MASTER THESIS

Including farmers' perspective in sustainability assessment tools. An entry for the voices of European quinoa producers in the Life Cycle Assessment methodology.

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WAGENINGEN UNIVERSITY AND RESEARCH

April 2022

Wageningen University – Social Sciences

Master in International Development Studies

Specialisation: Rural Sociology

MSc Thesis Chair Group: Rural Sociology Group

Thesis Code: RSO-80436

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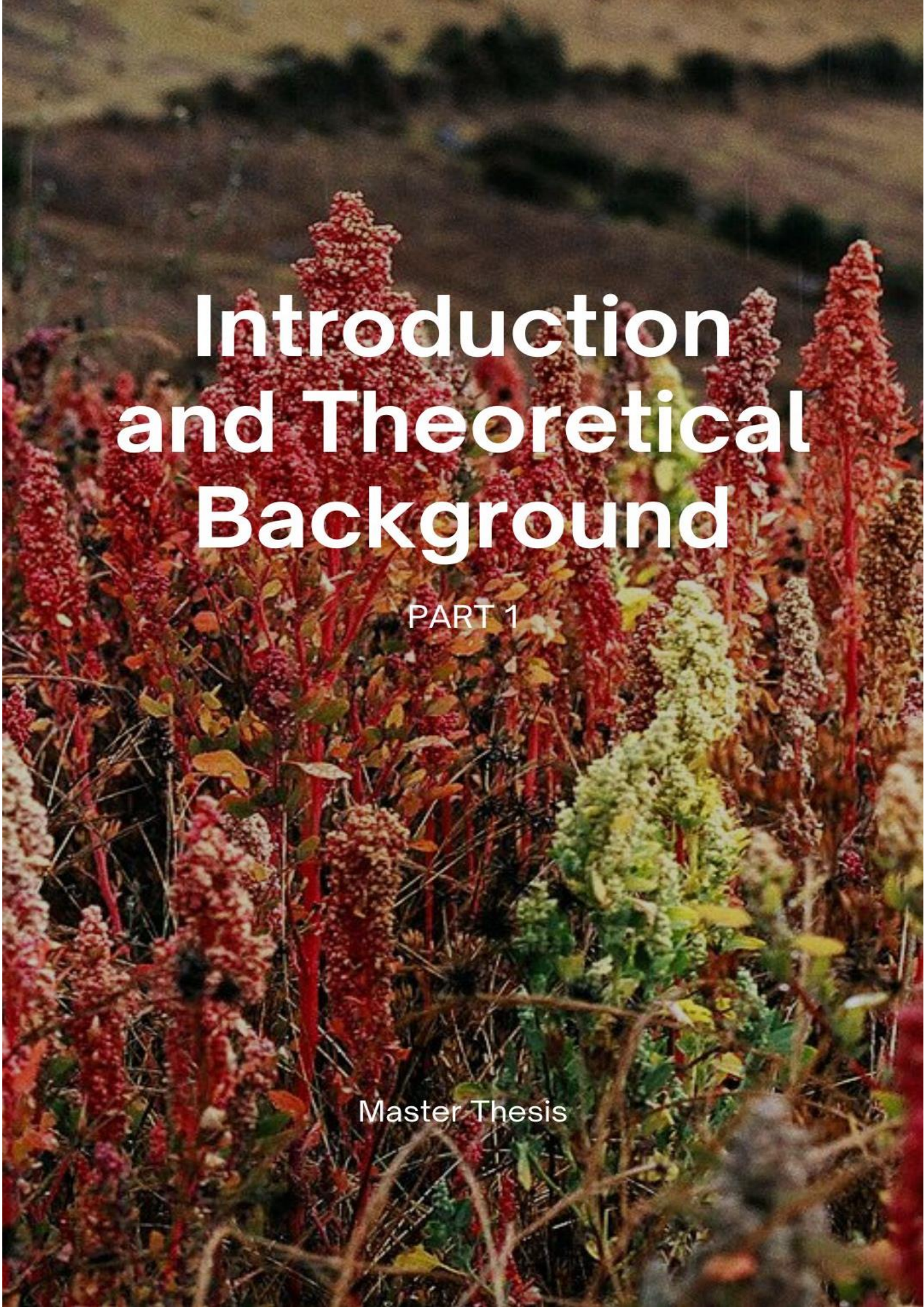
ABSTRACT

Because of the growing interest in climate change and environmental issues, assessment methodologies such as Life Cycle Assessment (LCA) are becoming more and more relevant to evaluate the sustainability of value-chains in the agricultural sector. These methods are elaborated within the research field, but they affect many other dimensions of society, from policymaking to agribusinesses, through their definition of sustainability. Moreover, they have been often criticised by previous literature for portraying a partial representation of the phenomenon and for excluding the perspective of farmers concerning environmental issues. Therefore, this thesis reflects on the possible inclusion of farmers' understanding of sustainability in these assessment methodologies, particularly analysing LCA. The perception of sustainability elaborated by, on the one hand, European quinoa farmers and, on the other hand, by LCA researchers has been investigated through interviews and participant observation and analysed thanks to the application of two main theories, Discourse Analysis and Actor-Network Theory (ANT). The results have shown that diverse understandings of sustainability can coexist within and between various groups of people. Farmers shared a practical perspective on the issue, based on their daily work and experiences, ideals and beliefs, as well as connected to a close contact with nature, people and the local context. Conversely, researchers represented sustainability as a theoretical and abstract vision, which needs to be understood through compartmentalisation and quantification. Despite the differences between the two viewpoints, several points of modification have been identified in order to improve sustainability assessment tools through the inclusion of farmers' perspective. Furthermore, this thesis argues for the transformation of power relations in the sustainability sector, which tend to isolate farmers, through the construction of a close relationship between them and the research sector, as well as the valorisation of their knowledge. Finally, a radical reconceptualisation of the idea of sustainability is proposed, as reproducing the struggles between structure and agency, concretised and daily experienced through actions and practices.

List of Tables and Images

List of abbreviations

ANT	Actor-Network Theory
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
LCSA	Life Cycle Sustainability Assessment
SLCA	Social Life Cycle Assessment
VCA4D	Value Chain Analysis For Development



Introduction and Theoretical Background

PART 1

Master Thesis

1. Introduction

Food production is a sector with a significant impact on biodiversity, climate change and environmental resources such as soil, water and air, playing, consequently, a considerable role in the international menaces to planetary boundaries (Alrøe et al., 2017). Yet, agriculture influences as well the everyday lives of the people working in it and the health of its consumers, if workers' rights, salaries and safety rules are considered (Czyżewski et al., 2018; Janker et al., 2019). Consequently, from the second half of the 20th century, scientists and agri-experts have created complex worlds of compliance, composed of standards, protocols, grades, metrics and benchmarks to assess the impact of food production on the environment and society. Besides, these metrics have been exploited by agribusiness as well, to claim an improved product quality in high-value markets (C. J. Rosin et al., 2017). Since then, sustainability indicators and complex indexes are growing in importance and international recognition as fundamental tools for policy-making, as they provide data on national and corporate performance in the environmental field. For these reasons, several methodologies have been elaborated and applied to achieve sustainability assessment (Singh et al., 2012), which is nowadays recognised as a core instrument to support the shift toward sustainability (Pope, 2003). Among these assessment methods, Life Cycle Assessment (LCA) is a science-based standardised environmental assessment methodology, which is internationally acknowledged and increasingly used as an analysis tool to calculate the potential impacts on the environment of a product or a service throughout its life cycle (Koroneos et al., 2013).

Nevertheless, the concept of sustainability itself – that those tools try to quantify and operationalize – is extremely complex and far from being clear and univocal. It entails a multiplicity of values and interests (Cheney et al., 2004) and its definition, representation and implementation are socially and politically constructed, reflecting the perspectives and benefits of those involved (Scoones, 2016). This makes sustainability not only highly contested, but also its interpretation dependent on local culture and language (Vallinga, 2012), as it involves people's relations with nature, environment and place (Cheney et al., 2004). Moreover, several social researchers highlight that the only meaningful interpretation of sustainability requires a multidimensional understanding of it, considering at the same time its ecological, social and economic aspects (Ratner, 2004). Applying these reflections to the agricultural sector, previous research underlined the relevance of considering the point of view of the people working in it, such as farmers. They represent, indeed, a fundamental actor to realise the transition toward a more sustainable system, as they are responsible for choosing the crops to cultivate and the agricultural practices (Aare et al., 2021; Baccar et al.,

2020b; Fleming & Vanclay, 2010; Gebska et al., 2020). Therefore, considering the motives and the values between their decisions as well as their perception of the sustainability of their farms can be fundamental in the perspective of a sustainable transition (Groetenhuis & Schoon, 2000). Yet previous research already stressed their frequent exclusion from both the scientific and political worlds (Fleming & Vanclay, 2010; Webster, 1999).

Consequently, the paradox becomes clear: the indicators and metrics prescribed in assessment methodologies like LCA are unable to satisfy their aim of assessing the sustainability of food production when the concept of sustainability itself is so complex and not only dependent on ecological factors, but on personal values, social definitions and economic viability as well. There exists a widespread theoretical debate concerning sustainability assessment and its indicators, which have been described as reductive and fallible in measuring reality (Hale et al., 2019). Several studies already argued that environmental sustainability assessment tools provide a partial and deficient understanding of reality, because of the exclusion of social and economic factors (Alrøe et al., 2017; Bosshard, 2000; Weiland, 2014). Because of its importance in the environmental field, LCA has been vastly discussed. Noticing its negligence of the social and economic sides of sustainable agriculture, researchers started proposing adjustments and complements to the method itself, combining LCA with techniques peculiar to different disciplines (Jeswani et al., 2010; Michalski & Krueger, 2015). These issues have been fostered by the traditional division between nature and culture, science and sociology, lying at the foundation of modern knowledge, while recently this cleavage has been challenged by a number of approaches, such as Actor-Network Theory (ANT) (O. Jones, 2009).

In this study, thus, I contribute to this ongoing debate by suggesting that, through its way of describing sustainability, LCA is constructing a certain discourse about this complex concept. More importantly, the methodology is able to influence policy-makers and society at large through this representation of sustainability, while other actors do not have this power. Previous literature has already demonstrated the co-existence of diverse discourses concerning sustainability in the agricultural sector, delineating the characteristics of the different perspectives on both its natural and social components. Particularly, the relevance of research and science in co-creating and influencing the understanding of this core concept has been highlighted (Feindt & Oels, 2005), as well as the performativity of indicators and scientific tools, namely their possibility to affect and alter reality and its understanding (Hale et al., 2019). Conversely, a fundamental actor who is often neglected is the farmer. Farmers have been proven to be fundamental in the move toward a more sustainable agricultural production as they directly affect the environment through their work

(Gebska et al., 2020; Webster, 1999). Nevertheless, their ideas on sustainability are rarely considered, neither in environmental research nor by policy-makers (Baginetas, 2008; Lowe et al., 2006)

I, therefore, argue that it is fundamental to investigate farmers' and LCA researchers' understandings of sustainability, articulated in all their environmental, economic and social components. To progress this aim, this research draws on the post-structural philosophical base of two approaches, namely Actor-Network Theory (ANT), which is able to conceptualise the complex network of relations between humans and non-humans – in this case among farmers, researchers and sustainability assessment methods (Benton & Craib, 2001); and Discourse Analysis, which offers theory and methodology to investigate the language and its uses (Klerkx et al., 2015). Combining these theoretical approaches, the aim of this thesis is to analyse farmers' and researchers' discourses about sustainability, reflecting on the possible integration of farmers' point of view in sustainability assessment methodologies.

Earlier studies investigated similar issues, such as debating opposite perspectives on the concept of agricultural sustainability according to farmers (Schaller, 1993), or trying to delineate the ultimate farmers' definition of sustainability in all its facets (Dunlap et al., 1993). Baccar et al., (2020) investigated the meaning of sustainability among Moroccan farmers, for whom the subjects of climate change and environmental footprint are almost unknown, while Baginetas (2008) compares the understanding of sustainability in the eyes of policymakers, scientists and farmers. A further remarkable example is represented by the article by Stuiver, Leeuwis & Van der Ploeg (2004) studying the different ways in which researchers and farmers build their knowledge. The cited studies displayed interesting findings in order to better understand the perception of sustainability from the different actors' perspectives. Significant discrepancies have been found in the sustainability definition of different categories of people, such as farmers and scientists, but also within them (Dunlap et al., 1993). These studies remarked the need for considering personal values and the cultural and professional background as important influences on people's behaviour (Schaller, 1993; Stuiver et al., 2004). Moreover, farmers have been discovered to have a strong hope in future technical innovation to achieve a greater sustainability, while believing that nowadays the desired sustainability transition cannot be reached without a significant economic reward (Baccar et al., 2020a). This thesis recognises the importance of these studies and uses their knowledge as a base, but it aims to go beyond them, both for the applied methodologies and for the tackled contents. Thanks to concepts learnt from these studies, in the interviews, I reserved particular attention to issues such as cultural and professional background, personal values and

economic remuneration derived from sustainable practices. Nevertheless, while Dunlap et al. (1993) employ a structured questionnaire and Baginetas (2008) applies a document analysis, this research exploited semi-structured interviews and participant observation to go deeper in the understanding of the way of thinking of both farmers and researchers. Moreover, the element of greatest innovation is to consider a non-human agent among the actors, namely the assessment methodology itself. Thanks to ANT, I let LCA speak for itself, elevating the tool to an agent at the same level of the human agents and considering what it has to say about sustainability, to understand how farmers' and researchers' perspectives are reflected in it. Moreover, through Discourse Analysis, it is possible to deeply reflect on different discourses about sustainability. On the side of researchers, clearly, LCA specialists have been selected in this study to express their vision and to talk on behalf of LCA as well. On the side of farmers, a specific type has been chosen, namely European farmers, who are already familiar with the idea of sustainability and who already integrated this concept into their daily practices. Especially, the research involved farmers who cultivate quinoa, as they represent a small group accustomed to experimenting with sustainable innovations and alternative agricultural practices.

Quinoa, indeed, is a highly debated crop (McDonell, 2015). Quinoa (*Chenopodium quinoa*) is an ancient grain that was initially domesticated in the Andean regions of Bolivia and Peru around 3,000 to 4,000 years ago (ICI Business, 2020). Its nutritional characteristics, wide adaptability and multiple uses explain the worldwide interest arouse around this crop during the last decades (Jacobsen, 2006), which brought the grain to be cultivated in 95 different countries over the world and, among them, in Europe as well (Bazile, 2015).

The consumption of quinoa has been fostered by its representation, as "miracle food", a global-scale potential cure for hunger, poverty, biodiversity loss, and climate change (Angeli et al., 2020; McDonell, 2015). At the same time, many studies concerning quinoa production in its original countries, Peru and Bolivia, highlight its relationship with local culture and economy (Ehlers, 2021). Yet, researchers also shed light on the negative consequences of the grain's globalisation, such as unsustainable rise of the price for local communities (McDonell, 2015), appropriation of communal lands, increase of intensive agricultural practices with consequent damage for the local ecosystem and biodiversity loss. These studies concerning the environmental and socioeconomic impact of the boom in quinoa production stimulated a vivid debate about the sustainability of this crop value chain in the Andean countries (Angeli et al., 2020). Conversely, a serious knowledge gap concerns quinoa production in Europe. Particularly, there has been no reflection concerning what quinoa sustainability means in the European contexts, how it is located in the European culture and

which is the European farmers' perspective about it. This is why quinoa production in Europe constitutes the ideal case study to analyse the interrelation of social, economic and ecological factors in sustainability assessment.

Consequently, the thesis aims to bring several contributions to the studied field. Firstly, it aims to bring closer the two worlds of farmers and researchers, stimulating a debate about a greater inclusion of the people working in the agricultural sector in the scientific field. Secondly, this study hopes to contribute to filling the gap in the literature concerning quinoa cultivation in Europe, contributing to a discussion on the sustainability of this crop in the European continent. Finally, a reconceptualisation of sustainability is proposed thanks to the interconnection of different theories and the results emerging from the research.

To tackle the subject, the following research questions will be addressed.

Main Research Question*: How can the perception of European quinoa farmers contribute to improving the representation of sustainability presented in sustainability assessment methodologies?*

Sub-Research Questions:

- *What characterises European quinoa farmers' discourse about sustainability?*
- *What characterises LCA researchers' discourse about sustainability?*
- *How are power relations structured between European quinoa farmers and sustainability researchers? How might these power relations shape whose discourse of sustainability counts?*

The thesis is structured over eight chapters. After this introduction, the main topics of the research, namely sustainability, agricultural sustainability, the sustainability of quinoa production and sustainability assessment tools are reviewed and questioned in the Literature Review, in order to show their complexity as well as their high relevance. Subsequently, the Theoretical Framework chapter is meant to incorporate the topic within a theoretical approach. Particularly, Discourse Analysis and Actor-Network Theory represent the two theories that, once combined, are able to provide the right lenses through which to understand sustainability discourse and, thus, analyse the data in order to answer the research questions. The Methodology chapter follows, describing how the fieldwork has been approached and which methodologies have been used to collect and analyse the data. After this introductory section which sets the fundamentals of the study, the results are presented as divided into two chapters answering the sub-research questions. The thesis is

concluded by two lasting chapters, namely the Discussion, which highlights the main points of possible incorporation of farmers' viewpoint into sustainability assessment tools and reflects on the theoretical contributions of the research; and the Conclusion, where the whole study with its main findings is recapitulated next to the recommendations for future research.

2. Literature Review

In the following chapter, the core concepts for this thesis are described and defined, while demonstrating how these are complex and highly debated topics. In order to do that, a narrative literature review is the selected style. Thus, a comprehensive background of the literature concerning sustainability is reviewed, particularly introducing the main discussions concerning five core notions, namely sustainability, agricultural sustainability, the sustainability of quinoa production and sustainability assessment tools, particularly describing LCA. The analysis of this information sets the basis for the following research, demonstrating the centrality and the actuality of the topic, while providing fundamental insights concerning the work that has been already done.

2.1. Sustainability Definition

Since the coining and diffusion of the term "sustainability" during the last century, different and contested understandings of its theory and practice have spread both within the academic sector and in the worldwide discourse (Frank, 2017).

Looking at its original meaning, the word "sustainability" reflects a concept of stability, durability and eternalness (Cheney et al., 2004), as it derives from the Latin verb *sustinere* which refers to "keep up" or "sustain" (Vallinga, 2012). In the early 1970s, the term started being conceptualised as commonly used today, linked to the environmental discourse and green movements (Cheney et al., 2004). Afterwards, "sustainability'' has often been used as an adjective, "sustainable'', to clarify and qualify several broad concepts, such as economy, growth, lifestyle and many others. Nowadays, the term is hardly used in isolation and the most widespread example of this phenomenon is the concept of "sustainable development" (Vallinga, 2012). This expression has been conceptualised in Brundtland Commission's report ''Our Common Future'' (1987) by the United Nations as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987). While another popular definition of it, described in the Sustainable Development Goals, portrays sustainability as composed of three main pillars: social, economic and environmental factors (Purvis et al., 2019).

Despite the official definitions, Vallinga (2012) highlights that all individuals encounter sustainability in their personal daily lives, elaborating on their own ideas about what the concept means. These different conceptualisations can be connected to people's interests, professional context, culture and values. Particularly, Horlings (2015) argues that culture plays a pivotal role in the understanding of sustainability, meaning how human communities give sense and attribute value to their place and environment. The article stresses the key importance of values in the comprehension of human behaviour, conceptualised as the result of people's principles, priorities and sense-making. Moreover, sustainability has been conceptualised as a social construct, whose definition relies on the standpoint of the observer (Webster, 1999). Social constructionism, indeed, theorised how language influences reality, creating different understandings of it (Hacking, 1999). When these social constructs are shaped by public discourse as groups of concepts and metaphors, sustainability can be studied as a narrative. Narratives shape a framework for categories of actors, creating a certain understanding of the world and transporting values and norms in sight of desirable future developments. They also have the power of justifying and legitimizing social practices and political actions (Guske et al., 2019). As elaborated in the next chapter, Discourse Analysis has been selected as a theory in this study exactly for its capacity to identify the values and the practices which shape social constructions, such as the concept of sustainability, and which transform them into narratives (MacDonald, 2003).

Furthermore, several studies underline how this multiplicity and changeability of sustainability can lead to conflict, as different understandings of it could collide (Hajer & Versteeg, 2005; Karami & Keshavarz, 2010; Vallinga, 2012). Furthermore, sustainability might be manipulated by politicians and business groups (Vallinga, 2012), which, arrogating to themselves the power to define what it means, could then influence its implementation (Neckel, 2017). In the same way, experts and researchers have been recognised to be able to strongly affect the perception over environmental issues, framing them through complex language, indicators and analytical schemes (Feindt & Oels, 2005). In this research, the focus of interest is to analyse the cultural background and the values underlying all different discourses about sustainability and to understand whether and how farmers' perception of sustainability could collide and be integrated with the one described by researchers and sustainability assessment tools.

2.2. Agricultural Sustainability

Agricultural production is a pivotal sector for its environmental performance. It is estimated to generate 50-90% of most environmental impacts - such as climate change, acidification, and land

occupation - in food production (Notarnicola et al., 2015). Thus, the importance of understanding and researching the sustainability of an agricultural system is clear.

Researchers with a natural science background tend to consider sustainable agriculture mainly as a technical process, while social scientists have pointed out that agricultural production should be regarded also as a human and social activity. Indeed, agriculture involves economics, trade, politics, international relations, social connections in addition to technology, biology and environmental problems. This makes agriculture as much social as agronomic and ecological (Karami & Keshavarz, 2010). Confirming the existence of this problem, Altieri et al. (2017) bring the example of agroecology, which has for a long time been described by the technological paradigm only as a science or a practice of applying specific ecological principles. Yet, the article argues for a redefinition of agroecology and other sustainable practices as based on the interaction of both the ecological and social spheres, stressing their role in the political arena, social movements and autonomous communities. Furthermore, stemming from the consideration of sustainability as a social construct, sociology can greatly contribute to the study of agricultural sustainability (Thomas, 1992). This discipline can aid in explaining attitudes and behaviour toward agricultural sustainability, comprehending the adoption of (un)sustainable practices, as well as interpreting the meaning of sustainability in this sector (Karami & Keshavarz, 2010).

Moreover, several social researchers initiate underlining the importance of farmers' role for the definition as well as the concrete realisation of agricultural sustainability, being them the ones taking decisions over the agricultural systems to employ (Aare et al., 2021; Baccar et al., 2020b; Fleming & Vanclay, 2010; Gebska et al., 2020; Groetenhuis & Schoon, 2000). Besides, Webster (1999) stresses that farmers have to participate in sustainability definition whenever research takes place. The article argues that, without their involvement, persuading all groups part of the rural community to follow a sustainable direction would be highly unlikely.

Other researchers focus on understanding farmers' behaviour and choices, which is rarely based only on a single set of reasons, while both internal and external factors play a vital role. On the one hand, economic aspects, as well as legislation, social relations or natural circumstances can be identified as strongly influential. On the other hand, values, conscience, worldview and experience influence farmers' choices on a sustainability level (Groetenhuis & Schoon, 2000). This explains why, a sustainable agricultural system relies also on farmers' knowledge and expectations, on their awareness concerning the risk associated with different agricultural practices, as well as their motivation and beliefs (Gebska et al., 2020). Additionally, further studies suggest exploring farmers' perception about the sustainability of their own farms to discover whether it matches with

reality. In doing this, a holistic conception of sustainability has to be taken in mind, comprehending all the internal and external factors previously cited, in order to fully understand the concept of sustainability and to overcome the point of view of the experts (Baccar et al., 2020a).

2.3. Sustainability of Quinoa

During the last decades of the 20th century, quinoa has attracted great attention at an international level (Bazile et al., 2016). Quinoa has outstanding nutritional characteristics, as it contains a considerable amount of calcium, iron, vitamin E, essential fatty acids compared to other plant food, and it is gluten-free and a complete protein. Moreover, it is extremely resilient, being able to thrive in salt-saturated soil with low fertility, while also resisting cold and drought (Hamilton, 2014; Galwey, 1992; Ruiz et al., 2014). There exist 3,000 varieties of quinoa (Mordor Intelligence, n.d.), classified as five ecotypes reflecting the adaptation to elevation. Thanks to this noticeable adaptability to diverse climates (Friis Pedersen, 2015), nowadays quinoa is tested or cultivated in 95 countries in the world (Bazile, 2015).

In Europe, this crop offers the opportunity to diversify the production system, which now revolves around a narrow number of species, increasing food biodiversity (Gęsiński, 2012). Furthermore, in order to lower greenhouse gas emissions and to reach a greater energy efficiency in Europe, quinoa could represent a fundamental input to produce new plant-based food alternatives to decrease meat production, which implicates high greenhouse gases emissions, massive use of agricultural land and high water consumption (Alandia et al., 2020). Finally, considering its resilient nature, quinoa is reputed as a "climate change adaptation crop" (Ruiz et al., 2014).

Over this period, many initiatives have been organised to bring quinoa in Europe as well as around the world, such as the project "American and European Test of Quinoa" in 1996 or the program "Quinoa – a multiple crop for EC's Agriculture Diversification" from 1993 to 1997. Nevertheless, the most significant action has been the declaration of International Year of Quinoa in 2013 by the General Assembly of the United Nations, which contributed to the rapid extension of the harvested area and to the perception and representation of the grain as a potential major crop (Bazile et al., 2016). All the mentioned initiatives were strongly supported by the Food and Agriculture Organisation of the United Nations (FAO), which defined quinoa as "one of humanity's most promising crops" (McDonell, 2015).

McDonell (2015) names FAO's strategy concerning quinoa the "miracle food narrative". The author argues that quinoa is depicted as a miracle food and a miracle crop, able to cure global

hunger and poverty, as well as to guarantee biodiversity conservation and climate change adaptation. Nevertheless, in doing so, those issues are framed in a simplistic way, which depoliticises them and reduces them to problems easily solvable thanks to a miraculous cure: quinoa. Besides, quinoa is not a miracle food by nature, but it has been portrayed as such by the material and conceptual work of several actors. The International Year of Quinoa is, indeed, analysed by the author as a full-aware project to increase and strengthen the socio-political connections fundamental to consolidate the narrative of quinoa as a miracle food worldwide.

Moreover, the role and the sustainability of quinoa production in Europe in comparison with other protein-rich foods has still to be fully understood. In their research, Linnemann & Swaving Dijkstra (2002) compared eight different crops including quinoa to comprehend their suitability for protein production in Western Europe. They considered, on the one hand, protein production, protein quality and prospect for crop improvement, on the other hand, familiarity of farmers with those cultivations and familiarity with the use for food products in the region. While the research reports the valuable function of quinoa in cereal rotation, the possibility of being cultivated even in marginal soils and the low need for pesticides, it also sheds light on the unfamiliarity of farmers with this crop, which requires additional efforts and could cause serious bottlenecks in the production. As an example, Pierre Jeanjean, a French farmer producing quinoa, when interviewed by a local newspaper, affirmed that quinoa "is still very difficult to grow. [...] There are many things that still need to be understood, at the technical level" (Schepman, 2016).

Overall, in the research by Linnemann & Swaving Dijkstra (2002), quinoa was classified as one of the crops lagging at the bottom of the list for realistic future production of protein-rich foods. This stimulates reflections about how important is the involvement of farmers' perspective in any study about sustainability. Although McDonnell (2015) extensively covers the discourse about quinoa from the point of view of policymakers, there is yet no complete study concerning the sustainability of this crop from the point of view of European farmers. Thus, in this thesis, the attempt is to start filling this knowledge gap.

2.4. Sustainability Assessment

In the last decades, several sustainability assessment methods have been developed by scientists to contribute to moving toward a more sustainable direction in food production (Alrøe et al., 2017; Pope, 2003). Sustainability assessment has its origins in primitive assessment exercises, while the traditional impact assessment methodologies have been broadened during the last decade. The tendency is to include elements from diverse disciplines, like environmental factors, economic

feasibility, social impact, as well as the realisation of sustainable development (Weiland, 2014). Indeed, the amount of tools for sustainability assessment is vast, as much as the body of literature reflecting on their merits and challenges (de Ridder et al., 2007). Many discussions on sustainability assessment concern its reliability, degree of effectiveness, fundamental tasks, as well as limits and potentials of science evaluation (Bosshard, 2000).

The critics directed to sustainability assessment methodologies have their roots in long-lasting reflection coming from some schools of thought belonging to the philosophy of science (Bond et al., 2012). Over the last half-century, the spheres of facts and values have been widely discussed and reconceptualised. After several centuries of structural distinction between science and society, facts and values, various philosophers started pointing out how facts are value-laden, as well as values are fact-laden, disrupting the pre-existent net division (Anderson, 2018). These thinkers underlined how values influence also scientific research, as human minds are not passive recipients of sensory experiences, but they influence the understanding of natural phenomena through their biased perceptions, personal beliefs and cultural background (Gorski, 2013). On the other hand, facts as well exercise a certain influence on values (Williams, 1985). Values have, indeed, an experiential basis, meaning that the life experiences of people can influence their vision of the world. Because of this reason, new facts can generate new values, as well as scientific discoveries convoy to new social beliefs (Gorski, 2013).

Applied to sustainability assessment tools, these reflections brought important breakthroughs and critical thinking in this sector (Weiland, 2014). Supporters of deep ecology thinking argue that sustainability assessment promotes an anthropocentric approach to the world in which humans are portrayed as dominating nature (Bond & Morrison-Saunders, 2012). Other authors underline how, despite the effort of scientific approaches, assessment procedures contain several implicit elements, connected to the widespread positivistic thinking, which is based on specific values and assumptions. Assessment procedures can be understood as systematised value judgements, where both implicit and explicit elements co-exist. The implicit elements consist in the bias coming from the previous scientific education, cultural values and personal visions, rendering paradoxical the principles of objectivity and universality (Bosshard, 2000; Desmond, 2007). Moreover, sustainability assessment has been described as a social process composed of multiple actors which influence the formulation, application and interpretation of the results (Weiland, 2014). This is why the necessity of considering the relation between knowledge and values is central for the issue of "how to implement sustainability assessment to achieve transformations towards sustainability in social-ecological systems" (Alrøe et al., 2017, p.2). Sustainability assessment tools are not only

particularly complex and, thus, only understandable by experts, but they are also incapable to provide general truths or the only best solution. Therefore, the discourses about these issues present within the whole society have to be investigated, as well as the voices of locals has to be listened (Bosshard, 2000).

Sustainability assessment tools usually require the operationalisation of indicators, which are employed as measures of the condition of the biophysical and socio-economic environment and which constitute, hence, the basis for comparing alternatives (Bockstaller & Girardin, 2003). Although indicators are pivotal elements, as they establish the characteristics of sustainability as it is investigated in a sustainability assessment (Bond & Morrison-Saunders, 2012), they are often criticised by social theories. Assessment tools are, indeed, frequently accused of not being able to fully understand complex and multidimensional phenomena, such as agricultural sustainability, because of the partiality of indicators, which would be incomplete, representing only certain aspects of the issue (Pavanello, 2009). Besides, the assumption that measures and indicators are impartial and independent reveal the misplaced faith in the objectivity of science. Although measuring reality plays an important role in creating knowledge, while using these tools, it is necessary to be aware of their partiality and dependence on specific cultural backgrounds (Levkoe & Blay-Palmer, 2018). Moreover, Hale et al. (2019) highlight how indicators are performative, because, representing a concept, they shape a certain image of it. Measures themselves are agents, as they make sense of reality, constructing it through their lenses, and they respond accordingly to the situation (Higgins & Larner, 2010; Rosin et al., 2017). In this way, not only indicators build a partial representation of a phenomenon, but they can also influence people's understanding of it, as well as the decisions taken in that regard, impacting reality and constituting political acts (Hale et al., 2019). Therefore, this thesis argues for the need of reflexivity in the scientific world, namely a recognition of the partiality, value-laden and performative nature of scientific knowledge, its tools and indicators by the researchers that employ it every day.

2.5. Life Cycle Assessment

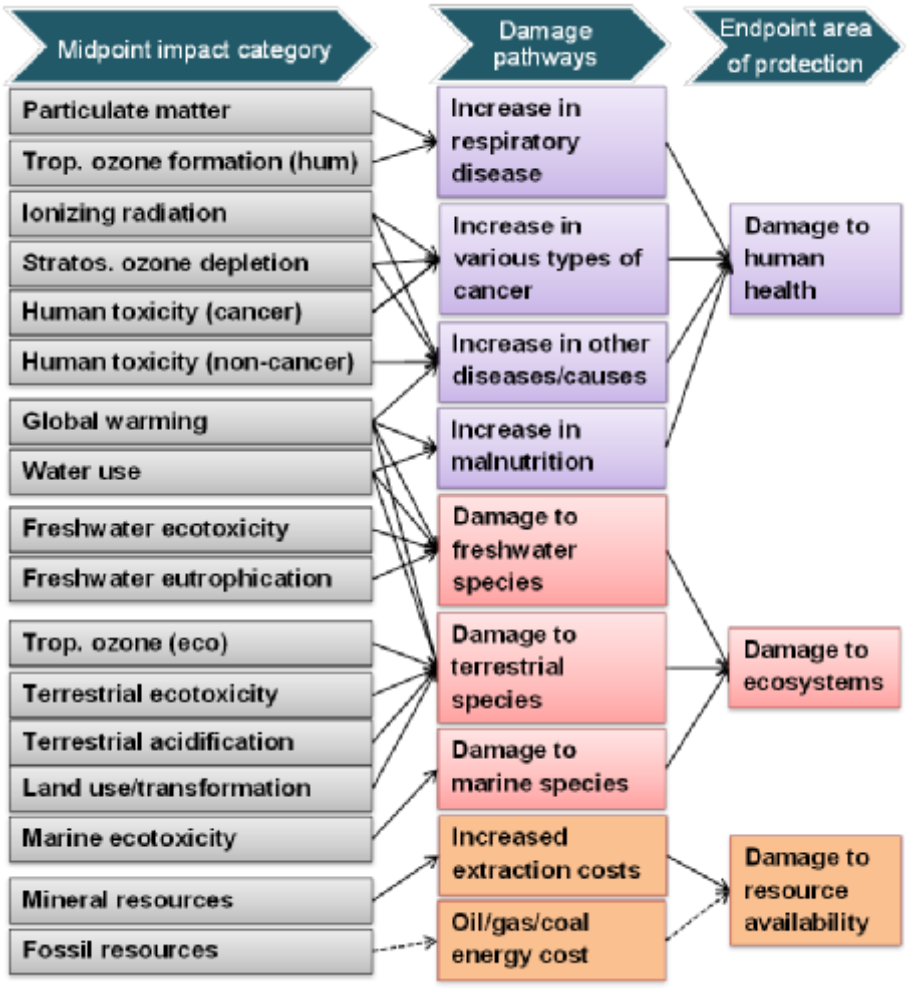
Nowadays, one of the most popular sustainability assessment tools based on indicators is Life Cycle Assessment (LCA). LCA is a system-oriented methodology that addresses the environmental impact of a certain product or service (Title et al., 2020), understood as the need to quantify the pollutant emissions to water, air and soil (Jolliet et al., 2015). It is defined by the international standards ISO 14040 and 14044 (Klöpffer, 2014) and, for this reason, it is widely acknowledged for its completeness as well as considered the environmental pillar of sustainability (Jouini et al.,

2019). LCA covers a large range of environmental issues, it is a quantitative technique and, thus, based on science (Hauschild et al., 2018). Moreover, it takes a life-cycle perspective, namely it considers the whole life cycle of a certain product. This principle is called "cradle-to-grave", meaning that all the significant stages in the life of a product are considered in the analysis, from the extraction of raw materials (soil, water, air), to the final product, its packaging, transportation, use and waste removal (Klöpffer, 2014). In this way, the methodology aids to determine the priorities of action in the life-cycle of a product, making it possible to optimize the production process to further reduce impacts (Jolliet et al., 2015) and to integrate sustainability into innovation, design and evaluation of products or services (Alessandra Zamagni et al., 2013). Thanks to this unique characteristic, LCA can be understood not only as an assessment tool but also as a way of thinking (Koroneos et al., 2013).

LCA further differentiates from other environmental assessment techniques thanks to another element: the "functional unit", which represents the basis for the comparison of the product. LCA is a tool designed for comparison with products fulfilling a similar function, and not for absolute evaluation (Klöpffer, 2014). The comparison of the environmental impact between different production systems made LCA interesting to be used in several fields, from the industrial sector as a support for corporate strategies, to research and development, in order to improve the supply-chains toward a more sustainable direction (Jolliet et al., 2015).

Furthermore, LCA presents two groups of indicators. The first group is represented by the midpoint indicators, which are around a dozen and are considered the more technical ones, mostly used and understood by the researchers (Kurisu & Hanaki, 2014). A few examples are ozone depletion, climate change, human toxicity, eutrophication, water depletion, erosion, salinisation and many others (Life Cycle Initiative, 2003). These are considered as a step in the environmental cause-effect chain of a certain impact category, prior to the next group, the endpoint indicators. Through specific characterization factors applied to the midpoints, the endpoints can be calculated to understand the relative importance of a certain impact. The endpoints consist of three main impact categories which are more straightforward to understand, namely damage to human health, to the ecosystem and to resource availability. Thanks to their easier legibility, they became more popular and they are often considered by policymakers in their decisions concerning environmental issues (Bare et al., 2000; Kurisu & Hanaki, 2014). Figure 1 represents the described indicators and their relation.

Figure 1. LCIA ReCiPe Model (Huijbregts et al., 2016)



Nevertheless, as it happened for all other assessment methodologies, the effectiveness and reliability of LCA have been discussed. Particularly, the exclusion of economic and social factors in LCA has been stressed as limiting the potential and the quality of the results (Michalski & Krueger, 2015). For instance, Pelletier & Tyedmers (2011) present an ecological-economic approach based on market information, arguing that LCA, focusing only on the environmental component of sustainability, ignores the economic efficiency of meeting human needs. Meanwhile, Gutowski (2018) highlights that LCA ignores human behaviour, eventually disrupting the realisation of a sustainable transition. Therefore, the author suggests a greater inclusion of social science in the methodology, to bring people to the core of the discussion. Another example is represented by Jouini et al. (2019), who combine LCA with a participatory approach to overcome the complexity of reading the results for non-specialists and to involve the values and interests of the stakeholders, however many other similar experiments could be cited. Overall, the attempts of expanding the LCA framework through integrating and connecting it with other methodologies

coming from different disciplines, such as sociology and economics, are widespread (Jeswani et al., 2010). Even the guidelines about its utilisation nowadays advise combining its results with other aspects of sustainability such as social implication, technical feasibility and economic performance, complementing LCA with other tools of analysis (Jolliet et al., 2015). Recently, a broader methodology has been developed, namely Life Cycle Sustainability Assessment (LCSA), to combine LCA with Life Cycle Costing (LCC), representing economic sustainability, and Social LCA (SLCA), the social sustainability (Guinée, 2015). LCC analyses the cost associated with the production of a certain good or service throughout its life cycle, identifying the most valuable economic hotspots (Spire, 2016), while SLCA aims to assess the social impact connected to the life cycle of a certain product (Venkatesh, 2018). Yet, these new methodologies are still in their infancy and they are rarely used, as they present several challenges (Hauschild et al., 2018).

Understanding the functioning of LCA and of the assessment tools combined with it plays a pivotal role for the research. Indeed, this thesis aims to analyse the methodology in order to interpret the representation that it makes of the concept of sustainability, answering the second sub-research question. To succeed in this, a complete comprehension of the LCA characteristics and dynamics is fundamental, as well as a certain consciousness concerning the debates around it.

2.6. Contested concepts

This chapter illustrated the relevance and the contentious nature of the concepts constituting the core of this thesis. Most importantly, the interest in going beyond the distinction between facts and values in both social and natural sciences has been stressed. The thesis recognises the concept of sustainability as highly complex and changeable depending on the perspective of the observer, its values and beliefs, while underling as well the social component and the consequent partiality of sustainability assessment methodologies and their indicators. Likewise, it supports a reconceptualisation of agriculture as a multidimensional and complex sector, involving economic, social and ecological elements. Moreover, the coexistence of different perceptions over natural and social phenomena stands at the base of this research, which aims, indeed, to compare and analyse the existing different understandings of sustainability taking into consideration all perspectives, including the often forgotten but pivotal one of the farmers. In order to do that, this chapter has shown the importance of the LCA methodology, while explaining its functioning and characteristics, as well as the influence of quinoa on the international scene during the last decades.

3. Theoretical Framework

To answer the main research question, Discourse Analysis and Actor-Network Theory have been selected as the theoretical framework, namely as lenses through which to approach the fieldwork and to analyse the results. Moreover, the two theories are compatible as they both stem from a post-structural theoretical basis (Crawford, 2004; Leipold et al., 2019). In the following paragraphs, the two theories are explained and subsequently applied to the study case of this research.

3.1. Discourse Analysis

Discourse analysis provides both a theory and a methodology to tackle the investigation of language and its meaning. This approach developed in the fields of humanities and social sciences between the 1960s and the 1970s (Klerkx et al., 2015), stemming from the conceptualisation of discourse as "an ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, and which is produced and reproduced through an identifiable set of practices" (Hajer & Versteeg, 2005, p.175). Particularly, the idea of discourse was introduced by the philosopher Michel Foucault, who stressed the importance of considering discourses as influential social constructs that convey and create our identities as well as our society, enabling or constraining certain actions (Fleming & Vanclay, 2010).

The majority of discourse approaches are based on post-positivist and post-structural philosophical orientations, which support the assumption that "reality is constructed through processes of social meaning-making" (Leipold et al., 2019). In order to understand these processes, two elements are fundamental. On the one hand, proponents of discourse analysis underline the connection between facts and values, highlighting the values embedded in diverse social constructions and reflecting critically on the views presented (MacDonald, 2003). On the other hand, discourse analysis is able to show the embeddedness of language in practice. Indeed, language does not merely float in society, but it relates to the everyday actions in which it is employed (Hajer & Versteeg, 2005; Gasper & Apthorpe, 1996).

From the 1990s on, discourse analysis proliferated in the field of environmental studies and contributed to its understanding in a number of ways (Fleming & Vanclay, 2010; Leipold et al., 2019). Characteristically, this approach adopts a critical position towards truth and emphasises the narratives through which knowledge is exchanged (Hajer & Versteeg, 2005). Thus, the environment is not considered as existing outside society, but as discursively co-produced, and environmental problems are analysed for the sense that society makes of them through strategies of power and

knowledge. Core concepts, such as “nature” and “sustainability” are considered contested and constantly produced through policy-making, research and everyday practices. Previous literature outlined the co-existence of different discourses concerning the environment, encompassing different ways of thinking and talking about it (Feindt & Oels, 2005). Indeed, discourses can work toward normalisation, but also act in opposition to each other, creating dynamics of constant change (Fleming & Vanclay, 2010). Moreover, conflicting discourses are the result of different actors attempting to impose a particular frame and influencing the definition of a problem, demonstrating the role of language also as a means of power (MacDonald, 2003; T. Richardson, 2007).

Within the sustainability world, a first group of actors is the one of experts, who frame environmental issues as complex, influencing the language used to talk about them and requiring analytical capacities and conceptual frameworks to tackle them. Moreover, in discourse analysis, even the technologies that researchers use, such as LCA, are considered as rooted in particular cultural formations, enabling certain practices and depicting only certain features of the world. A second group of actors is the one of policy-makers, who are responsible to deal with environmental issues, such as pushing toward a more sustainable production system (Feindt & Oels, 2005). Discourse analysis sheds light on why certain issues get popular at a certain time and place, explaining the processes by which a policy is enforced (Hajer & Versteeg, 2005). However, when it comes to topics such as sustainability and climate change, farmers’ understanding is not often taken into consideration (Lowe et al., 2006). Within the literature, the studies which tackle farmers’ point of view on environmental issues are few (Baginetas, 2008). Consequently, in this research, discourse analysis can fulfil an additional role, drawing attention toward marginalised discourses and democratising knowledge production (Feindt & Oels, 2005).

3.2. Actor-Network Theory

The Actor-Network Theory (ANT) was formulated at the end of the 1970s by French scholars Latour and Callon as an attempt to conceptualise scientific activity without the a priori distinction between social and technical elements (Bencherki, 2017; Tesch, 2021). This social theory looks at the social and natural worlds and how they are constituted by constantly shifting relationship networks (Latour, 1996). These heterogeneous networks of actants include a full range of elements, human and non-human, constantly interacting among each other to create our reality, as nothing exists outside of them (Benton & Craib, 2001). In this way, the theory broadens the definition of agency, which comes to reflect the capacity to create and maintain sets of relations with other elements of a network, contributing to an otherwise unrealised action (C. J. Rosin et al., 2017).

These notions are connected to some of the founding principles in ANT, namely the concepts of hybridity, referring to the heterogeneous composition of networks (Argent, 2009), and of generalised symmetry, stating that both human and non-human actants should be included in the same theoretic framework and attributed even amounts of agency (C. J. Rosin et al., 2017). Equally important are the principles of collectivity and durability, stressing the fundamental relational and collective nature of the networks, where each actant depends on the existence of all the others through time and space (Argent, 2009). ANT is particularly interested in investigating the infrastructure and functioning of actor-networks (Greenhough, 2009), conceptualising them as fluid and able to disassemble and reassemble (C. J. Rosin et al., 2017).

Moreover, ANT stands in opposition to the dualistic ontology and epistemology, which have prevailed in the understanding of the world according to modern knowledge, dividing nature and society into different realms of science. Accordingly, the proponents of this approach contrast the division between "truth and falsehood, agency and structure, context and content, human and nonhuman, microlevel and macrolevel phenomenon, or knowledge and power" (Crawford, 2004, p.1), which are instead analysed as effects of collective activity. Consequently, science as well is understood as a network of heterogeneous elements generated within a set of different practices.

Stemming from Science Studies, ANT suggests that the work of science is not intrinsically different and divided from other social activities (Crawford, 2004). Conversely, Latour underlines the importance of comprehending the relations between scientific studies and the rest of the world, as the notion of science cannot exist in isolation from society (Latour, 1999). Thus, ANT aims to analyse the daily practices of technology and science in the making, considering both human and nonhuman elements as part of this process. In this way, natural things, next to people, enter history. To realise this, the author proposes the ethnographic study as core methodology, to be able to observe the production of objects and measurements, which finally acquire the status of real things (Benton & Craib, 2001). Science is examined not only as a source of information about the world, but as a specific type of intervention in the world, being able to affect reality through its relationships with other elements (Greenhough, 2009). Particularly, several studies highlight the possibility and the importance to consider measures as active agents inside a network. Many emphasise the role of measures and indicators in impacting society through the representation they offer of it (Alrøe et al., 2017; Hezri et al., 2006; Levkoe & Blay-Palmer, 2018; Rosin et al., 2017). Indicators, indeed, can influence not only the idea that people have of a certain issue, but also the response that individuals enact to deal with them (Hale et al., 2019). Particularly, in the case of sustainability transitions, the active contribution of metrics has been shown to drive changes in

mindsets and daily practices. However, indicators do not only provide a symbolic representation of the world, but they also produce and participate in human and nonhuman relations. They are not only the product of the society around them, they enter society, interacting with people as shared attributes of reality. Indicators contribute to accelerating human-nature interactions, orienting representation, communication, policies and reflexive introspection (C. J. Rosin et al., 2017).

The network approach has often been used to analyse systems of food production, because its relational thinking has proven to be effective in shedding light on the co-production and complexity of materiality, while calling for "a more-than-human relational ethic" (Richardson & Whatmore, 2009, p.206). In other words, this theory brings attention to the active engagement of nonhumans in agri-food networks. Moreover, reasoning on society and environment, ANT can aid in understanding how human actions rely on an extensive set of ecological characteristics and how technology influences the characters of ecological agents present in our activities, making human-ecological relationships possible. The theory clarifies how contextual knowledge and environmental management reflect one possible iteration of many ways that we could network the world. Finally, ANT enables the understanding of how a relationship between a material and a discursive definition of the world can exist (Legun & Virens, 2020). Because of these reasons, in this thesis, ANT is fundamental to grasp the correlation among people, the environment and science, allowing to study sustainability assessment methodologies as actors themselves, with their representation of reality and their influence on it.

3.3. Application of the theoretical framework

Using this theoretical framework, the study takes a clear stance concerning the concept of sustainability. Sustainability is recognised as a complex and contested concept, socially constructed in different ways by diverse actors and able to influence society in various ways and degrees (Feindt & Oels, 2005; Vallinga, 2012). Thanks to the recognition that different discourses can co-exist, this research analyses the different perceptions of sustainability of farmers, researchers and the one of LCA itself. This research recognises, indeed, that our knowledge of scientific matters is shaped through particular material participation and that any phenomenon is conditioned by its social context. Thus, ANT allows focusing on the agency and the meaning-making created through collective and heterogeneous cooperation (Legun & Virens, 2020). In order to do that and build a complete image of the different discourses concerning sustainability, both values and practices, language and actions, are taken into consideration (Hajer & Versteeg, 2005; Gasper & Apthorpe, 1996). Consequently, the combination of Actor-Network Theory and Discourse Analysis allows

capturing the network in which humans and non-humans, nature and society, reciprocally and constantly interact, construct narratives and influence each other (Benton & Craib, 2001).

4. Methodology

4.1. Research Design

The purpose of this thesis is not to generalize findings to a larger extent, but rather to thoroughly examine the different understanding of the concept of sustainability in all its characteristics. Therefore, a multi-case study approach represents a suitable research design (Fidel, 1984), allowing in-depth and exhaustive inferences of how sustainability is materially and socially constructed in the field (Gerring, 2004). Moreover, utilising a multi-case study can aid in creating a more extensive vision on farmers specialised in quinoa production all over Europe, detecting the different cultural influences from the common characteristics. Despite the predominance of single-case studies in discourse analysis, a multidimensional perspective can be enlightening, bringing together and interpreting discursive developments from multiple cultural contexts (Leipold et al., 2019).

Looking at the methods, participant observation and semi-structured interviews are the research tools suitable for this study. During the fieldwork, I had the opportunity to spend a few weeks in the French Agricultural Research Centre for International Development (CIRAD) with a team specialised in LCA, to learn about the methodology, and afterwards, I spent a month between two farmers' communities, in France and Italy. Participant observation has been ongoing during the whole time, firstly in the research centre to fully understand the way of thinking of the researchers and, secondly, with the farmers, to get to know how the supply chain functions and to analyse how local workers express and conceptualise sustainability in their daily work. Furthermore, semi-structured interviews have been carried on, allowing to comprehend in more detail which is the understanding of sustainability from the point of view of all the actors. Overall, the qualitative methodologies have contributed to dealing with the values and cultural dimensions hiding behind the visible world, through the perception of local farmers, researchers and LCA.

4.2.Research Site

In 1993, the European Union approved a project titled “Quinoa—A multipurpose crop for EC's agricultural diversification,” involving field trials in several countries, among them Italy and France (Jacobsen, 2006). Quinoa is indeed a strong candidate for agricultural and nutritional diversification

in Europe (Bois et al., 2006), as in many other regions of the world, where it can initiate a transition toward sustainable agriculture (Bocchi et al., 2016).

In the two countries where the study is set, France and Italy, the organisation of the production has some common traits, as well as a few differences. In both case studies, the groups of farmers deal not only with the cultivation, but also with the following stages of quinoa production, allowing a life cycle view of the product. Nevertheless, the French production of quinoa started earlier, in 2009, and it is organised in cooperatives (Elzas, 2021), while the Italian one is still in its organisational process and is mainly carried out by independent farmers (Casini, 2019). These characteristics make the current research even more interesting, bringing different experiences to the attention, allowing for a more complete portrait of quinoa production in Europe.

4.2.1. France

France has been an avant-garde country for its interest in quinoa. The country counts among the main importers of the product in Europe, as well as among the first European countries attempting the cultivation of this crop (ICI Business, 2020), resulting now as one of its middle-size producers around the world (Alandia et al., 2020). Moreover, France has been indicated three times in a row by the newspaper The Economist as the most sustainable country for agricultural models (HortiDaily, 2019), with the government declaring the transition to a sustainable food system as one of the main objectives of its agricultural policy (French Government, 2015). These characteristics make the country the ideal setting for research concerning quinoa sustainability.

Particularly, the case study is located within the cooperative *Coopérative des Pays de la Loire (*CAPL), responsible for the production of Quinoa D'Anjou. This quinoa supply chain was born in 2009 thanks to the initiative of an American entrepreneur, who attempted the cultivation of this alternative crop in France and built a cooperation with the CAPL (Elzas, 2021). Nowadays, around 250 farmers are involved in this production for an amount of 1700 hectares cultivated. The cooperative organises the whole value chain, from the production, the collection of the grain, the selection, the packaging, until the marketing of the product, which enables it to guarantee customers total traceability from the field to the final product. The production of the grain is delicate and therefore requires good technical support, which the cooperative is able to provide thanks to the pooling of resources (La Coopération Agricole, 2021). Considering also that the company itself affirms that its main objectives are to ensure a mode of production respectful for the environment and traceable for the consumers (Quinoa d'Anjou, n.d.), it becomes clear the significant possibilities of placing the research in this context both for the scientific and sociological reasons. The

dimensions of the production, the importance of this supply chain in the European panorama, the historical consolidation of the company, the claimed awareness concerning sustainability issues are all factors that made Quinoa d'Anjou a suitable candidate for study.

4.2.2. Italy

The idea of introducing quinoa in Italy has its origins in the early 20th century, based on the consideration of the exceptional nutritional properties, particularly linked to the importance of the gluten-free sector in the Italian market. Moreover, the introduction of quinoa in Italy has interesting prospects for farmers from both an economic and environmental point of view. Indeed, quinoa provides a valid economic alternative to the low quotations of cereals and it adapts to the difficult environmental conditions linked to climate change, such as water scarcity, salinisation and droughts, which are causing more and more problems to Italian farmers. Nevertheless, the actual cultivation of quinoa in Italy has occurred only recently and in a disorganised way. Independent farmers went to Latin America to import the grain, learn about the crop and then start the cultivation back in Italy (Casini, 2019; FAO, 2015).

Complete studies on the introduction of quinoa in Italy are currently lacking (Casini, 2019). Although quinoa of Italian origin was an exception in 2015, since then it is increasingly common to encounter packages of this product. It is produced on approximately 500 hectares spread around the country, with a majority of organic producers. After the overall positive results obtained with several varieties experimentations (Vannuzzi, 2019), nowadays there are various quinoa producers across the peninsula, namely a farmer in Piacenza and other small groups in the regions of Tuscany, Emilia Romagna and Marche (Interview 1, 11, 12, 13). For this study, I interviewed the initiators of some of these groups. This included participants of a particular supply chain, the QUIN initiative, which was born in 2017 and is trying to build a structured supply chain for quinoa in Italy, mainly specialised in organic production and embracing a sustainable and ethical philosophy (Quin Italia, n.d.).

4.3. Research Methods

4.3.1. Participant Observation

Participant observation is a qualitative methodology, which allows researchers to learn about a community, its activities and culture in the natural setting through observing and participating in those interactions (Kawulich, 2005). As groups of people immersed in the same culture perform actions and express thoughts within a network of significance constructed during their daily lives,

only through sharing the same experience is it possible to obtain this deeper level of understanding (Allen, 2017). Because of these reasons, participant observation was selected as a guiding principle during the whole duration of the research, not only to grasp the meaning attributed to sustainability by local workers and its interrelation with the context and the culture, but also to comprehend the way of thinking of researchers and its relation to LCA.

During the two weeks of the introductory course on LCA at the research centre CIRAD, I could interact with the researchers during the lessons, but also during breaks and lunchtime. I had the occasion to make them more precise questions and stimulate debate about the nature of LCA and its representation of sustainability, as I was interested in better understanding the values and the cultural background carried by them and the methodology. Moreover, with the farmers, I had the opportunity to be shown around in their work stations and I even could observe them working and participate in some activities with them, such as sowing and driving the tractor. This opportunity contributed to understanding the internal dynamics and the functioning of the agricultural firm, as well as to encounter local workers. It gave me also the possibility to familiarise myself with the context, comprehending, on the one hand, the dynamics and the functioning of a research centre and the way of working of researchers; and on the other hand, it allowed me to comprehend the rural culture and values of farming, as well as to learn more on several alternative agricultural practices. Moreover, participant observation should enable to comprehend how ecological and social factors interact in sustainability assessment, as well as in the daily lives of farmers. All observations have been reported in a diary in form of notes at the end of every day. The fieldnotes are also meant to reflect on the experiences learned on the field (Allen, 2017).

Undisguised participant observation has been selected to create transparency about the research and to foster collaboration. This approach eliminates the ethical concern of ensuring the informed consent to participate in the research and the permission for divulgating the results, which have been openly asked to the participants (Sandiford, 2015).

The period spent in the field amounted to around two months, which was sufficient because of two main aspects. The first reason consists in the cultural proximity between the community and the researcher, as I am Italian and I have already lived in France for a part of my life, being able to properly speak the language. Secondly, a “focused observation” has been carried out, meaning that I concentrated on one specific aspect of local reality, sustainability. Finally, the research is supported as well by interviews, which contribute to the comprehension of the issue (Kawulich, 2005).

4.3.2. Semi-structured Interviews

In-depth semi-structured interviews consist of a dialogue between interviewer and interviewee, based on a set of open questions, which can vary according to the discussion and which concern a specific theme, in this case, sustainability. They enable an in-depth understanding of the issue, contributing to the research in the comprehension of participants' perspective and conception of sustainability, the values related to it, the connection with the work (Wholey et al., 2010). Interview Guidelines had been prepared – and they can be found in Annex 1 and 2 – but the conversation with the interviewees has been taken quite flexible, in order to let them the space to describe sustainability in their own words and through their mental connections (Miles et al., 1994). In other words, this tool has been fundamental to get mainly the social elements of sustainability and, in some ways, also their relation with ecological factors. Indeed, I attempted to notice and analyse how the participant creates the connection between the social and environmental elements and which are the implications of this relation.

Commencing the fieldwork with participant observation facilitated the understanding of the local context, the functioning of the quinoa supply chain and the entry into the community, allowing an aware selection of the key informants who participated in the interviews (Kawulich, 2005). Therefore, a purposive sampling strategy has been enacted, involving the identification and selection of individuals who are particularly experienced and knowledgeable concerning the phenomenon of interest (Palinkas et al., 2015). A total amount of 21 interviews has been collected, among them 9 researchers with an international background – 2 quinoa experts and 7 LCA specialists – and 12 farmers, half Italian and half French.

Nevertheless, it is important to underline that the category of farmers is extremely heterogeneous, as farms can differ based on several criteria, such as the type and size of land, the agricultural practices adopted, the output of the production and the number of people working in it. Thus, many different typologies of farmers can be identified and homologating all of them in one big group would result in losing some important outcomes or in drawing biased conclusions (Serra & Duncan, 2016). In this research, the focus is represented by small-scale family farmers, according to the definition of family farm as "an agricultural holding which is managed and operated by a household and where farm labour is largely supplied by that household" (Van Der Ploeg, 2016, p.5). Beyond that, all the interviewed farmers share some common characteristics. They own around 100-200 hectares of land, cultivated following the principles of crop rotation and diversification using a combination of traditional and alternative crops, either in organic or conventional agriculture.

Furthermore, in the selection I considered the theoretical approach of life cycle thinking, trying to interview people working at different stages of quinoa production, from farming to packaging and

distribution. The majority are farmers occupied in the cultivation of the crop, but I managed to interview as well two experts who help farmers with quinoa cultivation, two people involved in the commercialisation of the product and one farmer also involved with the transformation and packaging. The following tables represent the data concerning the interviewees, reporting as well a few more characteristics about them. Concerning the researchers, I found useful to clarify their specific area of research and concerning the farmers, I found interesting to specify the country of work and divide them into two main groups (conventional or organic agriculture).

Table 1. Interviews with Researchers

Researchers	
Interview	**Field of research**
1	Italian Quinoa Expert
2	French Quinoa Expert
3	LCA specialist at the research centre
4	LCA specialist at the research centre
5	LCA specialist at the research centre
6	LCA specialist at the research centre
7	LCA specialist for private companies
8	Specialist in economic sustainability assessment methodologies working for the European VCA4D project
9	LCA specialist with International experience

Table 2. Interviews with Farmers

Farmers			
Interview	**Country**	**Role**	**Characteristics**

11	Italy	Farmer	Conventional agriculture
12	Italy	Farmer	Conventional agriculture
13	Italy	Farmer & Responsible for transformation and packaging	Organic agriculture
14	Italy	Farmer	Conventional agriculture
15	Italy	Commercial responsible	
16	Italy	Cultivation expert	
17	France	Farmer & Cultivation expert	Conventional agriculture
18	France	Farmer	Organic agriculture
19	France	Farmer	Conventional agriculture
20	France	Farmer	Organic agriculture
21	France	Farmer	Conventional agriculture
22	France	Farmer & Commercial responsible for the cooperative	Conventional agriculture

4.4. Data Analysis

The interviews have been recorded, transcribed and analysed through the qualitative data analysis software Atlas.ti. In the realisation of the thematic analysis, the software has been used according to open coding, based on the interview guidelines and the research questions. The Code Book used for the coding of the data can be found in Annex 3. Finally, summaries of the different codes have been produced. A similar thematic analysis has been formulated for the fieldnotes resulting from the participant observation. The analysis attempted to put in relation more technical information about the functioning of sustainability assessment tools and certain agricultural processes and practices, with the more social and economic aspects of sustainability. Doing this, the attempt was to create a

connection between social and ecological factors and resulting coherent with the theoretical framework.

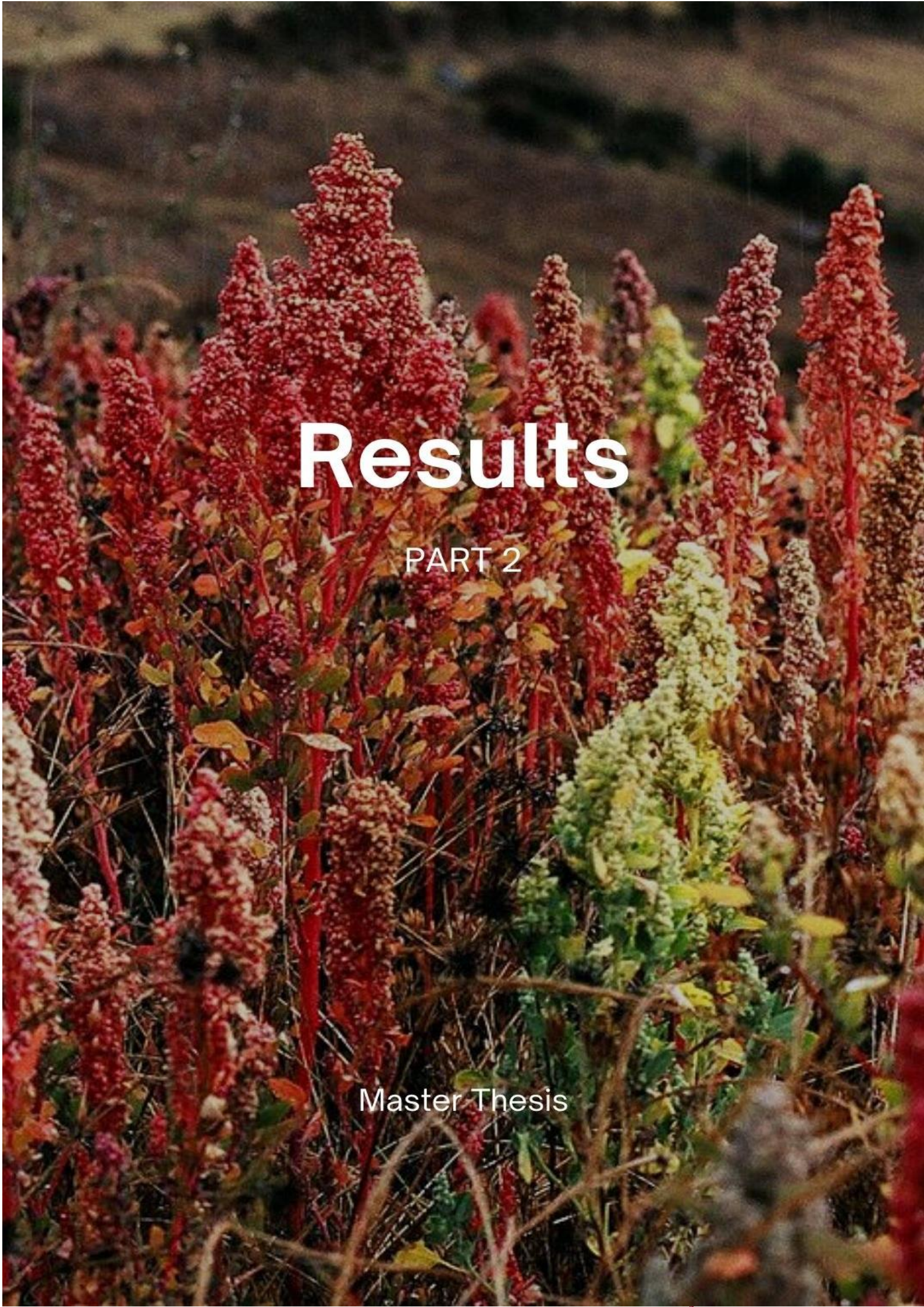
4.5. Ethical Concerns

Any research is a moral enterprise, as moral issues relate to the applied methods, the process of researching and the results. The human interactions and the knowledge produced can affect the comprehension of a certain phenomenon, but also the participants of the study (Brinkmann & Kvale, 2020). Therefore, the researcher is accounted responsible for the methods employed, which should adhere to certain ethical standards (Lord & Cowan, 2011). The present thesis engages in following the most appropriate moral guidelines, adapting them to the specific local context.

Participation in the research was completely voluntary (Mark et al., 1999), thus, everyone has been asked for explicit consent for collaboration in any part of the research, while informing them with all details about the study. Likewise, all participants were free to withdraw themselves or their information from the research at any moment. The research aims to protect the confidentiality and the privacy of the participants through several strategies, such as assuring anonymity. No name has been reported in the final work, but the different informers are indicated through a system of numbers (Allmark et al., 2009). More generally, confidentiality concerns data disposal and reporting as well, according to the guidelines of Wageningen University (Brinkmann & Kvale, 2020).

Concerning participant observation, I paid attention to ensuring the consent and the awareness of all participants by instructing them about the purpose and the details of the research. For the interviews, permission has been be orally asked to record the sessions and use the provided information. Moreover, the results will be shared with all the participants who demonstrated interest in the findings of the research.

Overall, as a researcher, I tried to be constantly reflective about my role and the impact of my positionality, meaning the stance I take in relation to the local context (Coghlan & Brydon-Miller, 2014). I acknowledge that identifying myself as an external researcher could have impacted the behaviour of the participant, hence, I considered this in the interpretation of the results. Particularly, the use of the fieldnotes diary has been pivotal to reflect on my role as researcher during the whole length of the study.



Results

PART 2

Master Thesis

RESULTS

The results are organised over two chapters, one reserved to farmers and the second one for researchers and sustainability assessment tools. The aim is to answer the sub-research questions:

- *What characterises European quinoa farmers' discourse about sustainability?*
- *What characterises LCA researchers' discourse about sustainability?*
- *How are power relations structured between European quinoa farmers and sustainability researchers? How might these power relations shape whose discourse of sustainability counts?*

In the first chapter, the farmers' perception of sustainability is illustrated in all its details, reporting the answers of the participants while highlighting the most relevant results. In the second chapter, the answers of the researchers are presented, elucidating their understanding of sustainability and its conceptualisation as represented by the LCA methodological tool. In each chapter, a section is reserved for the reflections concerning the power relations in the sustainability world and a conclusive paragraph is provided to summarise the main findings.

5. Sustainability: Farmers' Discourse

This chapter analyses the themes arising from the farmers' answers to the question: "What does sustainability mean for you in the agricultural sector?". Particular attention is reserved to both the ideas and the practices that farmers connect to their definition of sustainability, reflecting the main principles of Discourse Analysis, which underlines how discourse is created not only by language but also through actions (Gasper & Apthorpe, 1996).

Three recurring definitions of sustainability have been noticed in the answers of the farmers, namely defining sustainability a) as the possibility to keep farming in the long term; b) as identification with certain agricultural practices; c) as being composed of three dimensions, a social, an ecological and an economic one. These three interpretations of the concept will be explained in the following paragraphs, as well as further characterisations of sustainability that emerged during the interview and the participant observation, in order to portray a complete image of farmers' discourse. A paragraph is reserved to go deeper in the understanding of farmers' mindset, values and beliefs, trying to understand what being a farmer means for them and for their conceptualisation of sustainability.

Furthermore, all along the chapter, the ideas of farmers concerning sustainability are applied to the case of quinoa cultivation. Firstly, this can aid in better understanding the abstract conceptualisations about sustainability, clarifying the complexity of certain aspects. Secondly, it aims to reflect the practical way of thinking of farmers, who, during the interviews, tended to answer all the questions making constant reference to their daily activity and their work with quinoa. Thirdly, in this way, the thesis aims to collect information concerning the characteristics and the interests of quinoa production in the European context, starting to fill the gap present in the literature.

Finally, a paragraph is reserved to analyse the power relations between farmers and other key actors in the sector of sustainability, such as policymakers, agribusiness and researchers, in order to understand whether and how their discourse about sustainability can influence society at large.

5.1. Sustainability as the possibility to keep farming in the long term

Several respondents interpreted sustainability as the possibility to continue farming in the long term (Interview 17, 18, 20, 21).

> "There's a saying that goes: 'He who wants to go far, spares his mount'. It was the time when people rode horses, so if they wanted to go far with their horse, they didn't have to go very fast at first because, otherwise, they wouldn't go very far. There's another French saying, which is 'We don't inherit the land from our parents, we borrow it from our children'. So there you have it, I'm just passing through on this land. So my plots will one day be exploited by others, perhaps my children or other people, it doesn't matter. But there you go, so I don't want to attack my capital alone by making them produce excessively." (Interview 20)

This quotation represents perfectly all the aspects and values contained in this understanding of sustainability. Indeed, this way of thinking strongly values the connection between past, present and future, revealing feelings of gratitude for the past and hope toward the future. Moreover, it connects sustainability with attachment toward their families, as other farmers stressed their desire to leave the farm to their children, while displaying a sense of caring for the land itself as part of this relationship.

> "Sustainability is basically that I'm on the same farm as my father was. I hope that one of my children will take over with crops and practices that will no doubt be different from mine, but the idea is that we continue to cultivate the land, to live on it and then to leave it in a state that is at least as good as what I was given, this is sustainability." (interview 21)

This hope for continuing to grow crops and working the land is also connected to a more practical side of agriculture, meaning that to keep cultivating allows continuing to be productive. Interviewee

20 states practically that sustainability means "to ensure quality production over time without damaging its operating capital, its soil capital, its labour capital, its human capital, its material capital". This connects to the more practical side of the farmers who lives out of its farming activity and connects this abstract concept to the everyday working reality (Baginetas, 2008).

5.2. Sustainability as identification with certain agricultural practices

The research by Stuiver et al. (2004) underlines how farmers' way of constructing knowledge is strongly linked to the experiences and practices coming from their daily lives working at the farm. This characteristic is reflected in the second main definition of sustainability that farmers expressed in the interviews, namely they identified the concept of sustainability with certain agricultural practices (Interviews 11, 12, 13, 15, 19). Environmental knowledge is composed of ideas with practices, and this is particularly truthful when environmental issues concern everyday activities, such as the job of farming (Feindt & Oels, 2005). This is why, a relevant characteristic of farmers' knowledge, which is created through both mental capacity and physical skills, is its connection to action. Farmers' ideas are strictly connected to their regular and experimental practices, creating a spiral of adjusting, monitoring and adjusting again in a way that they learn by doing (Stuiver et al., 2004). These theories perfectly support the findings resulting from the interviews.

> "Sustainability for me simply means having as little impact on the environment as possible. This means only using water in the portions that are really necessary, and for us, sustainability goes hand in hand with organic because we have already abolished the use of various herbicides." (Interview 11)

> "You see, the production system I use is what I consider to be sustainable, namely putting agronomy back at the heart of the production system, lengthening the rotation. [...] A diversity of crops, soil cover, that's all. Sustainability goes with that." (Interview 19)

These quotations attest the identification of sustainability with certain reasonable and/or alternative practices according to the interviewees (Interviews 11, 12, 13, 15, 19). Some of the participants interpret sustainability as having the least impact on the environment (Interview 18) using, for example, the least amount of water, chemicals and machines (Interview 11). According to this interpretation, quinoa is regarded as having important contributions to local sustainability. The crop is described by farmers as having an image of a "clean crop", because it requires few inputs. As it has already been mentioned, quinoa has a low water demand, being able to grow also in dry conditions. A few farmers, thus, highlight the essential role of quinoa in the protein transition, comparing the environmental footprint and water consumption of producing this crop to that of animal proteins (Interview 12, 21). Besides, no chemicals, such as phytosanitary products,

insecticides and herbicides, can be applied to the plant, as none has been certified for this crop until now (Interview 1, 11, 12, 16, 17, 21). This characteristic aids in improving the local biodiversity, boosting the presence of insects in the field (Interview 11, 12, 16, 17, 21) and implying less work for the farmers (Interview 17, 22).

> "Working with a product that has to be almost exclusively grown using sustainable techniques since we can't even use agro-medicines, for me it's important. We know that we are preserving agro-biodiversity because we can't use products that are bad for the environment. We have to take great care of the soil to be able to have a good production of quinoa, and this forces us a little bit to follow the techniques of sustainable agriculture." (Interview 16)

Moreover, several farmers identified sustainability with the practices of diversification and crop rotation. Especially in Europe, where a small number of crops dominates the agricultural panorama, diversification is an increasingly urgent need (Martin et al., 2019). Monoculture systems allow farmers to use the same machinery on a large portion of land, improving the efficiency of farming activities. Nevertheless, this agricultural method increases the probability of pests or disease outbreaks, implying the need for larger quantities of pesticides and herbicides used on the crops, polluting water, air and soil, not to consider the impact on the health of consumers. Monoculture leads as well to soil exhaustion, reducing the presence of certain nutrients and increasing its degradation (Interview 17; Balogh, 2021). For these reasons, the farmers part of this study believe in increasing diversification through a system of crop rotation, in which quinoa plays a pivotal role. Differentiating itself from the majority of crops known and traditionally cultivated in Europe, quinoa is sowed in spring, opening the rotation. The farmers affirm that the problems connected to the lack of diversification and short rotations were visible in the regions, in terms of pests, weeds, fertility and declining yields. Consequently, they decided that it was necessary to modify their way of cultivating in order to see the yields rising again and the soil recovering (Interview 1, 17). Quinoa is considered as a core tool to reach sustainability, which is strongly identified with this technique of crop diversification, at the point that the Interviewee 17 states that "crop diversification makes farms and the region's agriculture a little more sustainable".

> "There's a work to be done in France I think to try to get other crops out there, unless we want to go down that spiral, making farming harder and harder. Because then you need more insecticides and fertilisers because things are kind of getting out of balance. So for me, sustainability means stopping that spiral, that downward spiral, that I kind of feel like that we're in." (Interview 17)

Other interviews identified sustainability with alternative practices, indicating a number of agricultural techniques, such as organic agriculture, conservation agriculture and intercropping (Interview 12, 20, 22), while Interviewee 19 underlines the importance of rediscovering the

knowledge of their grandparents concerning traditional agricultural techniques and using them in combination with modern technology. Below, Table 3 summarises the different agricultural practices indicated by the farmers, explaining their characteristics, benefits and drawbacks. Interviewees 13 and 15 cited as well techniques that can be used at a post-production level, which for them are synonymous of sustainability, such as using sustainable packaging (glass, recyclable paper) and recycling the waste coming from seed cleaning, sorting and husking to produce by-products.

> "Sustainability means cultivating the soil differently, working differently, green manure, rotations, things like that." (Interview 12)

Moreover, farmers stressed the importance of making experiments and trying different techniques, in order to discover innovative sustainable solutions, particularly valuing the importance of experience and intuition in the agricultural sector (Interview 17, 19, 29).

> "All this is a little bit my knowledge of my operations. And in the ten years that I've been doing this, I've done a lot of training and I continue to do so because it's infinite. You never really know how to do it. In fact, it's always a bit of a challenge. I don't have the impression that I've found a method that works. It's always a permanent search for a solution." (Interview 19)

> "It is with the experience of each other that we have been able to improve our agricultural techniques" (Interview 21)

Some farmers stated that they do not have a clear idea of which is the best option to be sustainable, due to the difficulty of obtaining information concerning the sustainability of the different practices and the confusion coming from the different information tools, such as the internet, social media and the European Union communications (Interview 13, 14). Several studies highlight as well that there is still an open debate about which are the best management practices on a sustainability level (Fleming & Vanclay, 2010). Nevertheless, other farmers expressed the idea that there does not exist one best technique for everyone, but that the most important point is to continue experimenting to look for new solutions and alternative practices (Interview 19, 21). These interviewees believe, indeed, that the future of sustainability in the agricultural sector lies in the hands of farmers.

Table 3. Agricultural Practices Mentioned in the Interviews (Wezel et al., 2014; Fieldnotes)

Type of Practice	**Description**
Crop rotation	Crop rotation is the practice of planting different crops sequentially on the same plot of land.

	Benefits: Improve soil health, optimise nutrients in the soil and combat pests and weed pressure. (All Interviewees use this technique)
Diversification	Crop diversification means growing more than one crop in an area, by adding a new crop species or different variety, or by changing the cropping system currently in use. Crop diversity encompasses several aspects, such as crop species diversity, varietal diversity within crop species, and genetic diversity within crop species. ***Benefits***: It allows to spread the production and the economic risk over a broader range of crops, thus reducing financial risks associated with unfavourable weather or market shocks. It may also help financially by expanding the market potential. Additionally, diverse cropping systems generally provide more varied and healthier food for humans and livestock. It has as well many agronomic benefits in pest management by breaking insect and disease cycles, reducing weeds and soil erosion, and conserving soil moisture while creating a varied population of beneficial pest-fighting microbes in the soil. ***Drawbacks***: Possible lack of infrastructure for storage and transportation, suitable equipment technical knowledge and references regarding their production practices. It needs price and supply inputs and generates concern of increased complexity. (Interview 22, 17)
Organic farming	An agricultural system that uses ecologically based pest controls and biological fertilisers derived largely from animal and plant wastes and nitrogen-fixing cover crops. ***Benefits***: Organic farming uses fewer pesticides, reduces soil erosion, decrease nitrate leaching into groundwater and surface water, and recycles animal wastes back into the farm. ***Drawbacks***: It has higher food costs for consumers and generally generates lower yields. (Interview 11, 12, 18)
Conservation agriculture	It is based on three principles. 1) "Minimum soil disturbance" is characterized by reduced tillage practices through direct seeding and/or direct fertilizer placement. 2) "Permanent soil organic cover" with crop residues and/or cover crops. 3) "Crop diversification" is the practice of cultivating more than one

	species in a given agricultural area, in the form of crop rotation and/or association. ***Benefits***: Conservation agriculture conserves natural resources, biodiversity and labour. It increases available soil water, reduces heat and drought stress, and builds up soil health in the longer term. It increases resilience to climate change, protect biodiversity and sustainably use natural resources. Finally, it enhances the process of stocking carbon in the soil. ***Drawbacks***: To initiate conservation agriculture, appropriate seeders are necessary, and these may not be available or affordable to all farmers. It is also knowledge-intensive and not all farmers may have access to that knowledge. Finally, conservation agriculture increases yields over time but farmers may not see the yield benefits immediately. (Interview 18, 19, 20)
Intercropping	Intercropping is a method of growing more than one crop in the same piece of land during the same crop season. ***Benefits***: It has many advantages, related to the complementary use of environmental resources by the component crops. This results in increased and better nutrient recycling in the soil, stable yields, better control of pests and diseases with increased biodiversity. It increases the production per unit area compared to single cropping through the effective use of resources, nutrients including water and solar energy, resulting in a superior yield due to the efficient utilisation of available resources. ***Drawbacks***: Differential maturity and harvesting can become a problem. It becomes difficult to control various pests and diseases. It is a labour-intensive practice and there is the possibility of problems arising in carrying out intercultural operations. There might arise a competition among the component crops. (Interview 17, 18)
Circular Economy	An economy capable of regenerating itself: what is normally destined to be discarded and dispersed in the environment is instead reused and valued. This can be realised with different practices. 1) Animal waste from livestock farming is used as a source to obtain fertilisers and soil improvers for agriculture. 2) Biomass**,** which is organic matter generated by plants and animals and used to produce energy. 3) Precision agriculture, use fertilisers and chemicals, according

	to the needs of the soil, trying to provide the right amount of substances at the right time, and in the right place. ***Benefits***: It ensures greater availability of raw materials, reducing environmental impact and increasing competitiveness. It also fosters innovation and economic growth. (Interview 13, 14, 18)

5.3. Sustainability as composed of multiple factors: environment, economy and society

Several people among the participants recognised a multidimensional connotation of sustainability, citing the definition - made popular by the United Nations in the famous Sustainable Development Goals - of this concept as characterised by three pillars: social, economic and environmental sustainability (Interviews 12, 13, 16, 22). This theory was conceptualised for the first time in 1987 by Barbier, but during the decades it has been widely used in many theoretical studies, as well as by policymakers (Purvis et al., 2019). Looking at the answers of the farmers, this concept seems to have spread among them as well, to the point that one of the younger interviewees admits to having learnt it at school and to continue taking it into consideration in his job. In their answers, some of them consider the three aspects on the same level (Interviews 12, 13, 16, 22), while others underline only the importance of the connection between the ecological and economic sides of sustainability (Interview 11, 14).

> "Sustainability is a balance between profitability and respect for the environment."
> (Interview 14)

Concerning the issue of social sustainability, instead, fewer interviewees directly gave it particular relevance. Participants interpreted social sustainability as the respect of workers' rights and human dignity, while indicating these issues as almost irrelevant in their activities, because farmers consider them obvious characteristics of the farming sector in Europe (Interviews 12, 13, 16). In the following paragraphs, the economic and social dimensions of sustainability are further analysed.

5.3.1. Economic sustainability in a capitalist system

In the study by Baccar et al. (2020) concerning agricultural sustainability in Morocco, the most frequently mentioned aspect of sustainability has been economic profitability in order to secure the survival of the farm. Looking at the answers collected in the interviews for this research, the economic security of farmers seems a focal issue in Europe as well. Several interviewees

underlined, indeed, how the first necessary criteria to have sustainability is to earn a fair remuneration for the job of the framer (Interview 11, 13, 16, 22). A few people, indeed, admitted the difficulties of this work, linked to their economic conditions, describing farming as a high-risk job at the mercy of the pricing market and of the unpredictable weather conditions which can destroy the harvest at any time (Interview 13, 19). The priority that farmers attribute to the economic pillar confirms the theoretical statement that a certain conceptualisation of sustainability is affected by the personal experiences of the individual describing it (Schaller, 1993). In this case, the economic challenges that European farmers have to suffer in their job had a repercussion on their perception of sustainability as well, bringing some of them to put the need for economic sustainability at first (Interview 11, 19). Small farmers are, indeed, peculiarly exposed to economic threats such as volatile global market prices, strong competitiveness, an increasing number of farmers leaving the sector and intergenerational succession (Rabinowicz, 2014).

The first difficulty is to remain competitive, being able to access technology, credit and land (Serra & Duncan, 2016). This information has been confirmed by several interviewees, both in Italy and France, who admitted that, to have a margin of profit for the commercialisation of the product, they often have to look specifically for crops with a high market price, affirming that this is what many farmers nowadays have to do (Interview 11, 13, 19). Nevertheless, the second difficulty is related to price volatility, making the work of the farmers constantly uncertain and unstable (Strijker, 2005). A few interviewees reported that, while they grow their crops, many farmers do not have any idea of whether and at what price they are going to sell their harvest (Interview 18). The explained challenges are consequences of the entrance of capitalism in the agricultural sector, connected for example to the drawbacks of the insertion of farmers in the international economy. The school of thought reflecting on the so-called “Agrarian Question” reflects on these issues and explains how farmers are forced to follow the market rules and be every day more and more productive to make their work viable (Banaji, 1976; Jonsson & Pettersson, 1989).

To answer to the difficulties of the farmers, the French cooperative organised a production based on contracts. In other words, the cooperative commission a certain number of hectares of a certain crop to the farmers and it takes the responsibility to pay for them at a pre-established price before the cultivation. In this way, the cooperative takes full charge of the commercialisation of the final product and creates a network of financial security around the farmers (Interviews 17, 22). Also in the Italian case, the newborn supply-chain of Quinoa QUIN is attempting a similar strategy (Interview 13). Furthermore, in the French case, autonomous groups of farmers decided to support

each other even more, putting in common several farming machines to share the costs (Interview 19).

> "The approach of the cooperative is called "agri-ethics". Farmers and buyers commit themselves over three years to pay the same price. In this way, they protect themselves from the price variation of each year." (Interview 22)

In this process of adaptation to the everyday financial challenges, farmers affirm that their profession has become a business, moving away from the simplicity of thirty years before. To be able to respond to these problems, farmers need to have all types of knowledge, not only agronomic but also legislative and economic (Interviews 12, 14). Nevertheless, if farmers fail in remaining competitive on the market while obtaining a fair remuneration for their job, the possible repercussions are various. Strijker (2005) affirms that one possible consequence is the abandoning of the land. Interviewee 19, talking about their situation and the one of their friends, affirms that their solution is to find several side jobs to be able to continue farming, which represents not only their work, but also their passion. Finally, an Italian farmer warns from the possible situation of labour exploitation known in Italy as caporalato.

> "All this means that you have to look for solutions. I have lots of friends who are farmers and who have other jobs on the side. We sell trees on the side, you know, it's another job, even tomorrow I'm going to do storage services, it's another thing, for economic reasons. We adapt ourselves. [..]And it's a pity, I think it's a pity that we can't necessarily make a good living as farmers. Today this is not the case. You have to consider the time that you spend on it and what you have left in terms of margin." (Interview 19)

> "Sustainability in the sense of fair remuneration for everyone, all production factors and all players in the chain. Because today, unfortunately, especially for those who work with large retailers and for the most upstream part of the chain, remuneration is really, really low. Then all these economic problems, of economic sustainability, result in caporalato, especially in southern Italy, but not only, this happens everywhere, especially where there are large concentrations of one specific cultivation, as may be vegetables or vineyards, there is not really the ability by the company to adequately remunerate the work." (Interview 12)

Moreover, a common debate in the sustainability sector is the one that opposes, on the one hand, the idea that using more sustainable agricultural practices has a higher cost to, on the other hand, the opinion that sustainability can bring a higher profit (Schaller, 1993). The participants of this research brought up the topic as well (Interview 11, 12, 16, 21). Interviewee 12 makes the example of organic agriculture, which is deemed to be more sustainable than the conventional one in some aspects and which was originally sold at a higher price by the farmers. Nevertheless, the interviewee affirms that nowadays there is not much difference in the pricing anymore, making it

difficult to balance the reduced yields of the organic production with fair economic compensation. Consequently, the question concerning who should then bear this increased cost immediately arises, as farmers notice that consumers often tend to buy the product at the lower price, minding only secondarily its sustainability (Interview 13, 15, 22).

> "Sustainability has a cost. But the question is: who should bear this cost? Because it is very easy to talk about sustainability, but then everything has a cost and you have to see who bears these costs. If the answer is the consumer, then clearly there are some problems." (Interview 11)

Finding a balance between the safeguard of the environment and the economic problems of the farmers seems one of the main issues on the plate. Previous research had already underlined the importance of giving more relevance to socioeconomic problems which farmers and rural communities have to face while fighting for the ecological side of sustainability, in order to realise a real change in the farming sector (Dunlap et al., 1993). The participants in the interviews underlined once again that it is necessary to talk more about economic sustainability and how to make environmentally sustainable practices profitable for farmers (Interview 11, 16, 21).

5.3.2. The role of quinoa for the economic dimension of sustainability

Talking about quinoa, the relevance of the economic side of sustainability becomes immediately clear. Beyond the agricultural benefit of its cultivation, farmers are often driven to this crop for economic reasons. In the previous paragraph concerning economic sustainability in general, the financial difficulties that farmers encounter nowadays have been largely discussed. Thus, the choice of farmers of looking for a "cash crop" can be understood. Quinoa has been described with that term in several interviews, both in France and Italy, meaning that, despite the low yields per hectare compared to other crops, its price is deemed as highly satisfactory (Interview 11, 13, 19, 22). Yet, everyone agrees that the quinoa market in Europe is still a niche sector, where few people produce it and buy it. Several interviewees mentioned the difficulty to find a market for European quinoa, as well the insecurity linked to it (Interview 12, 16, 17).

> "The problem is that there's just not a lot of market for things other than wheat and maize, and you know sunflower, there's a short list of things that you're guaranteed that you can sell it if you grow it, there will be a market you're sure you can. [...]But quinoa, well, if I sow it today, I'm not sure I'm going to be able to sell it. Who's going to buy it from you, really?" (Interview 17)

This is why the French cooperative, as well as the Italian supply chain, structured a system of contractualisation, where the company assures a fixed price for the farmers cultivating the crop.

Moreover, the organisation in a greater structure gives farmers more authority in the national market to negotiate a price (Interview 13, 21, 22).

> "The place of the cooperative is central because what a cooperative brings to us in terms of a group of farmers, we cannot do ourselves. We have this power on the market. If we go back to 2009, with 10 farmers in the Maine-et-Loire or a little more than the department making quinoa, we would not have had the same weight on the market, the financial weight, to put the tools in function, that a cooperative can have. *Unity is strength*." (Interview 20)

To understand the value of quinoa for European farmers, the complexity of the interrelation of all the aspects of sustainability needs to be introduced. The cultivation of this crop, indeed, is adopted because it combines at the same time the ecological and economic needs of the European agricultural production. Quinoa covers the pivotal role of opening the cycle of crop rotation, adding a spring crop to the system and increasing the diversification of local agriculture, while satisfying the need of farmers for fair remuneration. Beyond this, quinoa enables to abandon monoculture and to realise a system of diversification based on crop rotation, as farmers do not need to cultivate too many hectares of it to earn revenue. Hence, farmers do not forcefully need an intensive monoculture system to obtain a fair financial remuneration (Interview 22). Adding to that, also the impossibility of applying to quinoa any chemical can be understood as an ecological advantage, as well as an economic one, as farmers do not need to spend money to buy those products. Likewise, quinoa does not require special machinery for its cultivation, meaning that farmers do not need to make any particular extra investments for its production (Interview 13, 14, 19, 21).

> "I could harvest with rather conventional tools, quinoa did not require me to invest in any particular equipment; with the equipment I had for tilling the soil, sowing and harvesting, with few adaptations, we could harvest quinoa, so in terms of investment, it did not generate any additional investment, apart from the knowledge of the crop." (Interview 21)

> "This year in Italy the yields of other crops did not go very well, so there was a need to find something that would provide a higher income. Quinoa was an ideal plant because it is extensively cultivated, so it is easy to mechanise. And it's a product that gives you the possibility to reach the end consumer very easily. It is a niche, but even though it is a niche it has its market. So it has all the characteristics, we hope, to be able to give some satisfaction." (Interview 13)

Although at the stage of cultivation quinoa does not need special machinery, at later stages of post-production it does. After harvesting the plant, the grains need to be exposed to different processes, namely cleaning, desaponification, drying and storage (Salas Domínguez, 2003). These processes are too expensive to be managed individually by farmers, thus, in France, the cooperative created common structures to manage these steps and lower the expenses for the farmers (Interview 17, 18,

21). In Italy, all the interviewees agree that one of the main disadvantages of the local production is not to have this communal organisation, which yet represents one of the projects that the company Quinoa QUIN aims to realise in the near future.

Overall, farmers often underlined the complexity of the agricultural sector, in which many different factors have to be taken into consideration. Finally, any decision taken by them is the result of balancing the different components, as well as of the interdependence among the different criteria, environmental, economic and social (Interview 17, 20, 21).

5.3.3. Social sustainability

As previously mentioned, thinking to the social factors of sustainability, farmers immediately cited issues such as workers' rights and a transparency policy toward consumers (Interview 12, 13, 16, 17). The first issue connects directly to some of the challenges mentioned in the paragraph about the economic dimension of sustainability. Indeed, only through fair remuneration, it is possible to ensure fair salaries also for the eventual co-workers. Nevertheless, in the studied cases, the typology taken into consideration is small family-farmers, who usually do not have any dependents. Thus, the responsibility of securing a fair revenue to all farmers is more serious for the bigger structures, namely cooperative in the French case and the organised supply-chain in the Italian case, which structured their systems of contractualisation. The second point concerning transparency has resulted to be truly important both in France and Italy, where the farmers affirm to apply to the national and European high-level regulations concerning the health of food production, ensuring high-quality products for consumers (Interview 13, 15, 17, 18).

Farmers who cited the social and ethical side of sustainability correlated these two elements of human rights and transparency to the case of quinoa production in its countries of origin, Perù and Bolivia (Interview 11, 12, 13, 16, 17). As explained in the Introduction of this thesis, the global popularity that quinoa reached after the International Year of Quinoa in 2013, had some negative repercussions in the countries of origin, particularly from a social point of view, but also from the economic and ecological ones. Originally, quinoa was consumed by peasants in the Andean countries who counted on it for their subsistence and cultivated the crop in rotation with other local species, letting parts of the land for the pasture of lamas. After 2013, when the demand for quinoa on the international market grew exponentially, the local large landowners saw a possibility of enrichment, displacing rural populations. They converted large areas to a monoculture production of quinoa, causing a loss in the local biodiversity, generating weed problems and soil fatigue, and replacing the traditional agricultural methods of the peasants with intensive agricultural practices

(Angeli et al., 2020). In the meanwhile, the price of quinoa on the international market skyrocketed, rendering impossible for locals to afford it anymore and, thus, increasing local malnutrition (McDonell, 2015). Several Interviewees, of which the two quinoa experts and a few farmers, mentioned these phenomena, portraying the South-American system as not complying with their vision of sustainability (Interview 1, 2, 11, 12, 13, 17). Particularly, Interviewee 17 cites the relevance that the European production had in stabilising the international price of quinoa thanks to the creation of new supply chains, while the other farmers simply stressed the importance of respecting the environment as well as the local populations and workers' rights in their quinoa productions.

> "We know that, especially in Peru and Bolivia, the people of the Andes who used to rely on quinoa as their main source of food until 10 years ago, are now in difficulty because the price of quinoa has risen so much, because the large multinationals are growing quinoa for export to Europe. Therefore, the internal food need of some parts of these countries is affected. So if we talk about the sustainability of quinoa in particular, one aspect that should be taken into account, globally speaking, is that of ethical sustainability, namely the non-monetary cost, but the social cost, that people are paying, especially in Bolivia, in the Andes, precisely because quinoa is now used mainly for export, while for the domestic market they no longer have it. But sustainability is also ethical and social sustainability, understood as the exploitation of labour, understood as transparency, understood as a series of aspects that must allow the consumer to use any product, especially food, not just quinoa, with the knowledge that they are using something that has not harmed another, that in order to obtain that product, that service, whatever we are talking about, it has not harmed others." (Interview 12)

Going beyond this standard definition of the social dimension of sustainability, farmers cited other elements that they deem as fundamental to realise sustainable agriculture. For instance, a farmer in France mentioned as a factor of social sustainability the democratic way of participation in the cooperative in which all farmers take the most important decisions together (Interview 22). Other characteristics have been cited by several respondents and, thus, the following paragraphs are used to delineate them.

5.4. Sustainability as locality

The vast majority of the interviewees agree on the importance of the concept of locality to realise sustainability (Interview 11, 12, 14, 13, 15, 17, 18, 20, 21, 22). In this case, locality means the spatial and social proximity to the local context from an environmental and relational point of view. In this paragraph, the answers of the farmers are reported in order to explain the importance of this phenomenon from their perspective, as well as its articulation.

The majority of the interviewees cited the importance of the regionality of a product for several reasons. It is perceived as an act of support for the local economy, creating new activities and making money circulate within the region, while making the country more autonomous in its food needs (Interview 22). Additionally, a short supply chain is seen as a sustainability factor because it does not require long transportation across the world, but the final product can reach the consumer within the range of a few kilometres, if not even creating direct contact between the producer and the consumer. Therefore, farmers believe that in Europe consuming the locally produced quinoa would be preferable rather than buying the one imported from Latin America, as it would not need to be transported across the ocean, producing unnecessary emissions (Interview 15, 17, 18). According to the farmers, this proximity allows as well to create a relation between them, the producers, and the consumers, improving their relationship and creating awareness concerning sustainable issues and the farming job (Interview 13, 18; Fieldnotes). This point and its connection with the conceptualisation of sustainability is further explained in the paragraph "Sustainability as human relation".

Moreover, from an ecological perspective, farmers affirm that it is important to look at the local context (Interview 17, 20, 22) and to reflect on the local problems in order to solve them by adopting suitable solutions. Because of this reason, all participants underlined the ecological potential of cultivating quinoa in the European context, as the crop can answer certain problems that concern European farmers more and more every day (Interview 12, 16, 17). Climate change is nowadays palpable in the European agricultural sector, as the arid belts are increasingly moving away from the equator and northwards in this hemisphere. This results in a reduction in rainfall, affecting the availability of water resources as well as causing soil erosion. Climate change is also responsible for unexpected meteorological phenomena, such as extreme droughts or frosts, and it can lead to increased salinisation of agricultural land (FAO, 2015). Quinoa is a crop able to answer these issues, as it can be cultivated in marginal lands presenting high salinity levels and without requiring irrigation. It can adapt to extreme conditions, surviving as well to frosts and droughts (Interview 12, 16; Ruiz et al., 2014). As previously explained, quinoa answers the need of European agriculture for greater diversification of agriculture, enabling a system of crop rotation (Interview 17; Balogh, 2021).

Thus, the relevance of considering a certain production in its context emerges concretely. Interviewee 17 argues that it is impossible to extract a certain crop out of its environmental and cultural context in order to understand its level of sustainability, as in this way it would lose all the value that brings to the local region where it is cultivated. Clearly, all farmers recognised that the

cultivation of quinoa presents also some issues and downsides, being well aware that it does not represent a perfect solution to all problems. They emphasise its relevance in fitting the needs of their land, but they also report a few critical aspects. Quinoa is a relatively new crop for the European farmers, hence, they are still in a phase of experimentation, in which they try to understand through several attempts which is the best way of cultivating this crop (Interview 22). Moreover, the impossibility of using any pesticide and herbicides can particularly make the control of certain weeds and pests difficult, requiring more elaborated techniques and strategic thinking in the crop rotation (Interview 20, 21). Nonetheless, all farmers deem these difficulties to be sufficiently balanced by the benefits that the crop provides to their farms, environmentally, socially and economically.

5.5. Sustainability as contact with nature

Several farmers mentioned the importance of having a close relation with nature in order to create a sustainable system. On the one hand, indeed, the close observation of nature enables to better understand the lands and its needs; on the other hand, it allows to establish a relation between humans and nature (Interview 13, 15, 17, 20, 21).

> "You see your earthworm galleries, you see everything is done by nature. So if you put in the right roots, the right species, really, you don't have much to do." (Interview 19)

> "We are very happy to have bees to pollinate our fields. We love to see pollinating insects in our fields because they take the pollen and so on, so we have to let them do it and that's it, so we know, we observe." (Interview 20)

Many of the interviewees stressed that being in the field, touching the ground, observing the plants and getting their hands dirty are foundational characteristics of sustainability. This is part of a daily and indispensable conversation between nature and farmers, who put themselves in the position of listeners. Furthermore, this aspect highlights once more the importance of the experience in the creation of farmers' knowledge, as well as of their perception of sustainability. Also when talking about quinoa, farmers made constant reference to the specific characteristics of their land, their soil and their crops, based on a knowledge built up day after day through the observation of nature. They explain how it is through the practice and the observation of the soil, the plants and even the insects that they have a comprehension of the sustainability of what they are doing. Moreover, a farmer mentioned the importance of staying in contact with nature not only to know the land and take the correct agricultural decisions, but also because "some healthy outdoor work is more sustainable, better for people's health and psychology" (Interview 13).

5.6. Sustainability as human relations

Several farmers underlined the importance of creating social relations as a main character of sustainability. They talk, on the one hand, about strengthening the relations among farmers to create a closer community and a shared identity, and on the other hand, about establishing a conversation with consumers and neighbours (Interview 13, 15, 16, 18, 20, 21).

Various interviewees underlined the role of a short supply chain in creating a direct connection between the producer and the consumer, revealing a strong interest in having more contacts with locals, to create a community that understands and is interested in the work of the farmers. Overall, the words of the farmers reveal some mixed feelings toward consumers, as many complained about their lack of understanding concerning the farming world as well as for their constant search for the lowest price rather than the higher quality in food products (Interview 13, 15). However, they also focused on the solution, not only on the problem, considering as fundamental to educate consumers about how food is produced more sustainably and why farmers take certain decisions. They hope that creating a conversation between them and local people might produce a more sustainable system at the consumer level (Interview 18, 21).

> "The proximity with consumers is really important, not only for the lower impact on the environment due to the transportation, but also knowing that this food comes from not too far away. That I could go and meet the producer. I trust that the government structures are in order, they are doing everything for my health. That closeness, that familiarity, it has a point. I think there is something that you would lose quickly if everything came from far away." (Interview 18)

> "It's in our role also to communicate about our job, to explain to people why sometimes, when I put compost, people say that it stinks. So we have to explain why we use it and that it's a natural product and that we don't want to use chemicals and so on. Maybe on this or many other things as well: why do we produce this or that crop? What's the point? I think it's important for everyone to communicate about our profession so that people understand." (Interview 18)

Concerning quinoa, a French farmer pointed out how, thanks to the crop, he noticed a renewed interest in agricultural activities from the people living in the area. The interviewee described that people started stopping by the fields to ask for information about the plant, as they could not recognise it but they found it aesthetically pleasing. These events were interpreted by the farmer as the beginning of that process of contact with the neighbours and of involvement and education of non-experts into the activity of farming (Interview 21).

Furthermore, human relations cover an important part of the meaning of sustainability for both Italian and French farmers, not only with consumers, but also among them, farmer to farmer.

Sustainability for them means cooperating, helping each other among farmers and sharing each others' practices to head toward a more sustainable system together (Interview 13, 15, 16, 20). Particularly in the French case, the existence of these connections is facilitated and stimulated by the system of the cooperative. Indeed, the cooperative organises many services for the farmers and has a democratic structure based on the participation of all its adherents (CAPL, n.d.). Practically, it organises assemblies where all farmers share their experiences with their cultivations or with certain practices they were experimenting with. Moreover, it organises trainings with technicians and agronomists concerning specialised topics and incites farmers to increase their sustainability standards through the adoption of specific certifications, such as the High Environmental Value certification (HVE) (Interview 17, 18, 20, 21, 22). Thanks to all these activities, farmers get to know each other and, in some cases, develop smaller working groups. This format aid farmers to improve their activities supporting each other, sharing their experiences and putting in common particular tools, necessary for some alternative practices, such as conservation agriculture (Interview 18, 19). In Italy, the quinoa supply chain is in its construction phase, consequently, there are not such articulated structures yet. However, Italian quinoa production is a small reality and most of the farmers implicated in it know each other. Relations among them exist but are most frequently led by personal contacts rather than overarching structures (Interview 13, 14).

These concepts of locality and human connections entail a further aspect of sustainability for many farmers, both in Italy and in France, namely the pride for creating a local value chain. This aspect is particularly connected to the cultivation of alternative crops that are not part of the European tradition and landscape. Indeed, for the farmers, succeeding in this activity means being part of something new. They take the success, on the one hand, as a personal pride and, on the other hand, as a factor that strengthen the local relations with the farmers implicated in the same production, creating a communal experience. Approaching an alternative way of producing make the farmers feel part of something bigger and unique, which renders them recognisable, producing an identification with the product and the local territory (Interview 11, 13, 17, 20, 21, 22).

> "When I started, I used to say to myself that this was a small production on the scale of the cooperative or on the scale of the farm. There was no such thing as 100% French grain then. It came in the year that followed. I personally had 5 hectares of quinoa in 2009 and I don't remember who told me 'Do you realise that you have 5% of the French quinoa surface at home? And you have added 5% to the European surface of quinoa with your area?' Because we said to ourselves, if it works, so much the better, we're writing a page of history. If it doesn't work, we'll fail and then that's it, that's happened other times. But if it works, we'll do something. It was good to be in the boat." (Interview 20)

> "I want to continue because it's a common experience, we started with nothing at all, it was a meeting of a few people who made it possible to develop a culture in Anjou that didn't exist. And the idea is that we continue for the sake of proximity, for the sake of territorial development, for the sake of the acceptability of agriculture in my region." (Interview 21)

> "All this has created an attraction for the cooperative, it is a brand image. When we did the show in Paris, 'Made in Anjou' had a nice place on the show, and it's a source of pride to be there and to say to ourselves, here we are. Because this is the memory. We are very well known for our Anjou wines, the châteaux of the Loire. And maybe in 20 or 30 years, we'll talk to a guy from the South of France about Maine-et-Loire Anjou, and he'll immediately say 'Oh yes, where there's Quinoa d'Anjou', maybe, we don't know, I don't know, but that's a reward." (Interview 20)

The farmers affirmed that this sense of community, pride and belonging is a fundamental component of what sustainability means for them, even if it is difficult to quantify or even to explain. This is part of the reason why farmers are excited about their job and enthusiastic about their quinoa production. Because of the novelty of this crop for the European farmers, the contacts among people who cultivate it are fundamental to share the best practices and help each other (Interview 13, 18, 19). These relations and overall organisation, both in the Italian and French cases in their different ways, represent a core factor of sustainability, not only from an ecological and economic point of view, as this aids farmers to implement the best practices and reduce the expenses, but also on a human level, strengthening a sense of community and creating an added value to European quinoa.

5.7. Sustainability as a service

Several participants affirmed that the farming job is able to create fundamental services for the local environment and the local community, contributing to sustainability in a positive way. Indeed, they underline that through the use of certain practices they do not only attempt to have the least possible negative effect on the environment, but they also try to render a service. Interviewees 18 and 19 mentions the possibility of enriching the land, limiting erosion and stocking carbon in the soil thanks to certain practices such as conservation agriculture, as well as of increasing biodiversity thanks to quinoa production. Interviewees 15, 18, 21 and 22 cite their power of creating a beautiful landscape through the crops that they select, improving the quality of life of the people living in the surroundings. Having the responsibility to choose the crop to cultivate in the region, farmers feel to be "landscapers of France" (Interview 18).

> A Quinoa plant, some people will find it pretty, so it makes a beautiful landscape and so people are happy. (Interview 22)

All these examples demonstrate how farmers do not only impact negatively the environment through their activities, such as water consumption or soil pollution, but they are also able to contribute positively to it and to society, raising the sustainability of their production.

5.8. Farmers' values and the meaning of farming

In the previous paragraphs, farmers' discourse about sustainability has been defined in all its details and nuances. Here, the thesis aims to investigate farmers' mindset on a deeper level, trying to understand the values and beliefs connected to their identity and perception of their job, in order to better understand the influence of these factors on their definition of sustainability.

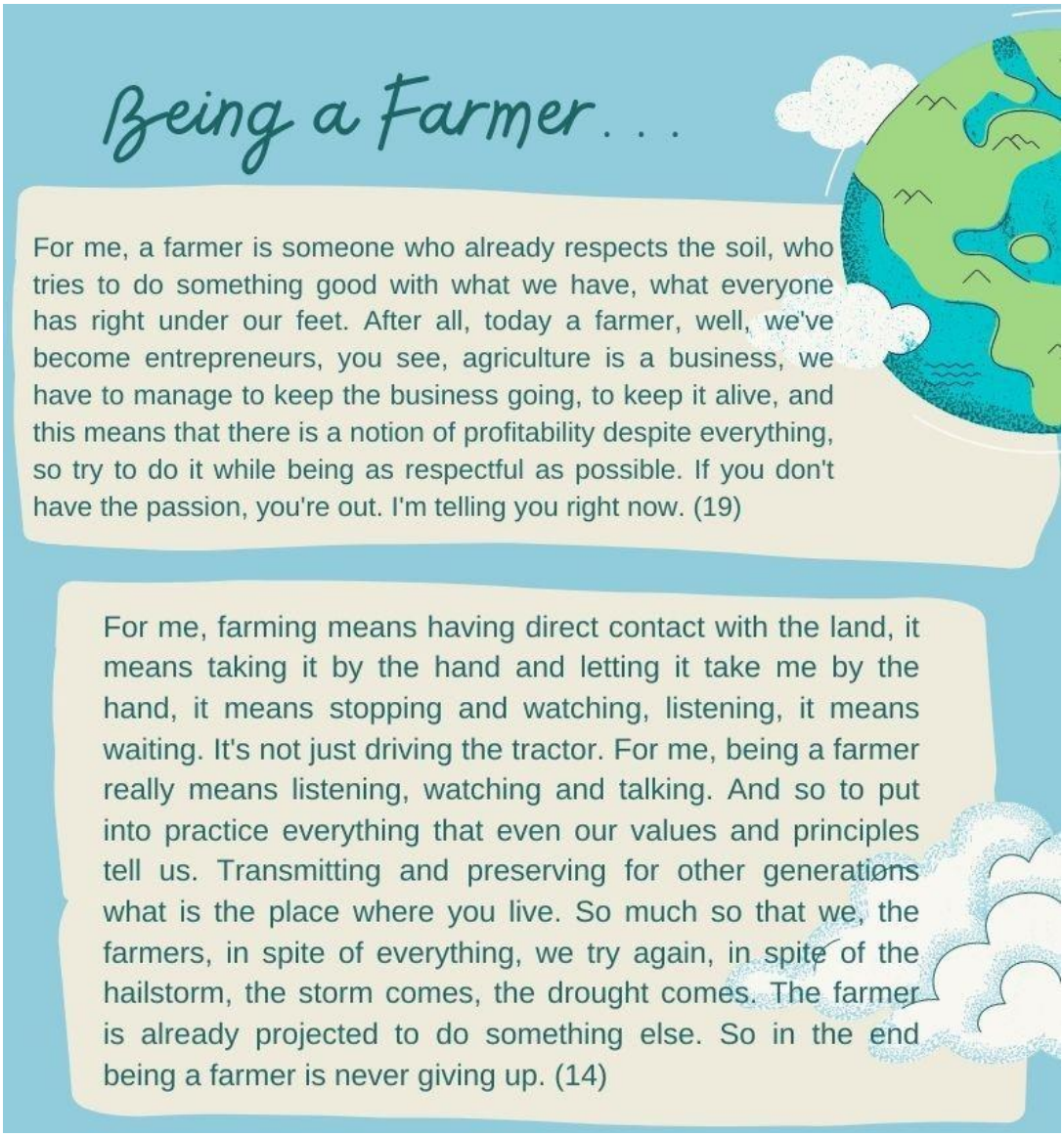
This is why, through the interviews, certain questions were specifically thought to reveal the subjective and value-based side of farmers' way of thinking. Particularly, farmers have been asked "What does it mean for you to be a farmer?", to let emerge the values, norms and feelings connected to their job, which could be associated as well to their perception of sustainability, or at least could reveal why they think about sustainability in a certain way. In the interviews, a solid connection between the significance of their job and the interpretation of the concept of sustainability emerged.

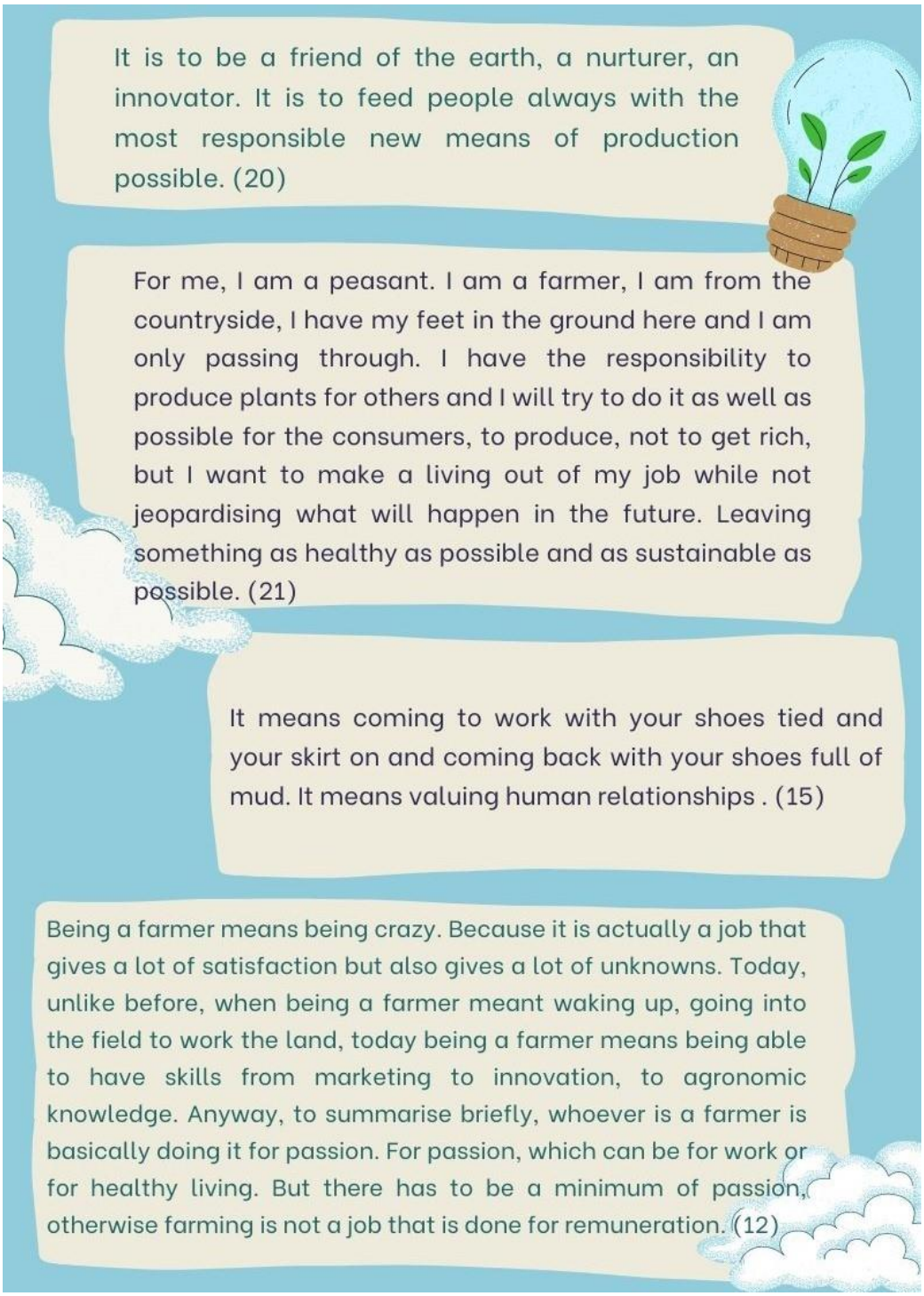
Certain farmers perceive themselves practically as producers of food, feeling the responsibility of feeding the world (Interview 13, 22). On the one hand, Interviewee 21 still considers themselves as a peasant, for the genuine contact with the land and the aim of following the steps of the predecessors. On the other hand, other farmers stress the change that happened in the agricultural sector, describing themselves as entrepreneurs (Interview 12, 14, 19). This group underline the necessity of dealing with different types of knowledge, such as economics and legislation, other than merely agronomic principles.

The majority of farmers mentioned, in relation to the meaning of farming, the importance of respecting land and nature while doing their work, to protect the environment, ensure a future for the following generations and produce healthy food for the consumers (Interview 14, 18, 19, 20, 21). Some of them mentioned more specifically that it is part of the work of a farmer to be in contact with nature, to talk to it, listen to it and observe it (Interview 14, 15, 17, 21), as well as to create a contact with people, among farmers and with consumers (Interview 13, 15, 16). It is noticeable how these issues that emerged while talking about sustainability are identified by the farmers as the supporting pillars of the farming job as well.

Two farmers affirm that to be a farmer means to be crazy, meaning that their passion for their job is so strong that it incentives them to continue working even in difficult times (Interview 12, 19). They stress once again how uncertain and risky can be the farming job and how difficult it can be to make a decent living out of it, underling the struggles linked to the economic side of sustainability. Yet, their passion for it leads them to overcome these obstacles. Finally, Interviewee 16 brings a definition different from all the others, affirming that farming is a constant school, a way to learn and discover new things about nature day by day, an opportunity to be in contact with people. The following infographic displays some of the most interesting quotes, able to represent farmers' value through directly giving them voice.

Figure 2. Infographic: The Meaning of Farming





5.9. Farmers' isolation

Both theories supporting this thesis, namely Discourse Analysis and ANT, underline the importance of taking into consideration the power relations existing in society to comprehend the impact that a certain vision of the world might have, spreading and becoming well-establish among different actors (Latour, 1999; MacDonald, 2003). Therefore, after having analysed farmers' perception of sustainability, this paragraph aims to reflect on the power or powerlessness of their discourse to influence other social spheres, such as the political, economic and scientific ones.

Asking farmers about their relations with other significant actors in the sector, the results show a situation of serious isolation. Farmers feel a general sense of frustration and incomprehension towards the political world. On the one hand, they are tired of the excessive bureaucratisation and they feel to be constrained by it, having to stay updated with all the new regulations for the agricultural sector popping up day by day (Interview 11, 14, 19, 20). On the other hand, farmers feel the political world as extremely distant, even when it takes decisions concerning the agricultural sector. Several farmers complained that "some legislations and rules concerning agriculture seem to have been written by people who have never set foot in a field" (Interview 11). Nonetheless, political entities can affect farmers' work and their approach to sustainability through the imposition of certain practices, regulations and through setting certain sustainability standards as the High Environmental Value (HVE) certification in France (Interview 17, 22). Yet, many farmers expressed confusion toward the direction indicated by the political institutions concerning sustainability and sustainable practices in the agricultural world (Interview 14, 20, 22), stating that "everything seems in opposition" (Interview 20). Moving on the other side of the relation, also farmers admitted to having had some degree of influence on regulations and institutions, even if gradually and involving much effort. Interviewee 18 affirms that the majority of innovations in sustainable agriculture are the product of farmers' experimentations and knowledge, being transformed into laws only successively. Besides, Interviewee 13 brings instead the example of quinoa, which after their request has been added to the list of crops recognised by local institutions.

> "Unfortunately, however, many times we farmers are far behind what is required of us, and many times the legislation is also behind what we farmers can do. With quinoa, for example, when three years ago I participated in a regional Project of Rural Development, quinoa was not even recognised as a crop, so luckily, by insisting a little the following year, the region included the crop." (Interview 13)

> "It always comes from farmers, it's thanks to the practices of certain farmers that a few years later this exception can become a rule. Not long ago, there was a decree that came out, the bees decree, which asks that every treatment that is used on crops in flower, especially with insecticides or fungicides, can be applied either 2 hours before sunset or 3 hours after sunset only, it's not to be applied in the daytime when you have crops in flower and pollinating insects in them. I've been doing it for a long time, but it took a while because it became a rule." (Interview 18)

Considering the relation between small farmers and the research sector, it can be noticed a difference among the farmers. On the one hand, the farmers who first brought quinoa to Europe declared to be in contact with researchers and universities specialised in plant genetics or agronomy – not sustainability – that helped them in the process of adaptation of the crop to the European conditions (Interview 11, 12, 13, 17). On the other hand, the majority of the farmers that joined this

cultivation afterwards affirms, instead, not to have any type of contact with the research sector (Interview 14, 15, 18, 19, 20, 21, 22). Apart from the technicians and agronomists specialised in the cultivation of quinoa who support the farmers in the culture of this alternative crop for the French cooperative and the Italian supply chain, farmers do not have contacts with other experts, particularly concerning the topic of sustainability (Interview 13, 16, 18, 22). When asked about where they get information concerning sustainable practices, farmers recognise general misinformation and confusion on the subject caused by the difficulty to find reliable materials online (Interview 13, 14). Two French farmers told that they autonomously created their own group of co-workers with whom to share information about new techniques, about the failure or success of their experimentations and to organise private workshops with experts (Interview 18, 19). Apart from these personal initiatives, French farmers receive some information through agribusinesses which mainly try to sell their products marketing them as more sustainable for the environment (Interview 18). Farmers recognise that these firms are connected to the research world, while the research world is not connected with them (Interview 14). Therefore, several farmers expressed a sense of disregard from the research world and when thinking of that sector, they mainly associate it with technological innovation for the creation of new machines, chemicals and genetically improved crops, not with sustainability assessment (Interview 11, 14, 19, 29, 22).

> "This is one thing that has always left me a little strange in agriculture, there are companies, many times large, that are very connected to the university and very connected to research. But the mass of agriculture feels very distant, feels very neglected. And many times there is never that passage that informs the masses of what in reality is being done behind because I have been in some realities where I see that the research is there and plenty. But many times, since there is no communication, it is not perceived and it does not go forward in this way. So that is certainly a stumbling block. We need to unite a little more." (Interview 13)

5.10. Conclusion

Answering the first sub-research question: "*What characterises European quinoa farmers' discourse about sustainability?"*, several remarkable findings have been uncovered. Three main definitions of sustainability have been identified. Some farmers understand sustainability as the possibility of continuing framing and passing the land to future generations, without spoiling its characteristics. Other farmers defined sustainability as composed of three components, environment, economy and society. Interestingly, most of the farmers stressed the importance of the economic side of sustainability more or less directly, explaining the difficulties inherent to the farming activity and describing the financial insecurity and the struggles to earn a fair remuneration out of their job. The third definition that farmers gave connects the idea of sustainability with daily

practical activities, associating the concept with certain agricultural practices. On the one hand, farmers understand sustainability as reducing their impact on nature; on the other hand, they deem to realise it through rendering services to the whole society, such as stocking carbon dioxide or creating a beautiful landscape. Going more to the details, some interesting findings are represented by the importance reserved by farmers to the contact with nature and the observation of it, shaping their knowledge, their instinct and their yearly experience. The sense of connection is extended also geographically through the valorisation of the locality of a certain production, meaning a reduced environmental impact due to transportation, closer proximity to consumers and the creation of a sense of pride and identity among the farmers. This attachment is focal to generate a relationship with people as well, both in a sense of solidarity and reciprocal help among farmers and to relate to the local community and educate the consumers over agricultural and sustainable topics.

Quinoa represents the ideal crop to interconnect all the points. Quinoa values locality through the creation of a national value chain, which enables to create special relations with consumers, while fostering farmers' pride and creating a local identity. This production fosters the local economy, ensures a fair revenue to farmers, guarantees transparency and health standards and avoids human exploitation. Besides, quinoa answers to the European agricultural challenges, enabling farmers' sustainable practices, such as diversification and crop rotation.

Finally, looking at power relations in the sustainability world, farmers depict a situation of serious isolation from all other actors of the food production world. They are constrained by politics through its rules and legislations but they faced difficulties and slowdown when trying to influence it themselves to update some agricultural standards. Similarly, farmers feel to be at the mercy of the market and the larger food companies, while they have almost no relation at all with the research field.

6. Sustainability: LCA and Researchers' Discourse

This chapter describes researchers' definitions of sustainability, both from their personal point of view and its connection with LCA methodology. In this thesis, LCA is considered as a non-human agent at the same level as human agents, namely farmers and researchers, in its ability to shape a certain idea of sustainability and modify reality. Therefore, this research aims to take into consideration as well how LCA can influence society's perception of sustainability, particularly the one of researchers who work with it, as well as political decision-making. The chapter is structured presenting first the definitions of sustainability reported by the researchers taking part in the interviews, integrating previous literature which focused on the same topic. Afterwards, LCA

representation of sustainability is analysed, based on the answer of the researchers as well as the study of books and guidelines presenting the methodology. As LCA cannot directly speak for itself, this research listens to the people who work with it every day and analyses the documents on which the methodology is based.

6.1. Researchers' definitions

Analysing the researchers' answers to the question concerning their perception of sustainability, it is possible to identify two main groups of responses that have been found also among the farmers' definitions. These are textbook definitions of the concept of sustainability, that the researchers probably studied during their years of education, constituting an example of how powerful is the influence of the professional background as well as personal experiences in shaping the personal vision of sustainability of anyone, researchers included (Baginetas, 2008). Conversely, a few other participants gave some more personal and original definitions, which nonetheless offer an interesting insight into the way of thinking of researchers.

The first category of answers describes sustainability as the possibility for a certain system to perpetuate in time (Interview 3, 6, 7), referring to the well-known definition of sustainable development contained in the Brundtland Report by the United Nations. Consequently, also in this case, it is interesting to observe how popular these political definitions have become, even in the scientific sector, at the point to be integrated not only in researchers' personal definition of sustainability, but also in their job. Indeed, among researchers, a strong identification of the person with their job can be observed as several of them initiated their response with the following sentence "For me, as a researcher, sustainability means .." (Interview 3, 8, 9).

The second group of responses, instead, proposes another UN definition of sustainability, namely the one that divides the concept into its three famous pillars: environmental, economic and social aspects (Interview 2, 3, 8, 9). This definition is particularly significant for researchers, as well as notably influential in the sector, because the sustainability assessment methods are constructed in a way that reproduces the three pillars. As it is further discussed in the following paragraphs, sustainability assessment tools are thought to represent each one of the pillars, to then be combined to offer a complete representation of the sustainability of the studied case, product or service. There is, hence, a methodology corresponding to the environmental pillar, which in this case is LCA, that is usually complemented by other two methodologies, one for the society and one for the economy (Jolliet et al., 2015). Moreover, the researchers who presented this tripartite understanding of sustainability tended to identify themselves with the pillar which is tackled by their methodology

(Interview 2, 3, 8, 9). For example, the one researcher interviewed in this study who is specialised in assessment methodologies for economic sustainability indicated the economic pillar as the primary sine qua non condition for sustainability (Interview 8). Vice versa, the interviewees specialised in LCA and, hence, in the environmental pillar, tended to give more relevance to it, putting the ecological level at the first place (Interview 2, 3, 9). Furthermore, even if all the respondents who presented this trilateral view of sustainability introduced all the three aspects, they also indicated that in their job they only addressed one of the pillars, while other specialists take care of the resting two facets. This reflects the compartmental way in which scientific knowledge is organised (Greenhough, 2009). In the coming section 6.4., this research analyses whether and how these separate compartments enter in relation.

Following on this identification between researchers' understanding of sustainability with the assessment tools that they use for their job, in their answers researchers included some of the characteristic elements of LCA to describe sustainability. Interviewee 7 affirms that "what you call sustainable depends on the criteria and indicators that you use", while Interviewee 5 remarks the necessity to compare different situations to establish what sustainability means in practice. These statements reflect a highly technical knowledge, based on two main elements of LCA: the comparison between two or more production systems and the environmental impact indicators, that the two researchers incorporated in their own vision of sustainability. Besides, these considerations as well as some other discussions concerning what sustainability really means that emerge during the interview reveal the scientific forma mentis of the interviewees (Baginetas, 2008), who continued referring to the concept as something that could be defined and quantified. An example of the influence of their scientific background on their perception can be represented by the following quotation.

> "Decisions should be made in such a way that are not only aimed to maximise positive economic benefits, but to reach this Pareto optimal, so this curve of optimality of an activity which does not maximise a goal without minimising others, that's Pareto optimal. So we need to do things in a way that money is made, but society is not too unhappy and the environment is not too destroyed due to this activity and this line of efficiency where you cannot improve one goal without deflating others is what we should aim to." (Interview 5)

In addition, a few researchers expressed a vision that differed from the two previous definitions. Interviewee 4 presented a different definition, referring to the concepts of strong and weak sustainability. Weak sustainability is a concept formulated by the neoclassic economic school, stating that natural capital and human capital are interchangeable. From this perspective, technological progress is believed to be able to generate solutions for any environmental problem

and monetary compensations are considered sufficient to counterbalance environmental degradations. Conversely, proponents of strong sustainability consider that certain critical natural resources are non-substitutable with other forms of capital and they should be preserved (Pelenc et al., 2015). The researcher affirms that their vision of sustainability conforms with the definition of strong sustainability, just described, as "you cannot have a sustainable economy if you do not have a sustainable society and you cannot have a sustainable society if you do not have a sustainable environment" (Interview 4).

Finally, Interviewee 5 states that sustainability is a vision, an ambition, a final aim that is impossible to fully and concretely realise or achieve, but that directs the actions of the people who believe in it. This vision emphasises a value-oriented understanding of sustainability, where the perception of the individual is put forward. This conceptualisation is supported by another researcher who describes sustainability as a "buzzword" (Interview 7), namely something that does not exist until when you do not define it through certain standards or your personal vision.

> "In the classical corporate strategy you have a mission and you have a vision towards which you try to move your institution or your activities. And the way you do it is a strategy. So, I developed a strategy to go get myself closer to my ambition, to my vision, which is to work in slightly improving the sustainability of agricultural systems." (Interview 5)

These responses reaffirm the results of previous research that found that there does not exist a single perception of sustainability according to all researchers, but that they also are influenced by their personal values, cultural origins and professional background (de Olde et al., 2017). The different definitions give relevance to different aspects of sustainability not only among researchers who adopt different assessment methodologies, but also among those researchers who employ the same assessment tool, namely LCA. The following paragraph further analyses the definition describing sustainability as composed of the three pillars, connecting to it the methods used to assess the state of the three components, environment, economy and society. Moreover, the study continues underlining the points of integration of the researchers' perspective with the characteristics of the assessment methodologies.

6.2. The environmental pillar: LCA

To understand the perspective that LCA offers about sustainability, this thesis investigates guides and textbooks explaining the approach of the methodology. Moreover, the researchers have been asked to talk about it during their interviews, as an additional source of information about LCA and its representation of sustainability.

All the interviewees stress that LCA only targets the environmental pillar of sustainability and that, in order to have a complete sustainability assessment, the method has to be combined with other approaches or other impact assessment tools. Moreover, several researchers highlighted the importance of not considering this as a weakness or a deficiency of the method itself. LCA has been built to report a precise representation of the environmental impact, thus, it is a choice of the researcher whether to stop there or add also social and economic components to those results (Interview 3, 5, 9).

Going further into the details, LCA takes into consideration the damage that the life cycle of a certain product or service causes to the environment. For this reason, some of the participants recognise the concept of strong sustainability reported above in the approach of LCA (Interview 4, 5).

> "Under strong sustainability no damage is acceptable. In LCA lifecycle assessment every damage is considered as a damage, as a negative impact, as something to be avoided." (Interview 5)

Interviewee 5 continues underling how, according to this perspective, no anthropogenic system by definition can be considered sustainable, as humans damage the environment "by doing whatever we do".

Through this perspective, LCA can provide interesting insights to reflect on the sustainability of a certain process of production. Indeed, if there are different ways to produce a certain item, LCA can demonstrate which one has a greater impact on climate change, water consumption or any other of its indicators. Besides, within a certain process of production, it can indicate which stage of the life cycle of a certain product is the most impactful and damaging (Interview 3, 5, 6, 9). Nevertheless, LCA is a tool of analysis, not "a magic button that tells you what to do" (Interview 5). The interviewees deemed important to underline that LCA only provides scientific data and environmental elements on which to formulate reflections or to base successive choices, but it does not tell directly what should be done with a certain production. Most importantly, researchers consider themselves as the people who apply the methodology and present the results, not those who make the decisions. Some of the interviewees conceive as part of their role and responsibility of researchers to translate their findings in practical recommendations to lead toward an improvement of the production system (Interview 2, 3, 4, 9), while others prefer to only tackle the technical part, presenting the results without proposing any advice, to let the decisional obligation to politicians and policy-makers (Interview 5, 6, 8). The first group of researchers is the same one that

invests high expectations in the potential of LCA to concretely help in improving the current agricultural practices.

> "Life cycle assessment can provide really solid insights not only on which lifecycle stage is most relevant to the environmental impact of your product, but also on which specific emission, or which specific process and what you would be able to do. So you can also use life cycle assessment in scenario analysis to investigate how you can do things differently and what the effect would be." (Interview 9)

Furthermore, in order to provide and correctly analyse the complex amount of data, LCA requires the knowledge of an expert. Many guidelines and books exist to explain how to apply the methodology but technical knowledge is necessary during the phases of the definition of the system boundaries, the collection of the data and the selection of the models. Otherwise, if some of these aspects are incorrectly defined, this can lead to erroneous conclusions (Interview 3, 5, 9). This is considered as a serious reality, at the point that one of the interviewees warns from the biased exploitation of the methodology for "green-wash" purposes (Interview 9). However, if properly implemented, LCA can contribute with interesting and surprising breakthroughs. The methodology can lead to results that may be contradicting the most common ideas over environmental sustainability. For instance, nowadays people tend to believe that the more local a product is the more environmentally sustainable. LCA contradicts this statement, demonstrating that the transportation stage is the least impacting on the environment (Interview 3, 7). Another example is the one of organic agriculture, which in many case studies demonstrated to be more damaging than a conventional system, according to the LCA criteria (Interview 5).

Researchers indicate other elements characterising LCA representation of sustainability. The method portrays a static image of it, describing the impact that a certain production has on the environment in that specific moment in time and assuming that it will stay stable over a period of time (Interview 3, 5). Thus, LCA has a linear foundation, representing a constant damage to the environment, even if the researchers recognise the dynamic nature of environmental phenomena (Interview 5). In addition, the assessment tool is only able to provide a relative comprehension of environmental sustainability, as it is not able to say whether a certain production system is sustainable in absolute terms, but if it is more or less sustainable compared to another (Interview 6, 8). After all, the LCA framework "models in a simplified way a representation of the interactions between men and nature in order to evaluate the performance of systems with the strengths of this life cycle and multi-criteria approach" (Interview 5). It does that while offering a mechanist vision of human-nature relations (Interview 4).

> "So it's really a rather mechanistic vision, in fact, it's to say that we start from a modelling framework which is to model human activities in the form of quantifiable flows, whether it's quantities of products or services, to be able to make the link between that and pressures on the environment, whether it's resources consumed or emissions of polluting substances, to be able to aggregate that into environmental impact indicators. So the LCA framework is based on this mechanistic and biophysical vision of the interactions between what we call the technosphere and the ecosphere." (Interview 4)

Indeed, to succeed in the construction of this model, some characteristics are indispensable, reproducing a highly technical and specialised comprehension of sustainability through a complex terminology. Being a scientific methodology, LCA is based on the possibility to quantify through numerical values the impact that a certain activity is having on the environment. Quantification is one of the core characteristics of the methodology, because "if you cannot quantify, then you cannot really improve practices" (Interview 3). Moreover, quantification constitutes the pillar to achieve objectivity, toward which all researchers aim, considering it a reachable, necessary and realistic objective. Another essential principle is universality, meaning that, being LCA based on natural phenomena and numeric models, researchers deem that it can be applied everywhere (Interview 3, 4, 5, 6, 8, 9).

> "We aim to represent the functioning of a system, but afterwards, when we measure our impact, we take into account relationships that are physical, biological, etc., and that don't depend on human societies. They depend on the environment where we are, and on which we can have some rules in a general way, and so it's rather in the order of biological science, et cetera that we're going to find what interests us on these stages" (Interview 6)

The claim for universality is one of the main traits of Western scientific knowledge, professing to be objective and generally applicable. Part of the process to realise this ambition involves the scientific attempt to make knowledge explicit, formal and quantifiable (Mccomas et al., 1998). However, recent studies recognised that the knowledge produced by scientists is far from universal and objective, but it has a critical local dimension (Stuiver et al., 2004). On the one hand, research can be considered as a network of different actors compromising on conflicting interests and creating a process of choices, alliances and imposed worldviews (Latour, 1999). On the other hand, values, personal criteria and local culture play a role in further influencing scientific criteria and its indicators (Singh et al., 2012). Also in the case of LCA, many books and guidelines are published every year to aim at a greater standardisation, uniformity and objectivity in the application of the method (Interview 3, 6, 9). This assumption of universality is so embedded in the researchers' mindset that, at the question asking from which cultural background LCA originated, almost all the participants admitted not to have ever reflected about it. They all agreed that the methodology

originated in the European technical-scientific world, but they all also believe in the universality of science and in the possibility to apply LCA in any different cultural context. Nevertheless, one interviewee reflected on the fact that diverse assessment methods have been elaborated in different countries, giving more or less relevance to different indicators and, hence, providing different descriptions of sustainability (Interview 5).

> "There are many LCA methods and these methods include for instance weighting and normalisation sets that we need in order to add all the categories of impact: climate change, acidification, eutrophication, there are many. To put them together into a single score, you need to add a weight, a relative importance to each impact category. And for us, I include myself in the West, the most important usually is climate change. For other societies, not Western societies, who have also developed life cycle assessment methods such as Japan, they have their own method called LIME, they don't do it like this, they express everything in yen, in money, so for them it's more important the cost of things than climate change. So definitely the model of a system reflects the way of thinking of the people who build the model. And most LCA models/methods have been developed in the West." (Interview 5)

Moreover, during participant observation, another researcher admitted that not in all contexts all indicators have the same value, but that, in the interpretation of the results, it could be significant for the research to take into consideration local environmental issues. In other words, the importance of the indicators should be weighted considering local challenges, for example, in a context of water scarcity, the indicator evaluating water consumption should have priority over many others to overcome the contextual water issues and develop a more sustainable system, adapted to the situation (Fieldnotes). These two examples demonstrate the relativity of the definition of sustainability also in the scientific world, as depending on the local context either the different cultural values and priorities can influence the "weight" of the different indicators, or the local challenges lead the method to emphasise a certain aspect more than others.

The pretence for universality can be understood as part of the assumptions on which the method is based, as a simplistic model of reality (Interview 5). A set of assumptions is at the core of any scientific methodology and they can portray a somewhat realistic representation of reality (Park et al., 2020). Overall, all interviewees agree that the LCA approach and its overarching conceptual framework is satisfactory in achieving its specific goal, even though they also acknowledge that still many improvements can be made.

6.3. The economic and social sustainability assessment methodologies

As introduced in the Literature Review chapter, during the last three decades, LCA has been broadened according to the rising popularity of the three-pillar definition of sustainability, to the point that a more comprehensive methodology has been developed, namely Life Cycle Sustainability Assessment (LCSA). Drawing on the three-pillar model, this new methodology combines LCA, the environmental pillar, with Life Cycle Costing (LCC), the economic pillar, and Social LCA (SLCA), the social pillar, distinguishing the three different impacts of a product along its life cycle (Guinée, 2015). SLCA is a tool still in its infancy phase, even though it recently gained popularity as a methodology aiming at understanding the social aspects of a certain production and, especially, their negative and positive influence over it (Spire, 2016). In detail, the approach aims to assess the social impacts on all the actors part of the value chain from production to consumption, from local workers to consumers and the society at large (Schau et al., 2012). Instead, LCC has been created to analyse the economic dimension of sustainability and it is considered one of the most suitable methods to be combined with LCA (Schau et al., 2012). Hunkeler (2006) defined it as able to take into account "all costs associated with the life cycle of a product that are directly covered by any one or more of the actors in the product life cycle (e.g., supplier, manufacturer, user or consumer) with complementary inclusion of externalities that are anticipated to be internalized in the decision-relevant future" (p.372). Consequently, LCC enables the identification of the economic hotspots valuable for the decision-makers looking at a full sustainability assessment (Spire, 2016). Nevertheless, LCSA and, particularly, LCC and SLCA, namely the economic and social approaches to sustainability assessment, are still under development (Schau et al., 2012). For this reason, they lack standards and databases, they are seriously underdeveloped in their resource efficiency and their data quality remains low. Thus, they end up being left unused (Spire, 2016).

As a consequence, even the European program Value Chain Analysis For Development (VCA4D), built to assess the sustainability of value-chains in the agricultural sector, selected different methodologies to complement LCA with the economic and social pillars. Each VCA4D study is realized by a team of four experts, three corresponding to the three pillars and one responsible for the contextual knowledge (Europa.eu, 2017). In the interview with the agro-economist specialist working for the European project, the researcher explained that the tool for the economic analysis used for the project aims to give an image of the value-chain in a specific moment through a static representation of it, founding the results on quantifiable evidence. Going to the details, sustainability is assessed by analyzing the contribution of the value chain to the economic growth of the local context as well as its inclusiveness for all the economic actors. Concerning the analysis of social sustainability, it aims as well to provide evidence-based results about the possible impacts of

the activities of the value-chain, detecting opportunities, benefits, problems, risks, constraints and uncertainties. The goal is to define a social profile composed of six categories, namely working conditions, access to land and water, gender equality issues, food and nutritional security issues, social capital and living conditions (Interview 8).

All researchers mentioned the importance of analysing the economic and social aspects of sustainability to have a comprehensive vision of the local situation. Particularly, the relevance of the economic pillar has been stressed as it is seen as the main concern of farmers. Researchers believe, indeed, that, in the scale of priorities, people are firstly interested in receiving an economic reward from their working activity and only secondarily in the environmental impact driving from it. The LCA experts specialised in developing countries highlighted that, especially for farmers living in those parts of the world, the central concern is represented by surviving the day and that, consequently, the interest in sustainability is perceived as extremely distant from their reality (Interview 3, 5, 6). Nonetheless, researchers recognise that also in less extreme situations, an economic incentive can help in leading people to care about environmental sustainability. Furthermore, they think that often the reduction of environmental impact is associated with a decrease of production costs, for example in the case of a diminishment of the inputs such as fertilisers and pesticides (Interview 3, 4, 5, 6). Thus, it can be affirmed that LCA experts consider the economic pillar of sustainability as a tool to incentive compliance to high standards of environmental sustainability (Interview 3, 5, 6).

> "The vast majority of people just care about the money. So if you sell sustainability as 'If you do this, you will make more money', you may say or not that they will also have a positive social impact and reduce environmental impact. People don't care, they just look at the economic part of things. I'm generalising in a very rough way, but in my opinion the talks, the thinking about sustainability, helps; very slowly but helps because at least, even in developing societies we are started." (Interview 5)

Because of the role of agro-economist for the VCA4D project, interviewee 8 attaches much greater importance to the economic sustainability compared to the other interviewees, considering it as a necessary first criterion to be met to successively enable the realisation of the social and environmental pillars as well. Besides, interviewee 7 is the only LCA researcher among the ones who participated in the interviews who works as well in the world of consultancy for private companies, thus, their answers partially differ from those of the colleagues who work in a national research institute. The specialist also believes that the only way to move toward a more sustainable direction on an environmental level is to leverage on the economic reward, while underlining that the pressure from the consumers is already leading the companies in that direction. Moreover, the

interviewee states to always include an economic analysis in its environmental assessment for private companies, while the other researchers affirm to do it only if requested by the commissioner of the assessment (Interview 7). These answers remark another time the influence of personal belief and the professional, educational and cultural background on the perception of sustainability of different people.

6.4. The connection among the methodologies

The researchers' conceptualisation of sustainability strongly reflects the functioning of the methodologies in their compartmental way of constructing knowledge. Therefore, this research aims not only to describe the operationalisation and representation of the three different components of sustainability within the methodologies and the minds of the researchers, but it also attempts to understand whether and how the three dimensions are connected according to their perception.

The totality of the interviewees agrees on the need to study and collect data concerning all three aspects of sustainability in order to produce a complete assessment of the local situation. However, not only this aim is not always accomplished in the practice of sustainability assessment research, but also diverse opinions co-exist regarding how to combine the information and the methods reflecting the three different pillars.

Several researchers admitted that, in their daily work of applying LCA, combining the three aspects of sustainability is not extremely common (Interview 3, 6, 9). Indeed, to make that happen, it would be necessary to compose a team of specialists with different expertise, complemented with a larger budget and time to combine all different data. Consequently, often only LCA is applied and the environmental issues considered, justifying this decision with the reason that the methodologies for the economic and social factors are not as complete and elaborated as LCA (Interview 3, 4, 6). It is necessary to remark, yet, that many researchers are currently working for this aim, namely to elaborate or improve strategies to combine indicators from various methodologies in order to obtain a complete view of the sustainability issues of cropping systems (Interview 3).

> "Every time I intervene, it's usually on the environmental aspects. On the social aspects, there's this little phrase, this little comment of 'Be careful, we are not considering everything. We should also take into account the social aspects', but in practice, they are not dealt with and this can also be explained by the difference in maturity that there may be between the two methodologies." (Interview 6)

Even when considering the three pillars as part of an institutional project as in the case of VCA4D, how to put them in relation is still a work in progress (Interview 8). Already from a theoretical point of view, the interviews revealed discordance among the participants. On the one hand, a few

researchers stressed the interest in collecting all types of data, but keeping them separately (Interview 6, 9).

> "Yeah, I'm not sure if you really need to combine them or whether you can use separate tools besides one another to get the full picture of the people, the planet, and the profit. So I think it's not really necessary to make them into one tool." (Interview 9)

On the other hand, the rest of the interviewees agree on the interest in creating a method reuniting environmental, economic and social indicators, while underlining that this method does not exist yet (Interview 3, 4, 5, 7, 8). These two positions reflect two different perceptions of sustainability, which is always seen as a concept that can be modelled and broken out in pieces, but, in one case, these components are considered as separate and independent from one another, and, in the other case, they are instead understood as in constant communication and reciprocal influence.

Practically, in institutional projects, such as the VCA4D, experts are asked to already connect the three dimensions and also provide advice and recommendations to policy-makers. Interviewee 8 admits that this work is not always easy, because experts conduct their research independently. The cooperation to gather all data and reflect about them with all experts reunited is the step always let at the end, for which thus not much time is left. In addition, sometimes problems of incompatibility or non-understanding among the different disciplines occur, as well as personal difficulties in working together among researchers. However, the structure of the project has been several times remodelled in order to incentive more interaction among the data and the researchers working on the same project. The researchers realise that, particularly to make decisions concerning a certain supply chain, it is fundamental to have a comprehensive vision of all three aspects. This is why, according to a few interviewees, the methodological tools provide the data, while it is up to policymakers to put them together, balance advantages and disadvantages, and determine a choice (Interview 5, 6).

6.5. The influence of science

One of the theoretical assumptions of this research consists in considering science and its tools as able to affect society through their representation of scientific concepts (Hale et al., 2019). Thus, after having delineated the representation of sustainability portrayed by researchers and LCA, this section assesses the influence of sustainability assessment tools on the definition of sustainability of policy-makers and society at large.

Interrogating the participants on this subject, everyone affirms that LCA is a valuable tool in the sector of environmental assessment, which has already been able to influence the understanding of sustainability, national policies and international projects, while predicting an even larger place for

the methodology in the future international scenario (Interview 3, 4, 5, 6, 7, 8, 9). From the first decade of the 21st century, LCA has attracted ever-rising attention firstly in textbooks and, secondly, in the political sphere. Indeed, the methodology has been increasingly used to support policies and performance-based regulations, while establishing worldwide the relevance and popularity of the carbon footprint standards and the life cycle thinking approach (Guinée, 2015). As a demonstration of this, many interviewees highlight how nowadays the main commissioners for sustainability assessment are governments and their political apparatuses, which ask directly for the application of an LCA, sometimes in combination with other tools. Moreover, it is important to underline that they were talking about European or in general Western governments, as in developing countries there is not yet the same interest for environmental issues (Interview 6). The VCA4D initiative is an example of this behaviour, as it consists of a project constructed by the European Union in network with several European universities and research institutes, to conduct sustainability assessments in developing countries (Interview 8).

The interviewed researchers provided many more examples where LCA has been able to influence the political sector. Several people affirmed that, overall, the legislation of various European countries already demands that an environmental claim of any kind should be based on LCA or on other lifecycle tools (Interview 3, 4, 5). More specifically, Interviewee 3 makes the example of the "Renewable Energy Directive" from the European Commission (2009), which requires the assessment of greenhouse emissions through a life cycle approach based on LCA to prove a reduction in the emissions or to compare fossil alternatives. Anyhow, the most important achievement for LCA inclusion in the political and economic practices is represented by the creation of a label system based on LCA and called ECO Score, which would classify products in five different categories (A, B, C, D, E) accordingly with their environmental impact (Interview 3, 4, 9). The project was attempted for the first time in 2011, but then it was arrested for lack of data to calculate the LCA for all the products available on the market. Nowadays, this initiative has been restarted and researchers are positive concerning its success this time (Interview 3, 4, 9; Fieldnotes). Interviewee 3 indicates how nowadays the databases with LCA data from all over the world are much more complete than 10 years ago, rendering available the majority of the needed information. Besides, in European countries nowadays people are increasingly aware of the importance of environmental impact for sustainability issues, particularly in connection with the food they eat every day. Moreover, today everyone owns a smartphone where they could check why and how certain products impact more or less on the environment (Interview 3). The interviewed researchers carry high expectations and hopes in this labeling strategy, on the one hand, to convince producers

to use more sustainable practices, and, on the other hand, to increase the awareness of consumers concerning the product they buy, enabling them to make informed choices (Interview 3, 4, 5, 9).

This increasing attention of consumers for sustainable practices and environmental impact is already influencing the international market, as well as producers' decisions. Several big companies introduced attention to green issues in their marketing strategies, some actually engaged in changing their structures of production, and in the meanwhile also green-wash practices were created (Galbreth & Ghosh, 2013). Therefore, big companies are another significant commissioner of LCAs, using it to evaluate their production chains, as confirmed by Interviewee 7, who works for them.

Other interviews underline the pivotal role of LCA not only in influencing policies and production-consumption choices, but also in changing the perception of sustainability over certain practices (Interview 3, 5, 6, 7). Interviewee 6 presents an exemplary case, describing how, after the first enthusiasm for biofuels, thanks to the application of LCA, bioenergy was discovered to have fewer benefits than environmental impact. As a consequence of this breakthrough, the political sphere, which initially demonstrated its support for the product, stopped the funds directed to those projects.

These examples illustrate the strong correlation between the scientific community with the political sphere and large enterprises. These two actors represent the main commissioners for LCA projects and, thus, they are the ones who get the final results and receive recommendations concerning sustainable strategies. A key actor for this research remains missing: the farmers.

LCA practitioners cooperate with farmers for their assessment projects mainly in the stage of data collection to evaluate the impact of a certain production from the cultivation to the disposal (Interview 3, 5, 6, 8, 9). Researchers denote sometimes some friction in the beginning to convince farmers to provide information about their cultivation, but, apart from a few cases in which farmers opposed or released purposely incorrect data, in most situations, researchers get them to participate (Interview 3, 5). Researchers underline the importance of talking to farmers to better understand local issues and context for a more reliable analysis, as new aspects that researchers couldn't know or that LCA doesn't take into consideration can emerge (Interview 6). However, researchers affirm that it is difficult to include the farmers in the following phases of the assessment because LCA is a methodology that requires high technical knowledge, therefore, it would take too much effort and time to explain to them its functioning (Interview 5). In some cases, workshops are organised at the end of a sustainability evaluation to share the results with the relevant stakeholders and, among them, farmers representatives are occasionally invited (Interview 8). Yet, the interviewees admit that these workshops are often not organised because of money and time constraints and that, when

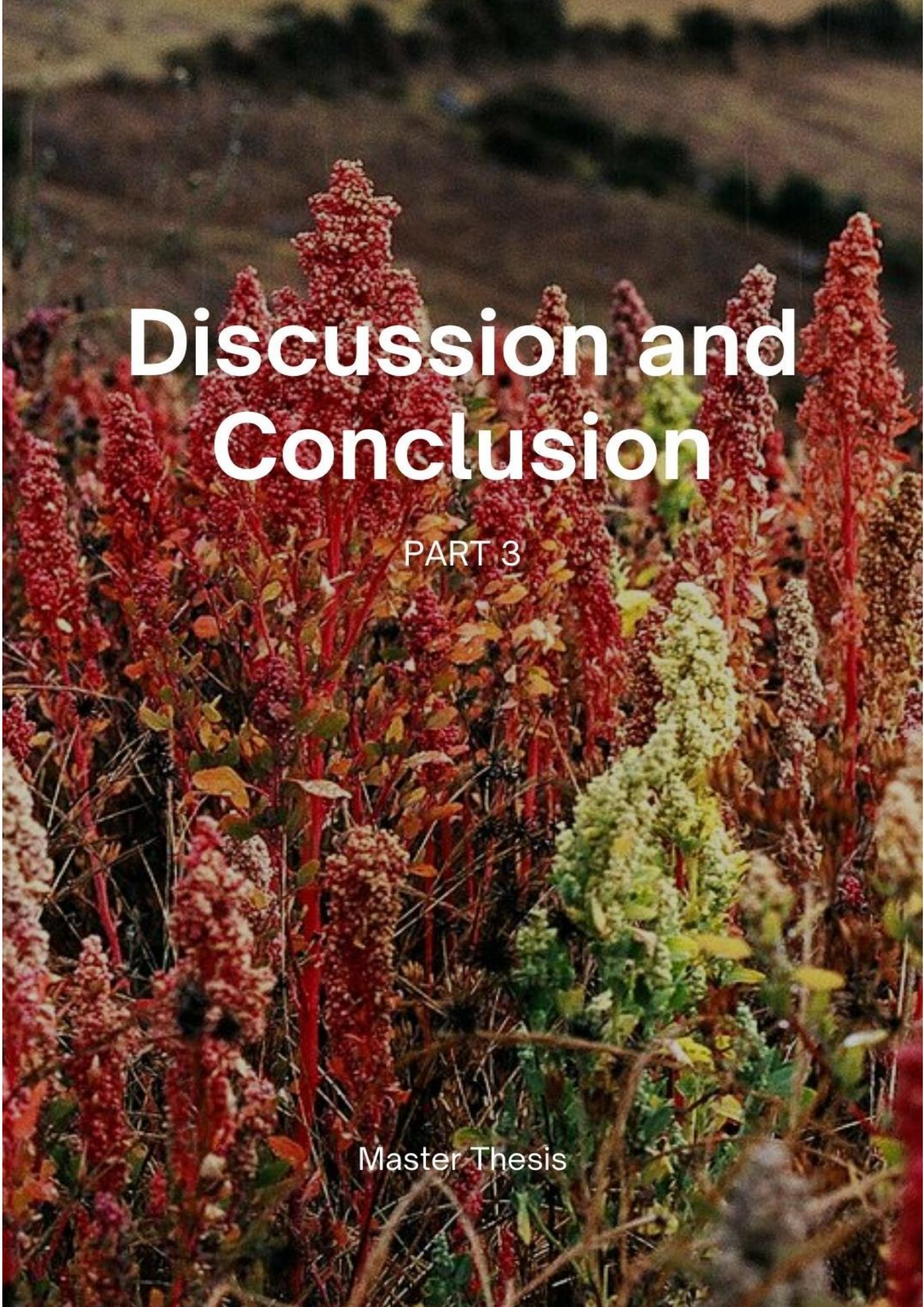
they are arranged, the main actors involved are politicians and bigger companies rather than small farmers (Interview 6). Nonetheless, the participants state that much can be done to improve the relationship with the farmers during a sustainability assessment (Interview 3, 5, 6, 8, 9). Interviewee 8 reports that LCA research is moving in the direction of elaborating a new easier and more user-friendly version of the methodology, in order to enable more people, even framers themselves, to apply it and better understand the ecological impact of their activities. In addition, interviewee 3 affirm that in France there exist already projects created to teach farmers how to implement LCA themselves and that "certain farmers are involved in the experiment to provide data on productions, to discuss in working groups concerning labels or methodological issues".

> "It's a matter of transmission to farmers and maybe interaction when farmers and the general public are more aware of the issues and the tool and the help it can provide. It's also possible to work together to make a database richer and more available for everyone." (Interview 3)

6.6. Conclusion

The second sub-research question tackled the following issue: "*What characterises LCA researchers' discourse about sustainability?"*. The interviewed researchers presented different perceptions of sustainability, reporting mainly well-known academic or political definitions. Almost half of the participants described sustainability as a system able to perpetuate in time, while another half reported the famous definition of the three pillars of sustainability. In addition, one interviewee identified its vision with the concept of strong sustainability, while another one described sustainability as a vision, an ideal objective impossible to reach but toward which to move. Overall, it was possible to notice the strong influence that the academic and professional background of the interviewees exercised on them through the words that they employed and the answers that they gave. Moreover, also the methodology that they use daily to assess sustainability impacts their vision and their discourse over the topic. Therefore, in their minds, sustainability becomes a concept that can be quantified and represented through a simplified model of reality based on the principles of universality and objectivity. They employ complex and technical terminology also when talking about their personal understanding of the concept, while openly identifying with their discipline. Indeed, for LCA researchers, the environmental issues of sustainability appear to be the most critical, while for the economic expert, for instance, the economy is the first and foremost issue to consider in a sustainable transition. All researchers agree on the categorisation of the different facets of sustainability in separate academic disciplines and assessment tools, while they disagree on whether and how to integrate these different categories in a comprehensive analysis. Particularly, environmental sustainability, represented by LCA, is understood as minimisation of the damage

caused by the lifecycle of production of a certain good or service. Concerning the economic and social pillars, instead, the methodologies to assess them are not as affirmed and effective as LCA, thus, there is not a definitive and established practice for them. Finally, considering the importance of power in discourse analysis, understanding the influence that science and, particularly, LCA exercise on the understanding of sustainability beyond the research sector is fundamental. A significant impact on the political field and policymaking has been detected, as well as the power of changing the perception over the sustainability of certain products. Yet, a real relation of cooperation with the farmers does not exist and, despite the efforts to change the actual situation, nowadays researchers consider farmers mainly as a source of data rather than a possible partner.



Discussion and Conclusion

PART 3

Master Thesis

7. Discussion

After having analysed and described the discourses of sustainability expressed by farmers and by researchers and assessment methodologies, in the Discussion, this chapter engages with the main research question of this thesis, namely "*How can the perception of European quinoa farmers contribute to improving the representation of sustainability presented in sustainability assessment methodologies?".* In order to do that, I identified differences and similarities between the farmers' and researchers' discourses about sustainability. Therefore, the first section focuses on the commonalities between the two visions, while the second part is devoted to the differences. Among all points of discordance, seven main topics have been selected to reflect on the possible integration of the farmers' perspective into the sustainability assessment methodologies, trying to demonstrate how this could be beneficial for the improvement of the understanding and operationalisation of the concept of sustainability in the agricultural sector. The tackled subjects are 1) the different ways in which the actors build their knowledge; 2) the (im)possibility of quantifying certain aspects of sustainability; 3) the opposition between a negative and a positive conceptualisation of sustainability; 4) the discussions over the compartmentalization of the concept in the three pillars definition; 5) the constrictions and the influence exercised by the capitalistic system; 6) the role of personal values and the concept of proximity in sustainable agriculture; and 7) the power imbalances between farmers and researchers. The last section is reserved for the final considerations on the matter. The support of sociological theories - such as Discourse Analysis and ANT, but also Practice Theory, the Agrarian Question and place-based approaches - is employed and strengthened to support the arguments, as well as to reflect on the theories themselves to expand the horizons of natural sciences and researchers.

7.1. Commonalities between farmers' and researchers' perceptions of sustainability

It is noticeable to highlight that farmers and researchers gave some common responses to the question "What does sustainability mean for you in the agricultural sector?". Both of them cite the two popular definitions by the United Nations concerning, on the one hand, the concept of sustainability as a continuation in time of the farming activity and transmission to the following generations, on the other hand, the idea of the three pillars of sustainability. These two definitions became incredibly well-known internationally in all sectors of human activity (Purvis et al., 2019), at the point that this similarity of vision can be attributed to this reason. Moreover, Stuiver et al. (2004) underline how farmers' knowledge is composed in some parts by elements incorporated

from science in different ways, such as during their years of education or from legislations based on those scientific principles. This reflection could be applied as well to researchers, who are trained in Western universities where these mainstream ideas about sustainability are reproduced.

Furthermore, many farmers identified sustainability with certain agricultural practices that could reduce at minimum the actions that can have an impact on the environment, namely using machines only when necessary, limiting water consumption and reducing the chemicals used on the fields. These principles agree with what LCA experts would advise, namely to reduce the impact on the environment. Indeed, all these examples are connected with the concept of environmental footprint, which is at the foundation of LCA's operationalisation of sustainability and which is familiar for farmers as well. The family of environmental footprints is extremely vast, grouping many different and more specific footprints. The two most well-known ones are the ecological footprint and the carbon footprint. The first concept was elaborated in the 1990s by Rees and Wackernagel and further developed as an indicator able to capture human appropriation of natural resources (Matuštík & Kočí, 2021). The idea of carbon footprint, instead, can be generally defined as the amount of gaseous emissions relevant for climate change and deriving from human activities (Pertsova, 2007). A large variety of approaches are based on these footprint calculations, among them LCA is one of the most relevant and complex. Thus, following the way of thinking behind the concept of environmental footprint, the least impact a production system has on the environment, the most sustainable the system is (Giama & Papadopoulos, 2018). For this reason, the more practical reflections of farmers of reducing to the bare minimum any activity which can impact the environment and its components fall within the logic of both the ecological and carbon footprints and would be approved by an LCA analysis. Yet, farmers expressed this concept practically through explaining their daily activities, while researchers and assessment tools elaborate these concepts with a theoretical and scientific approach. This phenomenon is further explored in section 7.2.1.

The commonalities between farmers and the scientific world do not stop there, as both farmers and LCA share the common concern for sustainable activities along all the value-chain, demonstrating, hence, a common life cycle thinking. Concerning LCA, indeed, its principle of "cradle-to-grave", stating the need of considering all the steps of production (Klöpffer, 2014), has been frequently underlined. At the same time, farmers made comments concerning the sustainability of the whole quinoa value-chain. Certainly, everyone referred the most to the stage of cultivation as it is closely connected to the daily experience of farmers, nevertheless, many of them mentioned also the successive steps in quinoa production. Several people mentioned the importance to have structures common to all farmers nearby for the post-production of quinoa to minimise the waste of energy

and transportation. In addition, in Italy, particular attention to packaging has been expressed as well by the quinoa company QUIN, which tries to use only recyclable materials. Finally, a further burning issue is represented by the distance to consumers, as farmers consider the fact that their product only circulates within national borders rather than having to cross the ocean as a positive criterion from an environmental footprint point of view. LCA practitioners would generally not agree with this last point, but this is an issue that is tackled later on in the following paragraphs. Overall, it can be affirmed that they both share a particular attention for all the steps of production and that sustainability is not limited at the cultivation stage, but it is by both considered as an attribute that has to characterise the whole value-chain.

The fact that both share an interest in looking at the whole lifecycle of the product and in acting on nature at a minimum not to create an unnecessary impact on the environment are factors of extreme importance and great hope for the future of sustainable agriculture. These points of contact can be starting points from where to initiate a conversation between these two actors in order to further enrich the scientific comprehension of sustainability in the agricultural sector. Nonetheless, the many points of discordance highlight the fact that on various other aspects the vision of farmers is not represented in sustainability assessment methodologies, therefore, the following sections reflect about their possible inclusion, the future perspective and the obstacles to it.

7.2. Differences and possible integration between farmers' and researchers' perceptions of sustainability

Despite the few points of contact between researchers and farmers in their understanding of sustainability, many differences persist. This confirms the initial assumption on which this research is based, namely that different definitions of sustainability in the agricultural sector can exist and co-exist (Hajer & Versteeg, 2005; Karami & Keshavarz, 2010). Among all the points of discordance that can be detected, seven have been selected as the most interesting in the perspective of possible integration between farmers' knowledge and sustainability assessment methods. Indeed, this section not only highlights the differences between the two discourses, but the aim is to consider the possible integration of farmers' perspective in sustainability assessment methodologies in order to answer the main research question. Including farmers' voices is crucial as they are the actors taking the decisions concerning which agricultural practices to apply (Aare et al., 2021; Fleming & Vanclay, 2010; Gebska et al., 2020; Groetenhuis & Schoon, 2000). Most importantly, this research aims to demonstrate as well that acknowledging farmers' ideas can give interesting insights about sustainability, which could help to improve sustainability assessment tools.

The problematic nature of these issues is discussed through applying the two main theories structuring this research, namely Discourse Analysis and ANT, as well as other theoretical approaches that particularly fit some of the arguments that will be made. Recommendations for further research will be provided as well.

7.2.1 Knowledge construction and the role of practices

First of all, it is necessary to underline the divergent ways in which farmers and researchers construct and organise their knowledge, as this fundamental difference stands at the origin of many others. The way farmers generate knowledge is diametrically opposed to researchers, as farmers tend to create knowledge from their personal and practical experiences, while researchers from their studies and academic background (Stuiver et al., 2004). Farmers' vision of sustainability is influenced by their daily manual work, whereas researchers are conditioned by their specific discipline's methodological and empirical assumptions prioritising their area of expertise and professional training (Baginetas, 2008). Farmers, indeed, immediately identified sustainability with the agricultural practices they use every day, that they know or that they have experimented with. They indicate practically the strategy adopted for their activity, their land and the supply chain they are part of. Moreover, they base their knowledge of what is best or most sustainable on their experience and intuition, as well as on personal choices and values. This argument is encapsulated by Interviewee 18, who stated that:

> "Oh well, it's very much by feeling, I know my plots. But we'll say, according to the plots, according to the crops I've had before, according to the problems I've had, whether it's grass, underground, disease and also, how the land is worked and so on. That's what makes me say, I'm going to grow quinoa in this place or not. I also consider the fact of breaking the cycles in the rotation. If you always do the same thing, nature gets used to what you do. We always try to foresee, anticipate, possible problems. It's not easy. But it happens through knowledge of one's plots. And then, by rotation, by postponing the sowing dates, that's it. That's basically it." (Interview 18)

Conversely, researchers and LCA offer a more idealised and abstract idea of sustainability, which does not originate from physical work in the countryside, but from years of studying a certain theoretical discipline and mastering all information concerning the scientific consequences and chemical reactions of certain human activities on the environment. This difference can be observed as well in the terminology used by the two actors, on the one hand, the extremely empirical one of the farmers referring to the observation of nature, the conditions of the soil, the agricultural practices; and, one other hand, the abstract talking of the researchers citing indicators, measures and scientific processes. Stuiver et al. (2004) notice how farmers and researchers often employ different

words when distinguishing between diverse categories of soil, plants or natural resources. The authors attribute this phenomenon to the fact that, unlike researchers, farmers relate those terms to practical use rather than to abstract characteristics or processes. Where farmers demonstrate experience and intuition, researchers value numbers and theories. Discourse Analysis, indeed, underlines how any discourse is the use of language in a certain context, constructed by people with a common history and ideological commitments, which shape people's way of expressing themselves (Krajcik et al., 2015).

In the scientific world, sustainability is considered as a vision, an aim for a perfection which is impossible to reach, but that researchers try to quantify and operationalise within a simplified model of reality. Through their numbers and benchmarks, researchers elaborated an ideal model of sustainability (Baginetas, 2008), while farmers aim to face their daily challenges and to experiment in order to render agriculture somewhat more sustainable day by day to leave a prosperous land to future generations.

This phenomenon can be better explained and understood thanks to Practice Theory, which is an approach becoming increasingly relevant in the field of sustainability. The theory considers human activities as expressions of people's understanding of social phenomena (Nichols, 2018). Practices are regarded as the embodiment of people's vision of the world, enabling human activities and constituting social phenomena, as well as reproducing cultural meanings, technologies, common tools and socially learned skills (Spurling et al., 2013). According to this approach, it is thanks to actions that understandings and meanings exist and are enacted into the social world, which is, hence, studied as a nexus of practices (Kennedy et al., 2015; Walker, 2020). Moreover, the common set of practices that one or more people realise on a daily basis is defined as *habitus*, meaning that similarities are likely to exist among people who share the same experiences (Bourdieu, 1992). Therefore, Practice Theory demonstrates the role of the professional and cultural background in influencing farmers' and researchers' understanding of sustainability, underlining that institutional and cultural structures play a pivotal role in shaping human actions (Kennedy et al., 2015).

Furthermore, Practice Theory has been vastly used to reflect on sustainability, as its supporters state that "sustainability occurs in practice" (Nichols, 2018, p.4). Particularly, this approach has been used to demonstrate the importance of daily activities to create a more sustainable world. Earlier studies concerning sustainability have neglected to consider the routine of daily activities, as well as the relation of everyday actions to the larger social context (Warde, 2005). Yet, according to Practice Theory, changing behaviour is not merely a matter of deciding it, but an ambitious objective requiring knowledge acquisition, alteration of the personal routine, revolutionising of

cultural norms, as well as reconfiguration of power relations. Both individual and collective activities have been studied, acknowledging the constant evolution of social practices (Kennedy et al., 2015). These considerations are demonstrated by the words of the farmers when talking about the adoption of quinoa or of alternative sustainable techniques, as these decisions involved an investment in knowledge, a change in their daily activity and in the products they used.

Bourdieu (1979) affirmed that commonly individual choices are influenced by people's position in society rather than rational calculation. In other words, according to the philosopher, people tend to make decisions on the basis of their daily activities and common behaviour, rather than through abstract thinking. This consideration valorises the importance for sustainability transition of the farmers' practical way of knowledge construction, based on everyday experiences and daily activities, over researchers' measures and calculations. Therefore, I suggest to researchers to reflect on the way they communicate the results deriving from the sustainability assessment methodologies. Researchers could try to translate their findings in more practical terms, in order to be understood by a larger public and, consequently, to foster the transition toward sustainability among a greater number of people. Overall, an open conversation between the two actors could be beneficial to widen the horizons of their specific ways of thinking in both directions. In this way, also farmers could learn the scientific processes behind the functioning of nature to increase their awareness.

This case demonstrates the usefulness of Practice Theory to comprehend how farmers construct their understanding of sustainability. Yet, this approach is mainly used in studies concerning sustainable consumption in order to analyse and comprehend the purchasing behaviour (Geels et al., 2015), while it could be further employed for research about sustainable production, such as in the cause of sustainable agriculture. Farmers, indeed, demonstrate how also the production world is constructed around daily rituals, shared practices and everyday repetition of activities. Consequently, Practice Theory can be pivotal to study as well the way sustainable production is structured or how it happens through the transformation of shared practices.

7.2.2. Quantification, standardisation and personal representation of sustainability

The second point of discordance between farmers' and researchers' discourses concerns the (im)possibility to quantify all facets of sustainability. While researchers argue for the necessity of quantification in order to tackle sustainability challenges, farmers enumerate several aspects that play a core role in their perception of sustainability but that they deem nonquantifiable.

All researchers agreed on the importance of being able to quantify the impact of human activities on the environment and to relate them to ecological issues. Particularly, LCA is a scientific assessment tool based on quantification, as it aims to quantify a large number of substance flows, resource uses and environmental accumulation in order to estimate the environmental impact (Jolliet et al., 2015). In the same way, also the tools created for the economic and social pillars of sustainability aim to depict a standardised image of the two aspects (Guinée, 2015). According to researchers, quantification and standardisation allow to identify the problem and act on it. Science aims to prove or disprove common sense concerning environmental issues and it can only do it through classification and quantification, creating parameters of reference. In line with this way of thinking, without quantification, there is no science, only opinions.

Farmers criticise the need of science and research to quantify and classify sustainability, affirming that many of the factors composing the concept according to their perception cannot be quantified. Farmers made the example of the social components, such as the pride they have in creating the first national supply-chain of quinoa in their countries, the satisfaction of local communities to have a beautiful landscape where to live, the value of contact with nature, human connection and the sense of community. These are all fundamental aspects of farmers' conceptualisation of sustainability, which are difficult, if not impossible, to quantify and categorise through indicators, and which are, indeed, excluded for example from what social sustainability indicators take into account. As previously explained, social sustainability assessment methods tend to look at what is more traditionally meant with "social factor", namely working rights, gender equality, access to land and water, food security and living conditions. Some farmers cited these issues as well, but without particular emphasis, as they did not feel them to apply to their particular situation. All the mentioned aspects were considered as minimum criteria and as almost obvious in the European context of small family farmers. Conversely, they expressed great enthusiasm for more personal factors, such as personal pride, sense of community, contact with nature and with local society. Farmers presented these elements as being of tremendous value in their daily life, giving greater meaning to their activity and motivating their life choices. This point demonstrates how strongly the perception of what sustainability means is context-dependent, as these are the focal issues for European small family farmers, while in other parts of the world, or for a different type of farmers, the core concerns for sustainability could be completely different (Horlings, 2015).

> "That's what's complicated, things that can't be quantified. A farmer's pride in being part of something new in France. There's no way of putting a number on that, but it has a certain value." (Interview 20)

Previous studies already discussed the nonquantifiable nature of certain aspects of society, while reflecting on how to go beyond this stall (Hale et al., 2019). When certain aspects are neglected by science only because they are not quantifiable, measurability and exactness are not synonymous anymore. In other words, according to Katzner (1978), "there is no excuse for setting aside important issues because it is difficult to see how the variables involved might reasonably be measured" (p.127). Therefore, regarding the methodologies realised for the social pillar of sustainability, more interesting data and details could be added to it, following farmers' suggestions. Considering the minimal standards for human rights connected to working conditions, gender equality, living conditions and food security is a beginning to comprehend the social environment in which a certain cultivation is inserted. Nevertheless, in the interviews, European farmers almost completely ignored those factors taken into consideration by the assessment tools, to reflect on the above-metioned issues, which are closer to their daily experience. A reflection about how to render more flexible and adaptable social sustainability assessment tools to the different priorities of different cultural contexts can be interesting to expand and improve the understanding of the social pillar of sustainability outlined in these methodologies. Distancing from the criteria of standardisation and quantification, the inquiries could be more open and let locals indicate what they value most in connection with the concept of sustainability, while accepting the impossibility to quantify everything. The result would be less standardised and comparable, but also more comprehensive and context-based. Ignoring factors such as the shared pride or the connection with nature that farmers cited would mean missing a significant part of local representation of sustainability, resulting in an incomplete analysis.

Representation is among the aims of science as well as a fundamental characteristic of human experience. As reporters of knowledge, researchers play a pivotal role in the symbolic representation of the world through metrics and indicators, which represent the foundations of scientific processes (Hale et al., 2019). Yet, representation has a performative power, meaning that portraying a phenomenon in a certain way can have repercussions on its understanding and on the decisions taken about it (Alrøe et al., 2017).

This thesis recognises the importance of representing society through models in order to have a better understanding of it, particularly regarding complex issues such as sustainability, which requires the discovery of solutions to create a better world. Nevertheless, I argue for the need to rethink these tools in order to make them flexible, fluid and vital, as reality is. Being more open and flexible, they might be able to include more aspects of sustainability that researchers could not imagine before and that represent the view of local people. Moreover, this research aspires to

remind that categories of meaning are constantly changing and, thus, the need for scientific research is to remain critical about its own work, in order not to lose the opportunity to improve people's lives as well as global sustainability.

7.2.3. Negative and positive conceptualisations of sustainability

The third point of discordance between the two visions concerns the portrait of sustainability, on the one hand, as an attempt to reduce the negative impact of human activities on the environment, and, on the other hand, as a possibility to positively contribute to the local context.

LCA is an assessment methodology that, looking at the life cycle of a certain product or service, considers the damages caused to the environment. Therefore, as previously mentioned, LCA reflects the perspective of the concept of strong sustainability, considering any activity impacting the environment as potentially damaging (Pelenc et al., 2015) and expressing this through a carbon footprint logic (Pertsova, 2007). In order to quantify the negative impact on the environment, two tools are fundamental, namely the indicators and the functional unit. Indicators express specific types of impacts, such as the contribution of a certain process of production to climate change or eutrophication and so on (Kurisu & Hanaki, 2014), while the factional unit defines the final quantity of that certain product (e.g. 500g of quinoa) to which to refer the amount of emissions, enabling the comparison. This second characteristic allows the comparison among different products, as it allows to contrast the impact on the environment for the same amount of product (Jolliet et al., 2015). To make it clearer, an example could be to compare the impact on climate change caused by the production of 500g of wheat, opposed to 500g of quinoa, to determine which is the most or the least impacting. Thus, the idea of sustainability portrayed by LCA consists in assuming that any human action will produce a negative impact on the environment and, hence, selecting those activities which would generate the least damage to the planet. Farmers partially share this vision, stressing the importance of reducing to the bare minimum their intervention on the land.

Nonetheless, they also believe that through their work they can not only attempt to reduce their negative impact but they can also render a service to the environment and society at large. The farmers mention the possibility of enriching the land, limiting erosion and stocking carbon in the soil when applying certain agricultural practices. They feel as part of their job the responsibility to compose a beautiful landscape, to create a good image of the region and to improve the life of the locals. This vision demonstrates attention to positively contributing to the local context, which goes beyond the simple limitation of the damages portrayed by LCA. Farmers impact the environment with their work whatever they do, yet agriculture is necessary for human survival. Therefore, they at

least decide to adopt those practices that not only limit the produced damage, but that can also foster some positive reactions, in society and in nature.

> "To realise a service for the community, for example, is putting different crops in a landscape, it makes the landscape different, so it's a service that the farmer gives to everyone. A crop of quinoa, some people will find it pretty, so it makes a beautiful landscape and so people are happy, that's it. Moreover, quinoa will make it possible for pests to protect other crops, so having quinoa somewhere can help reduce problems elsewhere. It's not necessarily true in absolute terms, but it's a kind of a service that can be provided. In water management, when a farmer has healthy soils, the water that comes out is healthy, it will also prevent erosion, things like that. So these are services that farmers normally provide to everyone." (Interview 22)

The farmers considered their choice of producing quinoa as a service for those consumers who want to consume healthy local food. The production of quinoa is regarded as a service to the European environment also because it answers to the increasing European problems caused by climate change, such as desertification, soil degradation, salinisation and biodiversity loss. Consequently, simply considering the negative impact on the environment caused by quinoa production compared to another crop or the same crop in another context would not portray a complete representation of the role of quinoa in Europe. Therefore, even assuming that, for instance, for an LCA producing 500g of quinoa is more damaging than producing 500g of wheat – as the yields per hectare of wheat are much higher than those of quinoa – producing quinoa would still be necessary to open a crop rotation and enable diversification. Cultivating a monoculture of wheat would maybe be the most efficient choice to use the least amount of products while obtaining the highest amount of yields, but this would only worsen the already existing issues that European agriculture is facing. In addition, a part of sustainability should be to consider the wishes, desires and gratification of farmers in doing their job. Several interviewees, indeed, mentioned that using alternative techniques and experimenting with different crops is a main source of satisfaction, which would be lost if they were asked to produce using an intensive monoculture system.

> "We have to assume there will be farming in France; so does the introduction of quinoa as a diversification/rotation crop make French agriculture, on the whole, more or less sustainable compared to French agriculture without quinoa? The answer is pretty obvious: diversification/rotation is a key element of sustainable agriculture, with positive effects on the whole farm. For one example, a lot of beneficial insects develop in quinoa and are there to help with other crops. The effects are impossible to measure, but the problems of lack of diversification and short rotations are clear in this region at least, in terms of pests, weeds, fertility and declining yields." (Interview 17)

A few farmers went even beyond that, stating the need to consider the role of quinoa in European nutritional habits. Quinoa is characterised by high nutritional properties, thanks to its high content of proteins, but it does not represent one of the essential grains which need to be consumed every day by Europeans. Consequently, even in the hypothesis that cultivating quinoa has a higher impact on the environment than producing wheat, for example, quinoa does not need to be eaten in the same proportion of wheat, requiring, then, a smaller amount of it, but at the same time contributing to a more complete and various diet. Moreover, the grain represents a resource for vegan and vegetarian diets thanks to its high protein content as well as for celiac people thanks to its gluten-free nature. Therefore, producing quinoa is perceived also as a service for this particular category of consumers in order to answer their dietary needs. One of the quinoa experts interviewed for this research proposed an idea in line with these reflections, namely to consider a crop both for its environmental sustainability but also for its nutritional values, taking into consideration the role of a certain product in people's diet, through connecting the worlds of agriculture and nutrition.

> "So there are aspects of sustainability which, in my opinion, are missing today, and that is the link between agriculture, food and health. The link that is important for me, in terms of sustainability, is to link agricultural systems and food systems and to think carefully about how agricultural practices will influence the nutritional composition of the quinoa grain in the end, and to think about agricultural practices not just in terms of agronomic technical itineraries to achieve a grain yield, but to rethink these practices in terms of having a yield of different nutrients. It's not just a question of quantity, but of quality in the final production of grain, because we're not aiming for huge yields, but we're aiming for a grain that has a very good nutritional balance, and we have to make sure that, according to the cultivation practices that we put in place, we maximise and optimise the response of the quinoa to its nutritional value at the end of the chain." (Interview 2)

These reflections advanced by the interviewees reflect as well the criticisms of scientific literature on the subject. Numerous LCA studies show that agricultural intensification results in less impact on the environment per functional unit because of the higher yields per hectare. The actual LCA is incomplete, as it does not consider certain critical aspects for long-term sustainable production, such as decreasing fertility and soil quality, increasing erosion and biodiversity loss (Notarnicola et al., 2017). Particularly, the methodology is missing specific indicators for biodiversity and soil quality (Hayashi et al., 2005). In other words, the incompleteness of LCA could lead to distorted results if the aim is to detect the most sustainable agricultural practices in the long term. In this way, this sustainability assessment tool penalises less-intensive systems which could be the best sustainable solutions for the future, while hiding the positive contributions that certain practices can bring the production apparatus, as remarked by the farmers. Yet, in the meantime, these twisted results influence decisions and policies, when, such as for the case of the VCA4D project, LCA is

supposed to be used as a base to give recommendations to companies and governments about sustainable strategies. This situation demonstrates the performativity of scientific tools, namely their effectiveness in influencing the representation of a certain phenomenon as well as the decisions taken about it (Hale et al., 2019; Turnhout, 2018; Waterton, 2002).

It should be said that there exists a certain awareness among LCA researchers working on agricultural systems concerning these problems of the methodology itself, as well as attempts to improve it are already under study, as several interviewees admitted. Scientific research on the matter as well underlines the importance of including the two above-mentioned issues into LCA indicators and of combing LCA with other tools for a more comprehensive understanding of local sustainability (Knutsson, 2015; Zamagni et al., 2008). Moreover, certain studies advanced proposals for possible modification of the methodology to realise a more realistic portrayal of a certain supply chain. For instance, McAuliffe et al. (2020) affirm that already sixteen papers focused on the integration of nutritional criteria to the LCA functional unit, as proposed by the farmers as well.

After having understood the problem, a few reflections are needed. Firstly, I aim to stress the importance of reflexivity also in quantitative research. Researchers in natural sciences should be constantly aware not only of the limitations of the methodologies they apply, but also of the political and social consequences of their results. Reflexivity has long been part of qualitative research for credibility and validity claims, while few quantitative researchers are used to reflect on their research project about the origin and the problematic nature of scientific knowledge (Lakew, 2017). The issues analysed in this chapter explains the importance of reflexivity in order to understand the responsibility of giving recommendations based on distorted results and influencing future policies about sustainability. Secondly, it is relevant to remark how what researchers choose to measure, as well as how they represent a certain phenomenon, create different realities (Waterton, 2002). In this case, it is noticeable how sustainability can be understood only as an attempt to limit the negative impact of human activities on the environment, or also as an opportunity to act in a way that can be helpful, positive and constructive. Further research could investigate how these different understandings can motivate or discourage people to act in order to create a more sustainable world. Thirdly, I deem as remarkable to underline how farmers, even if not familiar with the methodology, could identify such issues through a reflection concerning their daily work. This has to be stressed once more to emphasise the possibilities of amelioration for the methodology if there existed an open and constant conversation between farmers and researchers.

7.2.4. Going beyond the compartments to embrace complexity

I recognised an additional point of difference between the interconnected vision of sustainable agriculture of farmers and the abstract and compartmentalized one of the researchers.

All researchers recognise clearly the categorisation of the concept of sustainability in three different dimensions – environmental, social and economic – reflecting the three pillar definition. They identify themselves with their work, thus, with the specific pillar of sustainability tackled by their methodology, declaring the need of having different experts for different facets of sustainability. Indeed, the three pillars definition is pervasive in all sectors and in society as well, constituting the theoretical base of assessment methodologies, while dominating the empirical literature concerning the practice of sustainability (Nichols, 2018). As previously explained, three different methodologies are normally employed to assess sustainability, one for each dimension (Sridhar & Jones, 2012). LCA itself represents exclusively the environmental pillar, while different methods are used in combination with it to represent the social and economic dimensions. Being based on characteristics such as the need for simplification, categorisation and abstraction, all these methodologies employ tools like indicators, measures and classifications, representing a simplified model of the phenomenon of sustainability (Mattioda et al., 2014). Moreover, not only researchers support the necessity of creating categories, but, while some of them support the reintegration and connection among the different categories, others stand for the idea of keeping the results separate also during the final stages of the analysis. Yet, even those who attempt to combine the data concerning ecological, economic and social sustainability encounter difficulties, as the methods were built to keep them apart. This is one of the reasons why some researchers are actually working to improve the methodologies at the point of creating one which can best collect detailed data and put them in communication, even if this is not already the reality of sustainability assessment methods nowadays.

Conversely, farmers argue that agriculture is an extremely complex system where so many different aspects and actors reciprocally and constantly interact that attempting to represent it in a model made of variables and indicators may result too simplistic. When farmers talk about sustainability in their work, they link together all the ecological, economic and social aspects above-mentioned, considering their relation, interconnection and interdependence in the agricultural system. Farmers think that agriculture is composed of too many layers of complexity to be able to identify, classify and quantify all of them.

Various studies tackled the topic of the three pillars definition of sustainability as well as its relation to assessment methodologies, debating its appropriateness to describe such a complex phenomenon (Giddings et al., 2002; Grossman, 2013; Nichols, 2018; Thatcher, 2014). Numerous problems have

been highlighted in this approach. The division in three pillars has been criticised to be excessively fixed and, thus, not able to well adapt to different contexts and situations, while also being conservative in regard to changes (Sridhar & Jones, 2012). An example of it is that the methodologies based on this approach do not incorporate the dimension of time, limiting the possibility to comprehend the evolution of sustainability over a longer period (Thakshila et al., 2019). Furthermore, the three pillars definition encourages a mechanism of compliance with the standards set by the methodologies, namely a measurement approach that leads to a technical fix instead of a comprehensive solution. In other words, these methodologies can indicate technical changes, such as pollution control or changing interest rates, instead of involving a more fundamental analysis of the relationship between society, economy and environment, diverting the attention from the core issues of sustainability (Giddings et al., 2002; Sridhar & Jones, 2012).

Most importantly, the three pillars approach is criticised for considering the three dimensions as independent constructs, analysing them separately. Social researchers underlined how environment and society cannot be understood as separate and independent from each other, without neglecting the complex, interconnected and multi-faceted nature of sustainability (Nichols, 2018; Thatcher, 2014). For this reason, this distinction diverges the attention from the fundamental connections among society, economy and environment and leads to the assumption that a compromise can be found among the three dimensions, supporting a view of weak sustainability rather than the one of strong sustainability (Thakshila et al., 2019). This categorisation reproduces, as well, the long-lasting dichotomy between human and nature, science and social activities, that ANT attempts to deconstruct (Crawford, 2004). Moreover, separating the three dimensions opens up to the risk of giving different importance to the different components. Although the approach suggests that all pillars should be addressed to achieve sustainability, in reality, the attention and weight reserved to each pillar often reflect the orientation of the agenda of the interest group (Grossman, 2013). Particularly, in numerous measurement systems, the social component is neglected or inadequately considered. This happens because there exists a lack of agreement over the content of the different pillars, as often the same pillar is defined in completely different ways (Sridhar & Jones, 2012; Thakshila et al., 2019). Finally, understanding the synergies among the different parts can contribute to bringing new and unexpected results, considering that the whole is always more than simply the sum of its parts (Chambers, 1994).

Although researchers seem to be aware of the limits of their models to represent nature, they believe that the existing tools are fundamental to better understand certain human-environment interactions, while continuously improving the methods to obtain a more accurate representation of such

dynamics. Therefore, a way to further include the view of farmers within sustainability assessment tools could be to foster the integration of the three pillars. The literature on the topic support as well this idea of better interrelating the three aspects in order to concretely overcome the human-nature dichotomy and grasp the essence of sustainability, reconceptualising the design and implementation of assessment methodologies (Sridhar & Jones, 2012; Thakshila et al., 2019).

This integration cannot happen without difficulties. The social, economic and environmental aspects of sustainability have been separated in the methodologies for reasons of feasibility and practicality. Expecting a researcher to have all three competencies at the level to be able to carry on the whole analysis alone would be extremely difficult and time-consuming, thus the necessity to divide the three. Nonetheless, incorporating further the three dimensions during the final phase of the analysis or increasing the interrelations in the work of the different specialists working on an assessment would enable the methodology to make its model closer to reality. As farmers also underline, in the real world these aspects are constantly linked to each other and interdependent among them. Some researchers stated that this process of integration and connection of the three components is already taken care of, as several researchers are working on it. Yet, looking at the actual situation, the majority of the interviewees affirmed that it is uncommon in their daily job to integrate the three aspects. The change is happening, but it is not already a reality.

This thesis aims to suggest further research concerning these issues. It could be interesting to better reflect whether a tighter integration of the three pillars is sufficient to overcome this old, fixed and categorising vision of sustainability, or whether a greater change is necessary, involving the construction of a completely innovative and flexible approach and methodology reuniting the three components. It would be necessary to investigate which are the options that have been already attempted, as well as how this radical transformation could be made real and feasible.

7.2.5. The influence of the capitalistic system

At a superficial glance, farmers and researchers seem to agree on the pivotal role of the economy in sustainability challenges. Yet, analysing deeper the roots of their interest in this discipline as well as the reasons why they reserve it such a central role can provide interesting insights to reflect on the future of sustainability in a capitalistic system.

Capitalism is a historical form of economic and social organisation, characterised by capital accumulation, private property of the means of production and commodification (Harvey, 2006). It shapes and permeates social and cultural structures, political systems, individual and collective identities, personal values and perceptions. Most importantly, capitalism is described as the

hegemonic and dominant system in nowadays society, influencing the daily life of any person (Feola, 2020). Capitalism and economic logics have entered the field of ecological research, permeating the work of scientists, while creating new bodies of science which aim to link ecological and economic dynamics (Polasky et al., 2019). This can be noticed in this research as well. Looking at the answers of the interviewed researchers, economic terminology and langue are constantly used by the participants. Even the researchers who are specialised in ecological issues and environmental assessment often referred to economic phenomena, such as Interviewee 5 who described sustainability through the concept of the Pareto optimal. Despite this strong penetration of capitalistic way of thinking and economic language in research and, particularly, sustainability research, the scientific sector failed to undertake any significant critique against it, taking, instead, capitalism for granted. Recently, these critiques initiated rising, revealing the harmful consequences of this mingling between ecology and economy as well as questioning the alleged inevitability of capitalism (Feola, 2020). Uthes & Matzdorf (2012) have underlined how usually research that incorporates these two dimensions tend to be biased toward either the ecological or the economic perspective, failing to produce a holistic picture of the challenges of sustainability. This can be attested by both the previous reflections about the division of science in separate compartments and by the answers of researchers who affirmed to give priority to their field of study when applying the assessment methodologies. Moreover, the study stresses how ecological-economic approaches are incapable of producing results relevant for decision-makers, as they only consider approximate inferences of economic and ecological processes, while ignoring the role of farmers (Uthes & Matzdorf, 2012). Indeed, applying an economic analysis to natural resources and ecological struggles does not assure sustainable practices (Rull, 2011). Therefore, these methods are criticised in previous literature to only be able to suggest temporary fixes, creating new vulnerabilities and possibilities for additional exploitation (Böhm et al., 2012). This makes the correlation between sustainability and capitalism a contradiction in terms, trapping scientists in the same system that they were attempting to change (Feola, 2020; Rull, 2011).

On the other hand, several researchers in my study emphasised the importance of using economic incentives to convince farmers to adopt more sustainable techniques, referring to the greedy nature of human beings who would put economic interest first. Nevertheless, analysing the answers of the farmers more thoroughly, it can be noticed that they feel forced by the economic system in which they live to pay attention to the economic revenue, while they would rather care about the satisfaction for their work and about spending time in the countryside in contact with nature rather than tackling financial issues. The economic difficulties that they experience every day in their work, such as international competition or price volatility, force them to give priority to the

economic dimension in order to survive. In social sciences, this phenomenon is tackled by the so-called Agrarian Question, a school of thought that examines the consequences of the emergence and the hegemony of capitalism in the agricultural sector (Banaji, 1976; Jonsson & Pettersson, 1989). Conceptualised in the past century, the Agrarian Question is still one of the core questions of this century, as, despite having changed over time, it remains fundamental for the understanding of farmers' lives (McMichael, 1997). Nowadays, the theory observes the struggles over the global agricultural system, the new relations of production, the articulation of the industrial market, the increasing social differentiation and the effects of globalisation (Moyo et al., 2013). One of the main drivers of the capitalistic economic system is represented by the inexorable cycle of growth which is necessary to avoid collapse (Feola, 2020). As a result of this condition, farmers are fated to perennial income disparity, not being able to keep increasing their productivity and their capital accumulation. These are the main components of the entrance of capitalism in the agricultural sector, namely lower agricultural productivity, incompliance with competitive market economy and lower farmers' income (A. Czyżewski & Staniszewski, 2015). These phenomena have long-term transformative consequences on people's lives, such as rural exodus and de-pesantisation, being reported by the interviewed farmers as well (McMichael, 1997; Jonsson & Pettersson, 1989). Besides, the current globalising tendencies generated strategies of outsourcing by transnational agribusinesses, mobility of capitals, new forms of organisation of value-chains for agricultural products and high-profile agricultural regulations and trade (Bernstein, 2006).

Furthermore, being obliged to produce more and more, farmers are forced to embrace intensive agricultural systems with high levels of crop concentration and specialisation, obstructing them from employing more sustainable and less-intensive techniques (A. Czyżewski & Staniszewski, 2015). This mechanism accelerates the process of environmental destruction and soil depletion. This phenomenon is also known as metabolic rift, namely "the process whereby the agronomic methods of agro-industrialisation abandon agriculture's natural biological base, reducing the possibility of recycling nutrients in and through the soil and water" (McMichael, 2009, p.177). In other words, this Marxist approach believes in the correlation between humans and nature, revealing the tendency of capitalism to employ natural resources at an unsustainable rate, destroying the natural capital on which the system itself depends (Borras et al., 2022). In a vicious cycle, these environmental issues exacerbated by these capitalistic practices increase the vulnerability of farmers, who represent also the scapegoats for this situation (Mehta et al., 2012). The farmers participating in the research remarked the difficulty to oppose these capitalistic logics. They are aware of the destructive potentialities of intensive systems of cultivation, but, despite the economic

consequences, they refuse to use them in their fields, adopting instead practices that result less productive but beneficial for the environment and the land.

This behaviour shows emancipation from and rupture of the capitalistic structure in favour of the realisation of farmers' values and principles. Here, agency plays a fundamental role in shaping reality, as farmers challenge the impositions of the capitalistic system at their expense. To be able to subsist, they are, indeed, obliged to engage in side-jobs and to organise around communal structures, such as the cooperative in France and the quinoa company in Italy, understanding that structuring in a network can enhance their resources and their bargaining power on the national and international stage. Moreover, quinoa enables them to make this choice, helping their financial situation thanks to its high value on the market. Therefore, this case study gives the possibility to reflect on the literature and, for once, to find a point of conjunction between Marxist theories and ANT. These two currents of thought have been in opposition for a long time, as the first highlight the power of structures, while the second valorises agency (Söderberg & Netzén, 2010). Looking at this case, the influence exercised by the capitalistic structures is undeniable and affects all those farmers who would rather change their productive structures in a more sustainable direction, but who are still trapped in a monoculture system by the imperatives of perennial growth and efficiency. Nevertheless, it would be superficial to ignore those cases of farmers who are rising against it, enforcing their agency on the system by looking to alternative solutions in order to be able to survive. These theoretical reflections allow overcoming the criticisms against ANT of underestimating the power of the overarching structures and of being politically quiet, as well as the ones against Marxism of ignoring the efforts of individuals (Castree, 2002; Söderberg & Netzén, 2010). Only by using the two theories jointly, it is possible to understand this complex phenomenon happening in European agriculture. Therefore, agency and power are here considered as relational achievements, which can play a role in preserving the global capital, but also in trying to overcome it.

This study argues for a questioning of the presupposed inevitability of capitalism to broaden the range of possible conceivable futures. In order to succeed, firstly, capitalism and its consequences should be always considered and acknowledged while doing research in the agricultural sector (Feola, 2020). Therefore, these issues should be examined as well when applying sustainability assessment methodologies. Doing this could help increase the awareness over farmers' challenges and the capitalistic influence in agriculture, as well as incentivising a discussion about it (Brand, 2016). Further research could focus, for example, on analysing whether and how the capitalistic structures play a role in obstructing farmers from adopting more sustainable practices, hence,

restraining the sustainability transition. A better understanding of those existing situations of opposition against the capitalistic system is also auspicate. Secondly, imagining different futures other than capitalism is an essential step to further work on sustainability transition. This objective can be obtained through visioning exercises as well as fostering interdisciplinarity in research (Jones, 2011; Feola, 2020).

7.2.6. Personal values, the concept of locality and their role in the understanding of sustainability

Farmers' perception of sustainability can be better understood when taking into account the importance of values, culture and place-connection in influencing people's vision of a certain phenomenon. Several theories demonstrated to be useful in doing it, such as Discourse Analysis, ANT as well as place-based approaches.

According to Ratner (2004), people's perception of a certain phenomenon can be influenced by subjective norms, values and feelings. Particularly, focal issues such as sustainability and sustainable agriculture are value-based and can be regarded as subjective expressions with diverse meanings for different people (Baginetas, 2008). Values are key to comprehending human behaviour, as they indicate what people consider most important. In relation to sustainability, understanding human values means understanding why people take action or make certain decisions (Cheney et al., 2004). For this reason, Discourse Analysis aims to highlight the connection between values and actions, revealing the values intrinsic in social constructions (MacDonald, 2003), while ANT pleads for the reunification of reality and morality, depicting them as two sides of the same coin (Hajer & Versteeg, 2005). Besides, recognising the multiplicity of interests and values in the context of sustainability debates enables the inclusion and the participation of those who are often left unheard (Cheney et al., 2004).

Particularly, the sum of values coming from the professional situation, the social relations, the past experiences and the geographical location constitute a person's culture relate to their context (Horlings, 2015). This is why, recently, place-based approaches have started to engage in sustainability discourse, challenging the theoretical and non-spatial approach that has dominated until now (Grenni et al., 2020). Considering the spatial scale can provide particular insights concerning how values relate to sustainability (O'toole et al., 2006). Indeed, it is through the interaction with the local physical environment that people build the cognitive structure constituting their ideas, memories, feelings, meanings, attitudes, behaviours and values, as well as they might develop a certain place attachment (Vorkinn & Riese, 2001). Therefore, in this theory, sustainability

is perceived as a place-based phenomenon, recognising the principle of the uniqueness of all places and rejecting the employment of undifferentiated solutions that neglect local peculiarities (Calvo & De Rosa, 2017). Furthermore, sustainable place-shaping is a process that works in two directions, as, on the one hand, the meanings and values connected to a certain place can be shaped through more sustainable practices; on the other hand, the applied sustainable practices should be consistent with local values and meanings of place (P. Jones & Evans, 2012). Consequently, reflecting the position of ANT, places can be understood as dynamic assemblages of people, practices and objects, results of both material and immaterial mechanisms and relations (Grenni et al., 2020; Richardson & Whatmore, 2009).

Farmers' discourse about sustainability strongly reflects the centrality of values and place attachment. To better explain these concepts, two examples reported by the farmers themselves in the interviews are useful to engage in more details. A first example is the one of organic agriculture, namely a farming system that employs ecologically-based fertilisers and pest controls (Wezel et al., 2014). Farmers describe how, lacking the use of chemicals, organic agriculture produces fewer yields while still requiring mechanical work. Because of this reason, LCA studies normally depict organic agriculture as less sustainable than conventional agriculture. Therefore, who decides to produce or consume organic food does it because of other reasons, such as to pollute nature less or to have a clean final product, good for both the health of the producer and the consumer thanks to the avoidance of pests and chemicals. Overall, the farmers attest that any decision taken in their farms is mostly based on their personal values, interests and beliefs.

> "We realise that it's more a personal choice or conviction on the part of each person to say to themselves, I'm going to be organic, I'm going to stop ploughing, I'm going to do direct seeding. It's more the choice of the farmer himself that makes him choose one system or another than the factors of his farm." (Interview 20)

The second example concerns the concept of locality, which appears crucial for farmers. They consider the proximity to consumers as interesting from a carbon footprint perspective, as the final product remains within the national borders without needing long-distance transportation. Moreover, farmers highlight that producing quinoa 100% made in France or Italy, from the seeds to the final package, is an incredible source of pride for the producers and an identifying image for the region where it is cultivated. Creating a new supply chain generates as well new jobs in that sector, contributing to the local economy. Locality is understood also as closer contact between farmers and the local population, which create social value when consumers meet the producers. Furthermore, locality means looking at the local context, its issues, and finding specific solutions. Concerning this case study, the role of quinoa in the European landscape has been already

explained. The crop answers to the local challenges coming from both climate change and the international market, offering a fair remuneration for a plant that can easily adapt to soils affected by droughts and salinisation. Quinoa fits perfectly in a system of crop rotation, incentivising crop diversification and helping with the increasing issue of losses in agro-biodiversity. It is noticeable how, in framers' minds, symbolic and emotional facets of the relation with locality coexist next to the more material aspects, demonstrating the relevance of both material practices and values in people's conceptualization of sustainability (Grenni et al., 2020).

All these factors, their interconnectedness and their complexity collide with the position of LCA practitioners. These assessment methodologies do not particularly value the criteria of proximity and locality. From an LCA point of view, what would be relevant is to consider that the amount of CO2 emissions released in the atmosphere by a cargo boat to cross the Atlantic Ocean is not much higher than the emissions released by a truck to move across France or Italy. All the other aspects of sustainability that are related to the locality of a certain product mentioned by the farmers would be neglected. Besides, natural sciences are based on a principle of universality, namely on the assumption that scientific knowledge is independent from any context and that certain general rules are always true. Consequently, it is possible to see the opposition between a perception where sustainability is highly complex, multi-layer, multi-factorial and strongly context-dependent, and a vision aiming to configure a scientific, abstract and objective representation of sustainability based on natural phenomena and categorised in indicators.

Therefore, these reflections arising from the interviews with the farmers could help again in reconceptualising sustainability assessment methodologies in order to take into account this personal and place-based dimension of sustainability. It is necessary a renewed attention to the context in which a certain crop is produced, investigating which are the characteristics of the local environment, which are its issues and challenges, what is needed to be more sustainable and which are the practices already in place. Reflecting on why a certain crop is produced in a certain area and with certain techniques would be fundamental to understand whether that cultivation is answering certain problems or causing them. Therefore, to comprehend the role of a crop in its context, assessing the negative impacts of the production on the environment is necessary to understand how this damage could be reduced. Yet, a full comprehension of its role requires a reflection on how that specific crop is positively contributing to the local environment as well. Paying attention to the local context means as well relativising and weighing the importance of the different indicators considering local challenges and culture. As previously explained, on the one hand, different cultures can value differently problems and priorities, such as in the example of Japanese

sustainability assessment tools; on the other hand, specific issues in a particular place can make certain indicators more critical than others, such as in a case of water scarcity or biodiversity loss. Consequently, thoroughly analysing local context means learning to balance the importance of local issues and being able to find adapted solutions. As the meaning of sustainability is constantly defined by personal values, local culture and external risks, sustainability assessment methodologies could become more flexible in the analysis of the data to incorporate this context-based relativity, in order to have a greater impact on a sustainable transition.

The existing literature on the matter supports this suggestion. First of all, the discussions related to eco-efficiency show that the ecological optimum often depends on the specific conditions of the local context (Hayashi et al., 2005). Moreover, place-based approaches encourage greater integration of all social classes and local inhabitants in decision-making and in research concerning sustainability, in order to understand what they value as most important and most adaptable to the local place (Grenni et al., 2020). For instance, O'toole et al. (2006) propose to integrate the local perception of sustainability within the indicator section, considering that the definition of sustainability at a regional level depends on the values and point of view of local communities. In order to do that, the authors recommend a complete representation of all regional stakeholders, while adapting the indicators to the regional scale. A positive sign is that LCA itself is also going through a reflection concerning an eventual regionalisation, meaning that, in the cases in which a closer look to the local situation is necessary to grasp the sustainability of a certain value-chain, tools and adjustments have been developed to make results nearer to the actual situation (Frischknecht et al., 2019).

7.2.7. Power relations and the ability to exercise an influence

Going beyond the differences in the way farmers, researchers and LCA perceive sustainability, I argue that additional discrepancies and power imbalances can be found when looking at the influence that their different visions have on society. The theories at the base of this research can explain the importance of taking this aspect into consideration.

Discourse Analysis considers language not only as a tool of communication but also as a means of power (MacDonald, 2003). This approach has its origins in Foucault's conceptualisation of discourse as a complex of ideas and practices which create truths and, hence, a vehicle for power relations (Leipold et al., 2019). In social contexts, indeed, different actors exercise their power imposing a certain discourse, or a certain truth, about a particular issue, while others suffer the effects of this imposition, being less able to exercise their influence (Hajer & Versteeg, 2005).

Different actors actively position themselves, enabling or disenabling certain discourses, legitimating certain practices while hiding others (Feindt & Oels, 2005). Furthermore, ANT can aid in explaining this power differential within a network of relations, considering the agency of both humans and non-humans. Particularly, ANT understands power as the creation of common interest, generating actor-networks and underlining the relevance of discourse in stabilising or changing those networks (Müller, 2015).

Latour's theory about the circulatory system of scientific facts can be particularly interesting to understand the power dynamics concerning researchers and LCA. The author suggests investigating the relationship between politics and science, considering them as inextricably connected. This relationship, indeed, operates a translation between the two worlds, transforming "political questions into questions of technique and vice versa" (Latour, 1999, p.98). According to the author, this can happen thanks to five elements that can be found in the case of LCA as well. The first element is the mobilisation of the world around a certain topic, reflecting how sustainability assessment tools have been created and spread around the world through certain instruments and equipment, as well as sites such as research institutions and international organisations (Frank, 2017). The second factor consists in the autonomization of the concept of sustainability in the history of professions, disciplines and scientific institutions (Latour, 1999). An example of this is the growing amount of universities all around the world proposing degrees about sustainability issues as well as offering courses about LCA (Lozano, 2006). Thirdly, Latour underlines the importance of alliances between scientists and other groups in society, governments, industrialists, philanthropists. In the case of LCA, the relationship of researchers with the political institutions, as well as with big food companies, are impossible to ignore. As the interviewed researchers confirmed, policymakers are one of the main commissioners for sustainability assessments not only in Europe but all around the world. European and national institutions often finance the project of sustainability evaluation, asking for the results, as well as for comments and recommendations concerning the improvement of particular value-chains. Moreover, researchers and the scientific world are closely connected with big food companies. In some cases, the firms themselves hire LCA practitioners to evaluate their chains of production in order to improve toward a more sustainable direction. In other situations, these companies' production is part of an assessment commissioned by others, but also in this case they receive the results of the assessment with advice about possible ameliorations and take part in reflection meetings. As a fourth element, Latour (1999) mentions the public representation of the issue in order to foster a certain understanding of sustainability in people's everyday practices and systems of beliefs. Initiatives such as the ECO Score labelling and the Renewable Energy Directive, which require the application of LCA to attest

the sustainability of a certain product or value-chain, constitute a compelling example of this phenomenon. Finally, as expressed by ANT, it is necessary that all the previous points are connected together and the more connected they are, the faster their circulation of that specific representation of sustainability will be. Thanks to this process, the translation of sustainability and its assessment tools from scientific terms to social ones and vice versa happens in a complex and heterogeneous network of human and non-human actants (Latour, 1999).

Nevertheless, farmers are excluded from this network of alliances, resulting unable to exercise any influence concerning the definition of sustainability. In the interviews, farmers depicted a situation of complete isolation from all other actors of the food production world. They are constrained by politics through rules and legislations but they faced difficulties and slowdown when trying to influence it themselves to improve some agricultural standards. Similarly, farmers feel to be at the mercy of the market and the larger food companies, while they have almost no relation at all with the research field. Their situation demonstrates Foucault's theory that the structure of society has the power to shape and limit whether and how people can think, speak and act. The philosopher argues that discourses are vehicles of power relations, producing and reproducing the empowerment and disempowerment of different social groups (Feindt & Oels, 2005; Fleming & Vanclay, 2010; Leipold et al., 2019). This mechanism reflects the situation of farmers concerning the discourse about sustainability, relegating themself to a position of disempowerment and submission to the rules of the other prominent social groups, namely politicians, agribusinesses and, indirectly, researchers. Moreover, practice theory reflects on the concept of capability, namely this approach observe social practices trying to understand when they reproduce inequalities and how they are distributed among the population (Walker, 2020). Therefore, in this case, LCA practices result successful and reproduced at different levels of society, while the obstacles limiting the actions of farmers continue reproducing social injustice.

Evidence of the fact that farmers' perspective was never taken into consideration in the definition of the criteria for sustainability assessment tools is represented by the inexistence of a relation between the two actors**.** As it has been explained before, from the researchers' point of view, farmers represent resources to collect information for their assessment. An important fact is that researchers affirmed to recognise the fundamental relevance of farmers' knowledge in order to comprehend the local context, local practices and local issues, but they do not go deeper in the relation, which stays one way. Moreover, researchers employ farmers' knowledge to collect the data required by the tools, not to question the validity and comprehensiveness of the tools themselves. Farmers as well confirm the inexistence of any relation with sustainability research, even if they express a certain

interest in the possibility of creating one. The interviewed farmers are in constant search of new techniques and practices with which to experiment and be more sustainable, thus meeting with researchers would represent an interesting occasion for them.

Nevertheless, the inexistence of this relation could represent a serious obstacle toward the possibility of including farmers and their vision in the research field. Particularly, LCA and sustainability assessment methods are criticised for not being able to communicate their results in an efficient way (Guinée, 2015). Therefore, a valuable tool, which could aid in this direction and in strengthening the relationship between the two actors, is already in place, namely the post-analysis workshops. As mentioned by the participants, occasionally workshops are organised at the end of a research to share the results with the main actors involved in the process of production of a certain item or service. Usually, these actors are politicians and representatives of large industrial companies, whereas farmers are often excluded. Therefore, in order to include the farmers and create a stronger relationship between them and the researchers, these workshops could be incentivised and supported with increased funds, transforming them into a compulsory step in the process of application of sustainability assessment tools. Besides, farmers should be involved in these workshops, even if this step could require a change of perception from the researchers who should start seeing them as key actors and not minor ones. Other initiatives to further include farmers have been mentioned by the researchers in the interviews, namely the project of making the assessment tools more user-friendly and of teaching farmers how to use them. In this way, they would be more familiar with them and, consequently, more able to make their voices heard concerning possible adjustments.

An additional obstacle could be represented by the fact that the interviewed researchers themselves affirmed that there was no aim to include farmers in the definition of the methodologies, as they consider them to be sophisticated tools based on science. Therefore, researchers do not see the need, in the first place, to take into consideration farmers' perception, which instead could aid in the improvement of these methods, as demonstrated so far. This research attempts to explain how taking into account farmers' ideas can indicate interesting new directions to enable the sustainability assessment tools to create a more exact and complete model of reality for the understanding of sustainability. However, researchers' reluctance to see this possibility creates an obstacle to making their voice heard also in the future. It must be said that, as practice theory remarks, blaming researchers for not doing what is right would not be correct. The theory, indeed, affirms how daily routing, social rules and available resources generate default options for a particular mode of performance. In other words, researchers keep neglecting farmers' point of view

and disregard the relevance of their perspective because they are brought to do so by their daily habits and social context (Kennedy et al., 2015).

Future research could focus on different ways to bring these two actors closer at the point of recognising the reciprocal core role for sustainability and cooperating to make it a reality. Stuiver et al. (2004) recognise the resourcefulness of farmers' knowledge for the sustainability of farming systems and propose several activities to foster their integration with the scientific world. They suggest making farmers' knowledge more explicit and, thus, more understandable according to researchers' mindset, creating discussion groups, educating farmers with scientific insights and many more, which are also strategies that arouse from this thesis. Nonetheless, this integration is not a reality yet. Therefore, it could be also interesting to ask why this has not happened yet despite the suggestions and the research about it, analysing the obstacles that prevent this cooperation and how to overcome them. Certainly, a discussion and a revision of power relations in the sector of sustainability will be pivotal in order to solve these difficulties.

7.3. Final reflections

In the Discussion chapter, I answered the main research question concerning the integration of farmers' and researchers' understandings of sustainability, analysing similarities and differences between the two perspectives and advancing proposals for the improvement of assessment tools through the inclusion of farmers' ideas. Particularly, seven main issues have been selected and analysed thanks to the support of various social theories and previous literature on the matter.

As first point of discordance, the practical versus theoretical origin of farmers' and researchers' knowledge has been highlighted. Thanks to the insights of Practice Theory, it was possible to understand the relevance of an approach to sustainability based on daily actions and practices. Therefore, the suggestion is, on the one hand, to create a closer relation between the two actors to generate a greater reciprocal understanding and, on the other hand, to propose the results of the assessments in a more concrete way in order to make them more easily understandable.

The second issue concerns the discussion about the possibility or impossibility to quantify all aspects of sustainability. This research recognises the need for representation and quantification of science in order to understand reality and provide solutions. Nevertheless, concerning certain social aspects of sustainability, it could be useful to keep the measures and indicators more flexible and fluid to enable the representation of all aspects of sustainability linked to that particular context and considered relevant for local people.

Thirdly, the chapter discusses two different representations of sustainability, namely as limitation of negative impact or as opportunity to render a positive service, while reflecting on their implications. LCA, indeed, proposes the first type of definition but, missing to consider certain aspects typical of a long-term perspective of sustainability such as soil fertility or biodiversity loss, the methodology may result to propose a distorted vision of the situation. Farmers deem as crucial to consider both sides of sustainability, the positive service as well as the limitation of negative impacts, to have a full understating of an agricultural system. Therefore, this research encourages scientific researchers to be reflexive about their work and aware of the responsibilities coming from the application of these tools. Besides, interesting possible adjustments for the methodology are proposed.

In the fourth part, the three pillars definition, as well as the tendency to compartmentalise typical of assessment methodologies, is questioned. Farmers and the literature on the subject agree on the importance of the interconnection of all the aspects composing sustainability. Therefore, this study suggests to at least better incorporate the three pillars in the case in which the division wants to be maintained. Yet, further research is necessary in order to overcome this division, building a new methodology that can be able to grasp the separate aspects of sustainability as well as their relations.

The fifth issue analyses the penetration of capitalism and economic thinking in all sectors of society, therefore also in the way of thinking of both farmers and researchers. The consequences of this can be observed in the way researchers express themselves as well as in their beliefs concerning society and sustainability. Besides, as explained by the Agrarian Question, farmers experience capitalism in their daily lives, as it constrains them to be constantly productive and it creates several challenges for their lives as well as for the environment. Consequently, this thesis argues for raising awareness concerning these matters in the research sector, for the recognition of the agency of those farmers who oppose the capitalist dynamics, and for the overcoming of the capitalistic system.

In the sixth chapter, the role of personal values and local context in influencing people's understanding of sustainability is analysed, bringing the two examples of organic agriculture and locality. When talking about sustainability, farmers constantly referred to both material practices and personal values, as fundamental components of all aspects of the agricultural sector. Particularly, they value the role of the locality to answer to contextual environmental challenges as well as various other social, economic and relational issues, while assessment methodologies neglect all of them. Therefore, increasing the reflections about local context is suggested to improve sustainability assessment tools, next to enhancing their flexibility in order to consider the perspective and the values of the local population.

The last section concerns the power imbalances between the two actors. While researchers have close relationships with both the political and agribusiness worlds, farmers live a condition of complete isolation from all other actors. Moreover, the relation between farmers and researchers is limited to the collection of information for the assessment methodologies. Because of these reasons, not only this thesis auspicates a closer relationship between the two actors in time, but future research is recommended to analyse which are the obstacles that prevent this from happening.

Overall, these are all interesting points of reflection in the path of amelioration of sustainability assessment methodologies in all their components, independently from the fact that they have been proposed by farmers. Following these leads could bring assessment tools to give a representation of sustainability closer and closer to reality. Moreover, the perception of farmers demonstrated to be extremely insightful and to provide several valuable directions to make research progress. The inclusion of this neglected actor in the sector of research about sustainability and sustainable agriculture proved once again to be of main relevance to move toward a more sustainable future. The common scientific way of thinking is that progress and innovation originate from scientists and are, afterwards, applied by farmers and agricultural practitioners (Stuiver et al., 2004). This thesis aims to revolutionise this mindset, demonstrating the possible contribution that including farmers could bring to the research about sustainability as well as to sustainability assessment tools.

A theoretical contribution as well has to be taken from this chapter. Sustainability has demonstrated to be an extremely complex issue, requiring the application of several theories in order to have a complete representation of it. Even theories that seemed incompatible with each other have been used one next to the other, explaining different facets of this composite phenomenon. The most compelling example is represented by the juxtaposition of Marxist theories and ANT to explain the capitalistic struggle present in agriculture and in the life of farmers. On the one hand, the Agrarian Question is able to explain and analyse how the capitalistic structures can obstruct the struggle toward a more sustainable production, limiting farmers' choices and possibilities. On the other hand, ANT allows considering farmers' initiatives that oppose the capitalistic structures, proposing alternative sustainable solutions. Therefore, I suggest a reconceptualisation of the notion of sustainability as reproducing the struggles between structure and agency, concretised and daily experienced through actions and practices. Rethinking sustainability in these terms can contribute to understanding why individuals make certain decisions and not others, how strong is the influence of the societal and economic structures over their choices and possibilities, as well as when and why people are keen to overcome these obstacles to follow their ideals. Furthermore, this

reconceptualisation can only be expressed through the combination of all these different theories, as I argue that for a multidimensional concept, a manifold theoretical framework is necessary.

8. CONCLUSION

The aim of this thesis was to reflect on the possible inclusion of farmers' perception in sustainability assessment methodologies, demonstrating how this integration could result beneficial for the progress of sustainability science. In order to do that, the understanding of sustainability elaborated by, on the one side, European quinoa farmers and, on the other side, by researchers and LCA has been investigated through interviews and participant observation and analysed thanks to the application of two main theories, Discourse Analysis and ANT.

The results have shown differences in the representations of sustainability within the two categories of actors, albeit the strongest discrepancies can be found between the two. Farmers, indeed, talk about sustainability in a down-to-earth way, putting forward their own experiences and agricultural practices. For them, sustainability is associated with the possibility of continuing farming in the long term and being in contact with nature, people and the local context; according to farmers, sustainability means contributing to the local society and environment, while being able to subsist economically. Yet, farmers find themselves in a situation of isolation from other important actors in the sector of sustainability and feel powerless in influencing higher stages. Therefore, they organised structures, such as the cooperative, that can support and connect them, enabling them to cultivate through more sustainable practices, according to their principles and values. The thesis reports as well much information concerning quinoa cultivation in Europe, contributing to filling the knowledge gap concerning the topic. On the other hand, researchers tackle sustainability as an abstract and scientific concept, as a vision that can only be achieved through categorisation and quantification. Sustainability is broken down into three parts - environmental, social and economic - which are only rarely recombined together and which represent a source of specialisation and identification for the researchers. Unlike the interviewed farmers, researchers are closely connected with both the political and industrial worlds, influencing the perception of sustainability of other actors thanks to the conceptualisation of the phenomenon elaborated in assessment methodologies such as LCA.

Discussing these diverging understandings of sustainability, I identified several key issues on which to base possible proposals for the inclusions of the farmers' perspective in assessment

methodologies. Having recognised the reality of coexistence of different understandings of sustainability due to differences in values, interests, beliefs, local context and cultural and professional background, as well as the influence of these factors on people's valorisation of certain aspects of sustainability over others, the first suggestion is to make sustainability assessment tools more flexible and context-based. This means rethinking the universality of science and the faith in the possibility of quantifying any phenomenon. Besides, acknowledging the different ways of knowledge construction between farmers and researchers, as well as the pivotal role of practices for the sustainability transition, a first step to bring the two worlds closer could be to make the results of the assessment methodologies more concrete and accessible for everyone. The compartmentalisation of sustainability in three pillars should be revised as well to be able to understand and represent all the levels of connection and complexity that characterise the phenomenon. In the everyday life, social, economic and environmental aspects of sustainability constantly relate and influence each other, therefore, a unified methodology that can represent these interconnections would be able to portray a more reliable representation and understanding of the issue. Moreover, in order to fully understand the sustainability of a certain system, it should be considered not only how certain actions create a damage to the environment, but also how farmers' choices and practices can contribute to the wellbeing of society and nature. Considering an agricultural system in its context, hence, could allow understanding how certain decisions are taken to answer local issues. Besides, these same decisions can be limited by the socioeconomic system where farmers live. The influence of the capitalistic system on farmers' lives and choices is undeniable, as capitalism foster dynamics of restless growth and intensive exploitation, depleting natural resources while impoverishing farmers. Therefore, raising awareness concerning these issues could be necessary to understand the origins of certain decisions and practices, while conducting reflections concerning the overcoming of the capitalistic system itself. Yet, in order to realise all these changes, the power relations in the sustainability sector need to be rethought. Farmers and scientists should be in a relation of reciprocal communication concerning these subjects, mutually recognising the importance of each other's perception and viewpoint.

8.1. Theoretical reflections

The theoretical framework of this study has been built around two main theories, namely Discourse Analysis and ANT, which have been fundamental to analyse the data, answer the research questions as well as to set a certain understanding of the phenomenon of sustainability. In this research, sustainability has been regarded as a relational issue, highly complex and changeable according to different personal views. The understanding of sustainability is considered also as highly dependent

on the discourse that people build about it, as well as the power relations connecting the different actors. Therefore, both theories have resulted resourceful to comprehend this phenomenon.

Discourse Analysis has been fundamental to structure the research and analyse the results, allowing to detect all components of farmers' and researchers' discourses about sustainability. Thanks to this theoretical foundation, during the fieldwork I paid attention not only to the words of the participants, but also to their actions, constructing a more complete representation of their way of thinking. Moreover, Discourse Analysis underlines how social structures and power relations influence the diffusion or the obstruction of a certain discourse rather than another, unveiling the unequal relations existing between the different actors. For this aspect, the contribution of ANT as well was pivotal, as the application of Latour's theory about the circulatory system of scientific facts could explain the prominence of the scientific way of thinking also in the political and business sectors. Beyond this, ANT shaped the theoretical mindset with which I approached the research, namely the symmetrical and relational consideration of all actants, human and non-human, all endowed with agency. Not to mention the core role of ANT in the discussions about the philosophy of science, which allowed to analyse and question the functioning of the LCA methodology.

Nonetheless, such a complex and multifaceted issue as sustainability has demonstrated to require more than these two theories for its understanding and analysis. In the Discussion chapter, Practice Theory, Place-based Approaches and the Agrarian Question have been central to reflect on the discourses emerging from the interviews. This demonstrates the need for studies based on manifold theories, engaging them in creative and innovative ways, as well as interconnecting theories which are commonly used in contraposition. The theoretical contribution of this thesis, indeed, consists in the combination of ANT – which valorises the potentiality of people's agency – and the Agrarian Question – which highlights the constriction caused by societal and economic structures – in order to explain the influences of the capitalistic forces on farmers' decisions. I argue, indeed, for a reconceptualisation of sustainability as a domain where the struggle between structure and agency is reproduced. Therefore, only by combining these different theories, a complete representation of the topic can be given, as complex, conflicting and changeable as it is in the minds and everyday lives of people.

8.2. Limits and Recommendations

The thesis contributed to the understanding and the debate concerning sustainability and sustainability assessment tools, even surprising myself in the process of research. Therefore, thanks

to the discoveries that I have made, I now realise also the weaknesses and the limits of my research, recognising what could have been improved. For this reason, it is worthwhile to reflect on the limitations of this thesis to recommend potential enhancements for future research.

Following from the theoretical contribution, it is now clear the need to interconnect different theories in order to grasp all facets of this phenomenon. Starting with such a composite theoretical framework could have allowed me to more easily notice certain aspects of sustainability and go more in depth in their understanding during the fieldwork. To explain this with a practical example, I realised the importance of the local context for the concept of sustainability because this factor was consistently mentioned by the majority of the interviewed farmers, without even the need of making a question about it. Conversely, previously including a place-based approach in my theoretical framework could have allowed me to reserve a specific section of my interview guide to this topic, comprehending more in detail the implications of this factor. Consequently, my recommendation for future research which aims to portray a complete and close-to-reality representation of sustainability is to incorporate in the conceptual framework several theories representing different facets of the phenomenon, based on the ones employed in previous studies of the subject. Connecting them in unexpected ways can allow discovering new aspects of this complex phenomenon that were not possible to be identified before.

The second limit that is necessary to remind concerns the fact that, as clearly stated in the Methodology chapter, this research does not aim to be representative of all farmers and all researchers and their respective ways of thinking. It is important to mention, indeed, that I am aware of the specificity of my interviewees and that they have been selected for this reason. Quinoa farmers are probably not representative of the majority of European farmers as they are characterised by unique peculiarities. They demonstrated to be particularly sensitive to topics such as sustainability and care for nature as they selected this crop exactly to implement practices, such as crop rotation and organic farming, which are more respectful for the environment. Their small number, as well as this care for the environment, made quinoa farmers ideal to discuss about sustainability issues in this thesis, but for a more representative understanding of European farmers' way of thinking, the research should be extended to other groups of farmers.

The third issue which needs to be tackled concerns, instead, sustainability assessment methodologies. This thesis aimed to reflect on the inclusion of farmers' vision in these tools, in order to suggest possible improvements. Therefore, further research could start from here and reflect on the implementation of the enhancements proposed. An initial separate interrogation of farmers and researchers was necessary to clarify their understanding of sustainability, yet, at this

point, it would be much more interesting to create that connection and communication between these two worlds. In other words, I suggest structuring a research where farmers and researchers can discuss together concerning these matters through focus groups or other participative methods. This could aid in creating that connection between the two actors that now is missing, contributing to the deconstruction of farmers' situation of isolation as well as of the existing power imbalances in the sustainability sector. Moreover, through this conversation farmers' and researchers' consideration of each other could improve, helping both to see the importance of the work and the opinions of the other and, therefore, having positive consequences for the future relationship between the two.

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ANNEX

Appendix 1. Interview Guideline Local Workers

INFORMED CONSENT

Ask permission to record

Start recording

First of all, thank you very much for your willingness to participate in this interview. Allow me to introduce myself once more. I am Giulia, a master's students from Wageningen University, specialised in Rural Sociology. I am conducing my Master Thesis concerning the definition and operationalization of sustainability in the agricultural sector, specifically studying the case of quinoa production in Europe. The aim of the study is to understand the point of view of farmers who produce quinoa regarding sustainability, and whether this is different to that of researchers who tackle subjects of sustainability and sustainability assessment methods. The study will also explore whether sustainability assessment tools align with farmers' conceptions and concerns about sustainability, in order to make those assessment techniques more inclusive, efficient and reliable. In this way, I aim to give a voice to farmers within the debates concerning sustainability.

Read out informed consent and explicitly ask for compliance

Today is (day).

You, (name surname), are being invited to take part in this. I, Giulia Volpini, will be conducting this interview as part of my master study at Wageningen University in the Netherlands.

You are invited to participate in this study because of your expertise concerning the topic of quinoa production and sustainability research.

By sharing your experiences with me, you will be helping to better understand the perceptions about the concept of sustainability and sustainability assessment tools, as well as the production system of quinoa in Europe.

The information collected from this study will be reported in a way that ensures confidentiality (through safe storage) and anonymity.

You will be asked a number of questions. You are not obliged to answer these questions. In case you do not understand the question, feel free to ask for an explanation. Your interview is recorded

and, afterwards, it will be transcribed or summarised. If desired, you will be given a copy. If you feel uneasy about your continued participation you can withdraw your interview at any time.

The information I gather will be used for a master thesis and other academic publications.

Do you have questions? Do you agree to do the interview?

INTERVIEW QUESTIONS

First of all, I'll ask you if you want to introduce yourself. Who are you and which is your connection with quinoa production?

Part 1: Quinoa production in Europe

Why have you decided to produce quinoa here in France?

- Which techniques do you use for your production?
- How did these years of cultivation go?
- Are you working alone or in a cooperative? Why? Do you have contacts/cooperation with other farmers who produce quinoa?

Which are the potentialities of producing quinoa in Europe?

- Which are the reasons behind the choice of cultivating/producing quinoa?
- Which are the challenges of producing quinoa in Europe?

Agricultural information

- Land available (hectares)
- Agricultural practices used in the farm
- Land destinated to quinoa (hectares)
- How many people work with you in their farm?
- What is your yield per hectar of quinoa?
- Which other crops do you cultivate?
- Do you have any animal?

Part 2: Sustainability

What does sustainability means for you in the agricultural sector?

How would you link quinoa to the concept of sustainability?

- Are there any problematic aspects in the way quinoa is produced in Europe? Are there ecological benefits?
- Do you think that there has been a political representation of quinoa as sustainable?
- Are there incentives (political, economic, social) to move quinoa production toward a more sustainable direction?
- Are there specific challenges in moving quinoa production toward a more sustainable direction?

Which are the warning signals that make you understand that someone is not producing in a sustainable way?

- Whit which techniques is it possible to avoid that?

Which are the criteria that you take into account when you make decisions concerning the agricultural techniques to use?

- Is sustainability one of those criteria? How important is it?

Part 3: Research and Sustainability Assessment tools

Which are the fundamental issues that a good researcher should consider while assessing the sustainability of a certain production?

- Are there specific issues that should be taken into account concerning quinoa production?
- How can research foster a positive change?

How much the local context influence sustainability choices and sustainability assessment tools?

- Do you think that the same tool can be used all around the world? Why?

Do you think that farmers should be involved in the process of definition of sustainability assessment methodologies for the agricultural sector? How? Should they be involved in any other way/moment of the assessment?

Do you know the Life Cycle Assessment methodology? What do you think of its assessment of the sustainability of a certain production?

Do you have previous experiences with researchers and scientific research? Do you have any connection with it?

Last question: What does it mean for you to be a farmer?

CONCLUSION of the interview

This is the end of the interview. Do you want to add anything that has not been asked to you concerning the topics that we discussed during this interview?

Do you have any suggestions to improve the current interview for future participants?

Do you want to receive a copy of the transcript of this interview to check the reported information?

I thank you again for your participation. Here my contact to reach me at any time.

Appendix 2. Interview Guideline Researchers

INFORMED CONSENT

Ask permission to record

Start recording

First of all, thank you very much for your willingness to participate in this interview. Allow me to introduce myself once more. I am Giulia, a master's students from Wageningen University, specialised in Rural Sociology. I am conducing my Master Thesis concerning the definition and operationalization of sustainability in the agricultural sector from the point of view of European farmers and LCA researchers. During this interview I will ask some questions concerning your perception of sustainability sustainability and the LCA methodology.

Read out informed consent and explicitly ask for compliance

Today is (date).

You, (name surname), are being invited to take part in research on the understanding of LCA dynamics during the assessment of sustainability of quinoa production. I, Giulia Volpini, will be conducting this interview as part of my master study at Wageningen University in the Netherlands.

You are invited to participate in this study because of your expertise and experience concerning sustainability assessment tools.

By sharing your experiences with me, you will be helping to better understand the perceptions about the concept of sustainability and sustainability assessment.

The information collected from this study will be reported in a way that ensures confidentiality (through safe storage) and anonymity.

You will be asked a number of questions. You are not obliged to answer these questions. In case you do not understand the question, feel free to ask for an explanation. Your interview is recorded and, afterwards, it will be transcribed or summarised. If desired, you will be given a copy. If you feel uneasy about your continued participation you can withdraw your interview at any time.

The information I gather will be used for a master thesis and other academic publications.

Do you have questions? Do you agree to do the interview?

INTERVIEW QUESTIONS

First of all, I'll ask you if you want to introduce yourself. Who are you and which is your connection with sustainable assessment tools and, specifically, LCA?

Part 1: About the nature of LCA and its definition of sustainability

Which is your definition of sustainability?

- Which are the most important elements to take into consideration to be able to say that a certain production is sustainable?
- Which are the values linked to sustainability?

What does LCA tell about sustainability?

- Which idea of sustainability is conveyed by the indicators of LCA?
- What doesn't LCA tell about sustainability?
- Which consequences does this understanding of sustainability? Does LCA have an impact on the world? How does it affect farmers' choices or policy-making?
- Which path toward sustainability does LCA indicate?
- Which conception of nature does LCA imply?
- Which relation human-nature does LCA suggest?

Do you think LCA is based on a western way of thinking?

- Which are its theoretical roots?
- Despite its theoretical origins situated in a western scientific vision of the world, do you think it is possible to apply it to any context? Or could it collide with different conceptualisations of sustainability?

How strong is the level of subjectivity in the application of LCA connected to the choices and interpretation of the researcher?

Part 2: LCA and its relation with farmers

Are farmers involved in any way in the process of LCA / of applying LCA?

- If yes, how? During which phases?
- Do you think they should be involved more? Why? How?
- Do you think their vision or understanding of sustainability could be important for the success of LCA?

Which is the relationship between researchers and local farmers when applying LCA

How do farmers generally consider LCA?

- Do farmers understand what researchers are doing / looking for when they apply LCA?

Part 3: Final Questions

Do you think LCA has any weakness which should be improved?

Do you think social and economic elements should be taken into consideration during sustainability assessment? Why?

- What do you think of previous attempts of taking into consideration these social elements during LCA?

Do you think that the LCA is an effective tool to push agricultural production toward a more sustainable direction?

CONCLUSION of the interview

This is the end of the interview.

Do you want to add anything that has not been asked to you concerning the topics that we discussed during this interview?

Do you have any suggestions to improve the current interview for future participants?

Do you want to receive a copy of the transcript of this interview to check the reported information?

I thank you again for your participation. Here my contact to reach me at any time.

Appendix 3. Code Book

Code	Definition	Example
General Information	Data and details concerning the participant to interviews.	Introduction, name, age, professional field, etc.
Sustainability Definition by Farmers	Answers to the question "What does sustainability means for you in the agricultural sector?" given by the people within the group of farmers.	The three pillars definition and other official descriptions, but also the family stories and personal thoughts.
Sustainability as Agricultural Practice	The identification of the concept of sustainability with certain agricultural practices.	Practices in use, practices of the tradition or innovative sustainable techniques that farmers connect to the idea of sustainability.
Economic Sustainability by Farmers	All references to economic factors that participants correlate to sustainability.	Financial difficulties, money rewards, economic conditions that cause struggle for farmers or that can incentive them to adopt more sustainable practices
Social Sustainability by Farmers	All references to social factors that participants correlate to sustainability.	Reference to working and living conditions, human rights, but also the connection of sustainability with the contact with nature and people.
Sustainability as Locality	All references to the concept of local production as relevant for sustainability for social, environmental and economic reasons.	Transparency, short transportation, local value-chain, km0, etc.
Sustainability as a Service	The importance of considering also the positive aspects of a certain food production on for social, environmental and economic levels.	Beauty of the landscape, carbon stock, etc.
Farmers' Decisional Criteria	The factors on which farmers base their choices.	Economic reward, sustainability, environmental impact, agronomic reasons, farmers' instinct and experience, etc.
Farmers' Pride	Farmers' references to their sense of pride linked to their job.	The pride to be part of an innovative initiative or to share this experience with a strong

		community.
"Farming" Meaning	Answers to the question "What does it mean for you to be a farmer?".	The values and personal histories linked to their personal meaning of their job.
Quinoa Information	All information provided by the farmers concerning quinoa characteristics and its production.	The technical itinerary, nutritional characteristics, details of its cultivation in Italy/France, etc.
Sustainability of Quinoa	All answers connecting the production of quinoa to the concept of sustainability.	Adaptability, high price, beauty of the plant, etc.
Sustainability Definition by Researchers	Answers to the question "What does sustainability means for you in the agricultural sector?" given by the people within the group of researchers.	The three pillars definition, or the definition of sustainable development.
LCA Representation of Sustainability	Answers to the question "Which is the representation of sustainability portrayed by LCA?".	The definition of strong sustainability or all other ways in which the participants described the methodology and its relation to sustainability.
Economic Sustainability by Researchers	All references to economic factors that participants correlate to sustainability.	LCC, economic assessment methods, relevance for sustainable transition, etc.
Social Sustainability by Researchers	All references to social factors that participants correlate to sustainability.	Social sustainability assessment methodology, human and workers-rights, etc.
LCA Cultural Background	The theoretical base of the methodology.	Positivistic thinking, anthropocentric, weak/strong sustainability, etc.
LCA Imperfections	Limits of the methodology.	Issues under improvement or that are missing in the analysis of LCA
LCA Influence	The impact of LCA in political, economic and social dimensions.	The use of LCA in legislations, the importance for agribusiness, etc.
Relation farmers-farmers	The relationship among framers.	Any form of connection, influence or communication among farmers.
Relation farmers-consumers	The relationship between farmers and consumers.	Any form of connection, influence or communication between the actors.
Relation farmers-	The relationship between farmers	Any form of connection, influence

policymakers	and policymakers.	or communication between the actors.
Relation farmers-agribusiness companies	The relationship between farmers and agribusiness companies.	Any form of connection, influence or communication between the actors.
Relation farmers-researchers	The relationship between farmers and researchers.	Any form of connection, influence or communication between the actors.
Relation researchers-consumers	The relationship between researchers and consumers.	Any form of connection, influence or communication between the actors.
Relation researchers-policymakers	The relationship between researchers and policymakers.	Any form of connection, influence or communication between the actors.
Relation researchers-agribusiness companies	The relationship between researchers and agribusiness companies.	Any form of connection, influence or communication between the actors.