issues such as a decline in attractiveness, loss of producers or internal social problems. The implementation of the grid could thus act as a problem-solving tool by identifying core issues and engaging dialogue among producers. Similarly, the framework could be used on non-GI value-chains willing to obtain a GI scheme. It could thus constitute an entry point for producers in their sustainability pathway to define sustainability requirements to receive a GI label.

2.2.2 The QSAT to inform agricultural partners and build alliances

The sustainability diagnosis generated through the QSAT could be communicated to agricultural partners, the Region, the State, or the European Union to support measures necessary to develop the GI effectively according to the objectives defined. In the case of the present study, the study results were indeed communicated to the Region Hauts-de-France what led to financial support for the Maroilles PDO to reach its objectives.

Through its wide network of institutional partners and GI supporting organisations, Qualimentaire, with its tool, acts therefore as an important intermediary and catalyst of progress for GIs. Alliances should be now developed to ensure the effective development of the

framework in other territories. In that respect, a partnership should be created in the coming months with the Regional Institute of Food Quality of Occitania (IRQUALIM), the Qualimentaire counterpart in the Occitania Region, to expand the framework beyond the Hauts-de-France Region in other GI territories.

2.2.3 The QSAT to communicate GI performances to the consumers

What is more, the Maroilles' diagnosis made it possible to identify the multi-dimensional value of the GI, which could be communicated to the consumers, thanks to the Qualimentaire consumers' network.

2.3 Implication of the results in light of the overall study objective, requirement principles and the research question

The discussion of the results enabled checking if the initial objective of the study and the related seven requirements principles were met. Table 23 below provides an overview of the major changes resulting from the QSAT consolidation towards the study objectives and principles requirements. As the table illustrates, some principles were still not fully achieved, resulting in a set pf propositions (see following Section 3.)

For instance, Principle 1 - *A user-friendly framework, simple to apply and to monitor* - could not be fully completed due to the still complex and time-consuming data collection and processing process. This called for the need to propose an **automation of the QSAT.**

Likewise, Principle 7 - *A framework designed for action* - was not entirely validated as the last workshop was not completed due to time constraints. Therefore, the derived proposition would be for the Maroilles PDO to set another participatory workshop designed to create **an Action Plan** based on the QSAT diagnosis.

Coming back to the research question, results revealed a number of trade-offs when seeking to combine the six required principles simultaneously:

1. Specific (Principle 4) vs. generic and reproducible (Overall objective);
2. "Easy" and "fast" diagnosis (Principle 1) vs. scientifically robust (Principle 2);

Same limitations were observed by Binder et al. (2010). This implied taking a step back and looking at the broader picture to not only develop a tangible grid of evaluation but an adaptive framework drawn on the stepwise and iterative process developed with the Maroilles case.

Finally, considering the overarching research objective to disseminate the QSAT to other GIs territories this methodology to other GIs in France and beyond, one can acknowledge that this objective would only be achieved if clear guidelines are defined. This condition called for the **creation of a guiding manual** to enable users to appropriate not only the QSAT methodology.

Table 23: Summary of the key major changes in light of the overall objective and seven principles, state of achievement and related propositions

Overall objective and the seven related principles	Major changes compared to the 2020 QSAT	State of achievement of the overall Objective and Principles	Resulting propositions and implicated organization
Overall objective: To consolidate the QSAT to become a tool of reference for the dairy and cheese GIs.	Participatory consolidation of the conceptual and methodological frameworks of the QSAT and adaptation to the dairy and cheese GIs	Still not fully achieved	Guiding manual of the QSAT methodology (for Qualimentaire)
Principle 1: *A user-friendly framework, simple to applicate and to monitor*	*Google Forms* questionnaires for the data collection	Still not fully achieved	Automation of the grid (for Qualimentaire)
Principle 2: *A scientifically robust framework*	Review of seven reputable sustainability assessment frameworks and GI-expert support	Achieved	
Principle 3: *A holistic framework*	A multidimensional framework with the integration of the *Governance* dimension	Achieved	
Principle 4: *A framework adapted to the specific context of the GI*	Co-constructed indicators with local actors	Achieved	
Principle 6: *An inclusive framework*	Integration of each different type of actors constituting the governance of the GI + Integration of a large proportion of subjective indicators	Achieved	
Principle 7: *A framework designed for action*	Prioritization of objectives towards an Action Plan	Still not fully achieved	Another workshop for the creation of an Action Plan (for the Maroilles organization)
Research question: *To what extend is it possible to consolidate and to adapt the QSAT to the dairy and cheese GIs while applying these six principles requirements?*	**Response to the research question**: several identified trade-offs between the principles		A stepwise and adaptative framework for GI evaluation (subsequent Research)

3 Propositions

3.1 Proposition for the Maroilles PDO: The organization of another participatory workshop towards the creation of an Action Plan

This proposition aimed for the Maroilles' coordinator to set up another participatory workshop designed to draft an Action Plan. To this aim, the different sessions not completed from the last workshop's agenda could be kept.

As a reminder, it consisted in:

- The creation of focus groups assigned to each prioritized objective to reflect on concrete actions.
- A plenary session where each group could present its ideas, which would have been written down on post-its. Participants then stick the post-it are then stick on a timeline with different time laps: *short term action*, *middle term action* and *long term action.*

Besides, an adaptation of the Eisenhower matrix - also referred to as the "Urgent-Important" matrix - could be implemented to the time-scale to differentiate "urgent actions" from "important actions". For instance, a short term action could be urgent to implement but not necessarily crucial versus a long term action, requiring more time to be realized but which could be of a higher degree of importance (Eienhower, 2017). The adapted Eisenhower matrix could therefore take the following form:

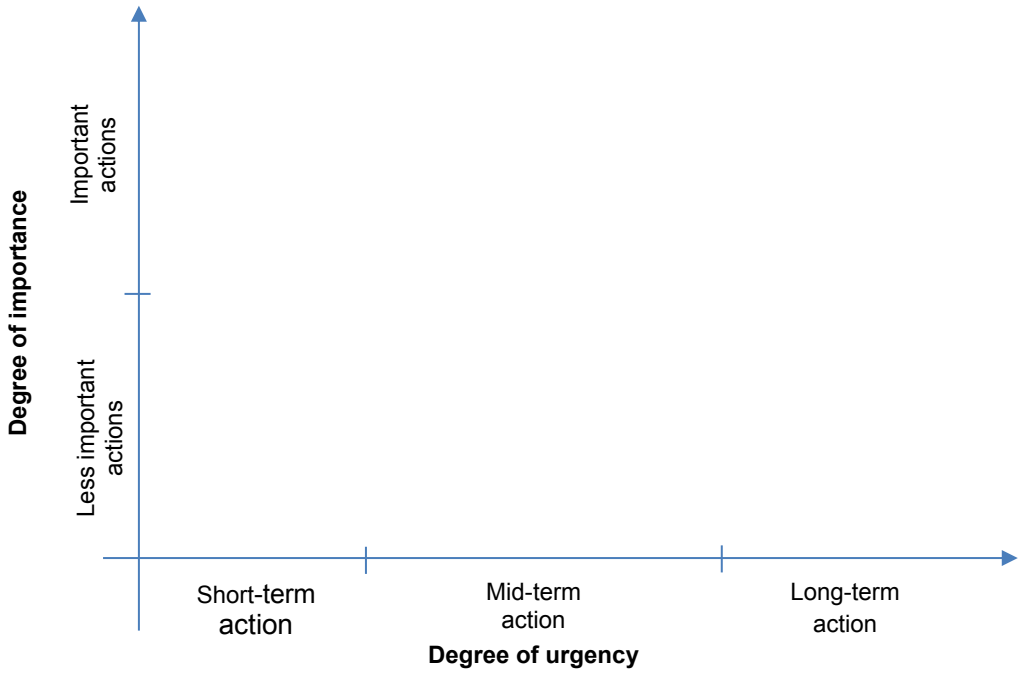

Figure 33: Adaptation of the Eisenhower matrix for the formalization of an Action Plan for the Maroilles' organization

3.2 Propositions for the Qualimentaire: The automation of the QSAT grid

As already stated, a critical improvement point for the grid would be to convert it into a digital tool, which would render the data collection and processing phases significantly easier.

As a first step, automation of the Excel file of the QSAT was realized in parallel to the Maroilles study. Questions related to the indicators were automated using the drop-down list function with the different response modalities. An extra column called "Results" was thus specifically created

where the responses could be entered. Similarly, another column called “No grade” was added where responses not entering in the diagnosis could be typed (see Table 22).

Table 25:Snapshot of the Qualimentaire grid in its automated version

Indicators	Questions	Target	0% to 20% of sustainability	20% to 40% of sustainability	40% to 60% of sustainability	60% to 80% of sustainability	80% to 100% of sustainability	No grade	Results
Maintain of the engagement in the GI-organization	*Do you intend to maintain your involvement in the sector in the coming years ?*	Producers and cheese makers	Not at all	Rather not		Rather yes	Yes, abolutely	No opinion	Yes, abolutely
Known successor ?	*Do you have a successor ?*	Producers and cheese makers	No				Yes	Not concerned	Not at all Rather not Rather yes Yes, abolutely
Attractiveness of the GI-organization for new incomings	*Do you think that the PDO-label makes the Maroilles sector more attractive for new incomings compared with a dairy sector without the PDO denomination ?*	Consortium representatives, Producers and cheese makers	Not at all	Rather not		Rather yes	Yes, abolutely	No opinion	Not at all
Ease of installation	*On a rating scale from 1 to 10, how would you evaluate the ease to integrate the Maroilles' sector ?*	Producers and cheese makers	1 to 2	3 to 4	5 to 6	7 to 8	9 to 10	No opinion	3 to 4

This automation enables the interviewer to conduct the data collection and processing phases at once, which saves a significant amount of time. Indeed, the work is undertaken only on the automated Excel file instead of converting the questions on Google forms and then translating the responses again on Excel for data processing.
For the interviewee, it allows to benefit from an individual sustainability diagnosis with the generation of scores and spider graphs right after the interview and before each interview’s score is aggregated for the final diagnosis. Although it was not the initial objective of the QSAT, this would enable producers to take concrete actions towards SD at their scale.
The automation of the grid is still a work to be continued, requiring further expertise from persons dedicated to this task.

3.3 Proposition for the research: A stepwise and adaptative framework for GI evaluation

As outlined in Section 2.3, the objective of this study posed the major challenge to offer a generic grid to all GIs while considering their intrinsic specificities given the wide range of GIs even in the same sector, *viz*. the dairy and cheese sector.
As a result of this issue, a stepwise and flexible assessment framework was proposed, thus enlarging the initial objective to not only propose an evaluation grid but a whole procedure. This procedure that I will refer to as the *QSAT methodology* drew on the framework presented in this study and complemented with existing frameworks from the literature on sustainability assessment tools (see Figure 34). Likewise, the development of the QSAT within the Maroilles case, the development of the QSAT methodology is considered as a learning process with reflections made on the tool design, application and the generated results.
This process could be used by anyone, internal to the GI organization (GI coordinator or president, group of producers *etc*.) or external (GI supporting organizations such as Qualimentaire, local planning authorities, NGOs, businesses, researchers *etc*.) referred to as “practitioners” from here on.

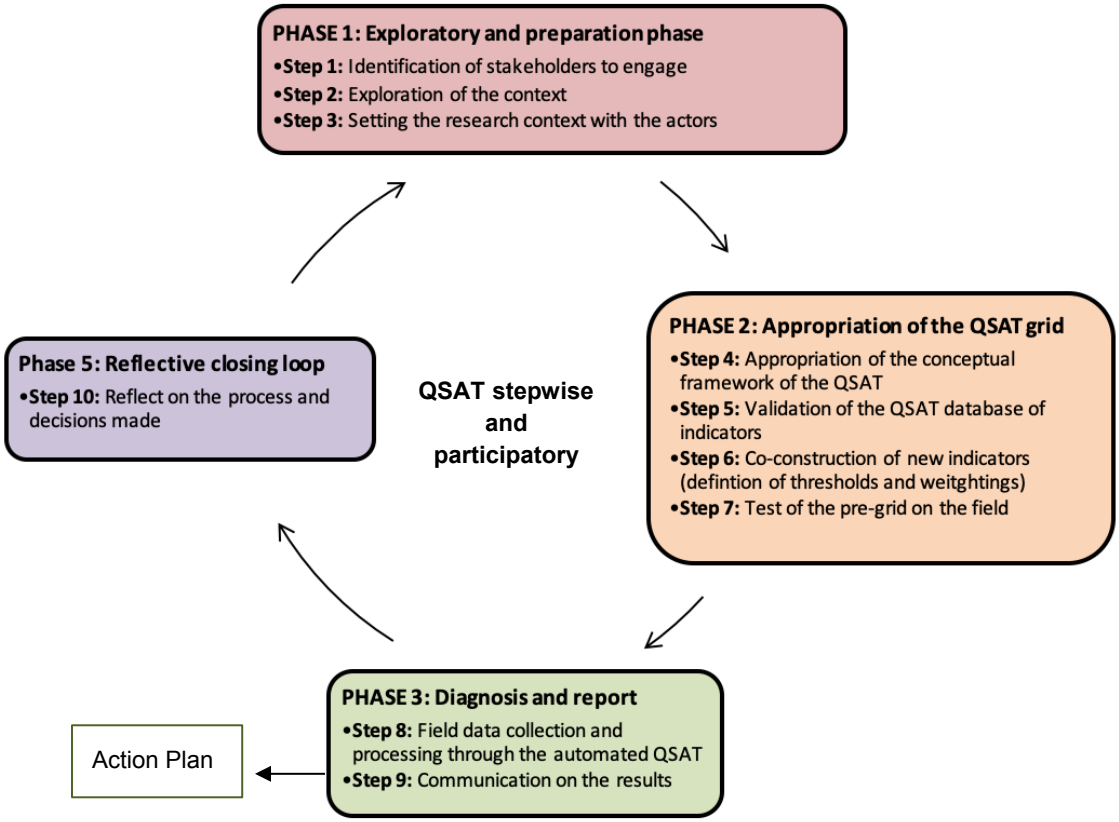

Figure 34: Stepwise and adaptative QSAT framework, adapted from de Olde et al. (2017a)

Following the proposed method, QSAT users should first identify the stakeholders to engage and explore the local context to identify the system boundaries (**Phase 1**). The following phases should then be carried out with the active participation of the engaged stakeholders. The practitioners should then appropriate the QSAT database and discuss the QSAT indicators with the GI actors (**Phase 2**). For this core phase, a set of conditions were defined:

(1) Keep the entire set of the 34 generic objectives.

These 34 objectives are the backbone of the QSAT and thus should not be modified, or only in an extreme case of necessity. Even if it is not the approach we went for, having identic objectives for all systems would allow an easy comparison of different GIs. This could also foster emulation between GI systems and allow them to share relevant insights based on the use of the QSAT

(2) Keep as much as possible the original dataset made off the 241 indicators.

These 241 indicators originate from various reputable sources and have been tailored specifically for the cheese and dairy GIs and tested on the field, guaranteeing a certain robustness and applicability. However, if one wishes to add extra indicators, this can be done through a co-construction process as it occurred for the Maroilles case. Also, depending on the level of maturity of the concerned GI, the QSAT database could be incremented with further indicators of higher complexity. Yet, attention should be paid to add new indicators to a small extend. The Qualimentaire grid is designed to repeat the evaluation on a two to five years' interval; it is thus important to keep the same indicators' foundation to avoid biasing the diagnosis.

(3) Modify the indicators' thresholds if one realizes that they do not fit the reality of the assessed GI field.

As thresholds are difficult to generalize from one region to another, especially for environmental indicators (Riley, 2001), it is strongly advised to adapt them to the new GI to be evaluated. Likewise the integration of new indicators, it is recommended to operate for a participatory process likewise for the Maroilles.

Then, the practitioner would be in charge of collecting and processing data from the measured indicators defined in Phase 2 to obtain the sustainability diagnosis of the GI (Phase 3). The latter would be then communicated and disseminated to the local stakeholders towards the creation of an Action Plan. Finally, the experiences with the tool should be used to reflect on the tool design (e.g. selected indicators and thresholds) as well as the actions undertaken (**Phase 4**).

As stated by the FAO and OriGin, sustainability should be seen as a pathway and not a state, which implies to look at sustainability as a continuous improvement process in a GI sector (FAO and OriGIn, 2020). In a fast-evolving world where new sustainability challenges arise constantly, stakeholders' priorities may evolve. This is why the QSAT methodology should be iterative and was represented as a feedback loop (see Figure 34).

The next logical step was to formalize this iterative process into a guiding manual in order for Qualimentaire to disseminate its evaluation framework.

3.4 Propositions for Qualimentaire: The creation of a Guiding Manual

The present study was the opportunity to design a Guiding Manual for future individuals willing to engage in a similar sustainability journey with their respective GI. Without imposing a rigid framework, this guide, entitled *Guiding Manual to use the Qualimentaire Sustainability Assessment Tool*– a stepwise and participatory methodology, thus aimed to help any GI practitioner to :

- Initiate a participatory approach and a collective learning process with the respective GI community by facilitating the appropriation of the concept of SD by the stakeholders.
- Provide a holistic sustainability diagnosis thanks to the generic database of objectives, criteria, and solid indicators tailored for PDO systems and that could be modulated to each diverse situation.
- Induce action responses based on the generated sustainability diagnosis.

The original Guiding Manual (in French) can be seen in Appendix 20. Practical recommendations on how to implement the QSAT framework with some relevant anecdotes from the Maroilles case study.

General conclusion

The present action research proposed a significantly improved assessment framework compared to its previous version and tailored for dairy and cheese GIs. The development of the Qualimetnaire Sustainability Assessment Tool is innovative as it combines top-down reductionist and scientific support with a bottom-up, community-driven participatory approach involving Maroilles' stakeholders. Within this process, I started to define stakeholders to engage and the context and scope of the evaluation. The conceptual and methodological frameworks of the tool were then consolidated using a wide range of methods, combining diverse sources and participatory approaches, which resulted in a relevant set of indicators adapted to the objectives of the dairy and cheese GIs. This process resulted in a robust and holistic framework including the essential dimensions of Governance and Territory. In addition, this framework is innovative as it is the first one looking at the different levels of the GI by combining the farm-, the value chain- and the territory- levels as well as considering the different actors constituting the system (milk producers, cheese makers and GI coordinators).

Results of this experience were then discussed with the Maroilles' stakeholders in order to reflect on the development of the tool and on the sustainability diagnosis. This is why the QSAT can be considered as a learning tool as it fosters understanding, empowerment and decision making on sustainability. With this regard, the QSAT goes well beyond a simple evaluation tool.

However, several trade-offs appeared when designing the framework, especially regarding the inevitable challenge of producing a generic tool for all GIs that should be specific to the local context. This led to rethink the research objective and to not only propose an evaluation tool but a whole methodology drew on the one presented in the Maroilles case study with the Maroilles PDO. With this stepwise and adaptative methodology, any practitioner would be able to engage in such a sustainability journey with its respective GI. This will be possible through the Qualimentaire Guiding Manual, ensuring the dissemination and well appropriation of the methodology to future users.

It remains to know how the Qualiemtnaire will further use the tool, especially regarding the ownership rights, which will also heavily determine the degree of dissemination of the tool.

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