UNIVERSITA' DEGLI STUDI DI CAMERINO

School of Advanced Studies

Doctorate course in

"Pharmaceutical, Nutraceutical and Food Sciences"

XXXIV Series

TITLE OF THE THESIS

"Sustainability, promotion and valorization of the excellence of agri-food productions in the Marche Region, with focus on the Crater area"

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Preface

"Le rughe della terra e della pelle mi insegnano delle cose che non conoscevo"

Mario Giacomelli, Photographer (Senigallia, 1925-2000). Landscapes. Marche

The present PhD thesis has been the result of three-years activities and read up on the agri-food system at national and regional levels.

This PhD of the University of Camerino inscribes in the innovative PhD project scholarship for research and innovation of the Italian regional system (i.e. Marche Region), in collaboration with the Cluster Agrifood Marche and the Marche Polytechnic University (UnivPM), and was funded under POR Marche FSE 2014/2020.

The research activities were divided into three main parts strictly interconnected and adapted to the new conditions and restrictions encountered under the Covid-19 pandemic.

The first part of the PhD was dedicated to the mapping of the Marche territory, the knowledge of the pedoclimatic characteristics of the region and the assessing of priorities, needs and gaps of the companies and stakeholders involved in the agri-food sectors, with focus on the Crater area[1].

In fact, the Crater area in the Marche Region is a wide area which has been affected by the earthquake of 2016 and is currently facing socio-economic disruptions, which need particular attention for rehabilitation and development of its territory and related activities.

The second part has been an applied investigation mainly on sustainability and circular economy principles application to the agri-food sectors, which also resulted in the definition of a personal project, supported by the Supervisor and UNICAM, which has then be funded during the third year of the PhD under EU Horizon 2020 PRIMA Call, for a total project amount of around 752.000,00 euro.[2]

The third one, horizonal to the entire PhD, was mostly dedicated to knowledge transfer, networking, communication and dissemination activities and related to the preparation of workshops, congresses, webinars and events organized along the entire PhD programme.

During the third year and thanks to the Italian government prorogation of the PhD due to the pandemic, three months of research were developed abroad at the premises of the University of La Laguna (Tenerife, Spain), within the

[1] List of municipalities pertaining to the Crater Area in the Marche Region: Acquacanina (MC); Acquasanta Terme (AP); Amandola (FM); Apiro (MC); Appignano del Tronto (AP); Arquata del Tronto (AP); Ascoli Piceno; Belforte del Chienti (MC); Belmonte Piceno (FM); Bolognola (MC); Caldarola (MC); Camerino (MC); Camporotondo di Fiastrone (MC); Castel di Lama (AP); Castelraimondo (MC); Castelsantangelo sul Nera (MC); Castignano (AP); Castorano (AP); Cerreto D'esi (AN); Cessapalombo (MC); Cingoli (MC); Colli del Tronto (AP); Colmurano (MC); Comunanza (AP); Corridonia (MC); Cossignano (AP); Esanatoglia (MC); Fabriano (AN); Falerone (FM); Fiastra (MC); Fiordimonte (MC); Fiuminata (MC); Folignano (AP); Force (AP); Gagliole (MC); Gualdo (MC); Loro Piceno (MC); Macerata; Maltignano (AP); Massa Fermana (FM); Matelica (MC); Mogliano (MC); Monsapietro Morico (FM); Montalto delle Marche (AP); Montappone (FM); Monte Rinaldo (FM); Monte San Martino (MC); Monte Vidon Corrado (FM); Montecavallo (MC); Montedinove (AP); Montefalcone Appennino (FM); Montefortino (FM); Montegallo (AP); Montegiorgio (FM); Monteleone (FM); Montelparo (FM); Montemonaco (AP); Muccia (MC); Offida (AP); Ortezzano (FM); Palmiano (AP); Penna San Giovanni (MC); Petriolo (MC); Pieve Torina (MC); Pievebovigliana (MC); Pioraco (MC); Poggio San Vicino (MC); Pollenza (MC); Ripe San Ginesio (MC); Roccafluvione (AP); Rotella (AP); San Ginesio (MC); San Severino Marche (MC); Santa Vittoria in Matenano (FM); Sant'Angelo in Pontano (MC); Sarnano (MC); Sefro (MC); Serrapetrona (MC); Serravalle del Chienti (MC); Servigliano (FM); Smerillo (FM); Tolentino (MC); Treia (MC); Urbisaglia (MC); Ussita (MC); Venarotta (AP); Visso (MC).

[2] https://prima-med.org/results-of-prima-call-section-2-2021-multi-topic/

Interuniversity Group of Food and Environmental Toxicology, under the supervision of Prof. Carmen Rubio Armendariz (https://portalciencia.ull.es/grupos/6548/detalle)

Introduction and aim of the project

The companies of the Marche Region, especially within the agri-food sector, are on average small-scale firms, often with a family-run dimension. In fact, the manufacturing companies in the agri-food sector are almost exclusively micro enterprises (84.9% of companies with less than 10 employees; data elaboration on ISTAT, 2020), a percentage significantly higher than the general average of Italian enterprises (78.6%; data elaboration on ISTAT, 2020). This trend towards micro-size is even more pronounced in farms (98.6%; ISTAT, 2017).

This represents, in some respects, a point of strength of the regional production system, leading to a high respect for peasant traditions and traditional knowledge, complemented by innovations to keep up with the market, to a healthy competition on the quality of products between producers, with the pride of being able to affirm and demonstrate that each product is of high quality, high resilience, etc.

The downside of this small dimension is that small businesses have few resources to devote to the promotion and marketing of their products, and on innovation and internalization, resulting in scarce visibility and low economic margins, and restriction to local markets instead of to international ones.

The PhD project proposes an effective contribution to the development of potentials of the territorial realities towards a broader international level. In particular, research focused on the positive characteristics (e.g. nutritional, health, nutraceutical, etc.) of the products of regional agri-food companies and the definition of the potentially most successful products for the market, as a basis for a promotion of the regional products. Such promotion also involved the study of claims to be possibly affixed on the labels, and the most effective ways of communicating the quality via media instruments, and helped setting up the marketing strategy targeted to inner needs.

As mentioned above, the core aim of the PhD was to increase competitiveness of the agri-food companies of the Marche Region through the enhancement and

promotion of their high-quality products, with particular attention to companies of the Crater area. The scope of the PhD activity was wide and ambitious, and all the research activities were related to the enhancement of the agri-food system of the Marche Region. Thus, current policies and trends were analyzed and put in place through capacity building and knowledge sharing among project partners and resulted in outcomes presented along this dissertation.

In particular, the PhD contributed to the development of policies and communication tools to ensure traceability and authenticity of local products, communication to consumers (residents or tourists) of the potential of local products (what is on offer and what are the characteristics of the product) through networks, events, web marketing, best practices sharing, presentation of companies and their production history (the manufacturing companies and their history, the companies' commitment to the environment, etc.); the commitment of agri-food companies (knowledge transfer) as well as for improving the quality of their productions also to increase sustainability from the point of agro-environmental view, stimulating multi-functionality through different tools (certifications alternatives, such as Mountain Product and others).

The Marche Agrifood Cluster[3], which includes various regional business realities, including centers of research and service centers that deal with quality, product labeling certifications, supported the three-year research activity, making available not only companies and producers of local products, but also research institutes (IZSUM, CREA, CNR) and services enhancing new business models.

Moreover, the synergy between the agri-food and tourism sectors was developed, without neglecting the repercussions of agri-food in the environmental, landscape and cultural fields, especially evident in the case of sustainable agri-food productions and the need after the pandemic to go back to slow and territorial tourism (e.g. food and wine regional tours).

Particular attention was dedicated to policy enhancement and involvement of companies in emerging core topics, such as climate change and circular economy.

The PhD was developed according to the following indicative timeline, which can be generically divided as follow:

[3] https://www.agrifoodmarche.it/it

Months 0-6: identification of companies though the network of the Agrifood Cluster, Unicam, UnivPM and other associations, with the collection of memberships through the application of a participatory approach.

Months 6-22: study of the products of the participating companies and their placement into the market also from a point of view of sustainability and quality traceability. The aim was to identify those with the best characteristics and therefore the possibility of their promotion at national and international levels. Active collaboration was undertaken with some of the companies, in order to respond to their necessities. Definition and use of *ad hoc* questionnaires.

Months 22-30: Analysis of the results obtained with the previous study, and subsequent study of the most effective methods of promotion (websites, claims on the label, etc.)

Months 30-36: active participation to European and national Calls.

Months 36-38: period abroad at the premises of the Interuniversity Group of Food and Environmental Toxicology of the University of La Laguna, to exporting and importing the related good practices.

More in detail in Chapter 1 it is presented the methodology adopted to develop the basis of the research; Chapter 2 is dedicated to the presentation of the territory and stakeholders involved in the PhD project, as well as the policy framework related to climate change and circular economy; Chapter 3 presents more in detail the Marche Region and the agri-food companies; Chapter 4 analyses the alteration occurring after the spread of Covid-19, which altered the research activities; and Chapter 5 presents an additional result of the PhD achieved through the AgrI-fiSh project and the main communication and dissemination activities, as well as information on the research period abroad.

Chapter 1. Methodology

This first chapter showcases and analyses the main methodological approaches adopted to develop the project aim and analyzes the most relevant participatory approaches throughout a literature review.

1.1 The Marketing Research

The activities related to the valorization of the agri-food systems within the Marche Region has been fostered through a systematic model of applied research defined as “Marketing Research”.
According to the definition given by the American Marketing Association, a Marketing Research is “the systematic and objective identification, collection, analysis, dissemination, and use of information for the purpose of improving decision making related to the identification and solution of problems and opportunities in marketing” (Malhotra D., Dash S., 2019).
According to the Marketing Research approach, the research focused on six axes:

1. Definition of the problem
2. Development of an approach to the problem
3. Research design formulation
4. Fieldwork and data/information collection
5. Data/information preparation and analysis
6. Report preparation and presentation

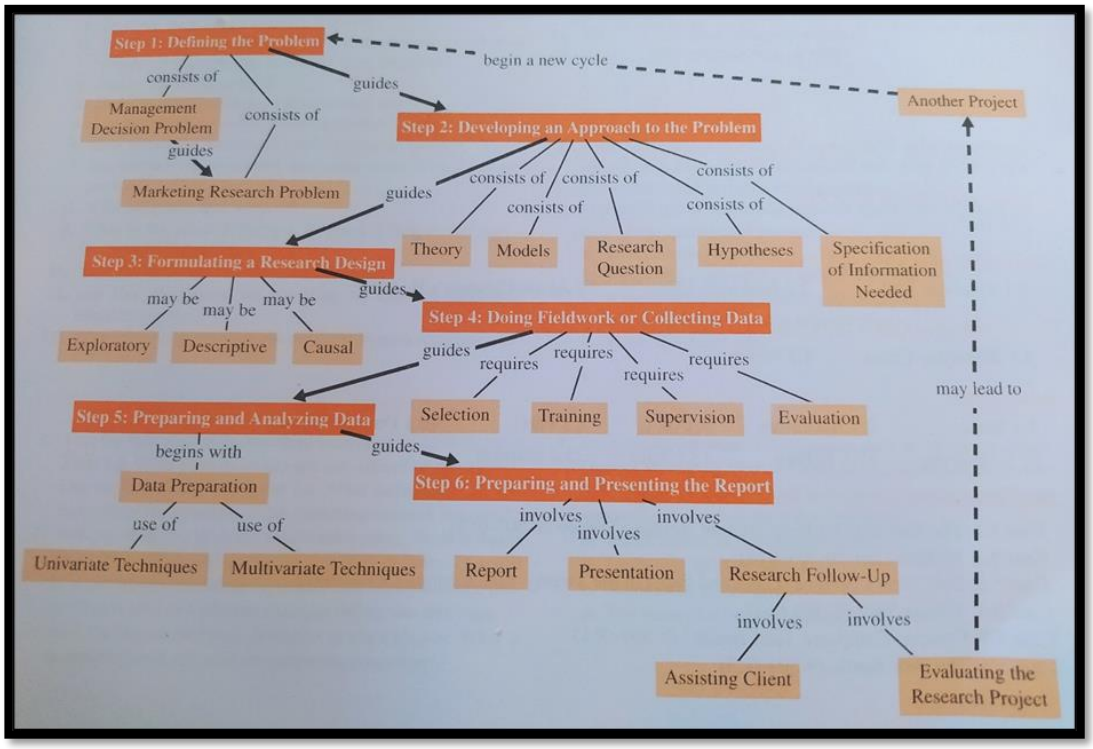
During the definition of the problem (step 1) phase, the main activities related to the understanding of the current and past situation of the regional agri-food system was followed by the collection of background information and the definition of the main problems to be overcome with a problem-solving approach. Meetings with all main stakeholders, institutions involved in the decision- making process, and the use of qualitative data such as interviews with companies, farmers and fishermen, and associations, have been crucial in defining the strategy to be further adopted.

The second phase of the PhD research focused on the definition of the main problems and the development of the approach to the problem (step 2), which consisted in formulating the objective of the research and collecting the main information available. During this phase the main problems identified where: the small and scattered dimension of the companies, the lack in cooperation among them, the limited access to information and funds, the limited resources available for networking and training activities, and a lack of participation in internationalization and digitalization processes. All these problems are interconnected and, thus, the solution is often unique.

After the definition of the main issues, the research design formulation (step 3) was defined to test the hypotheses of research and define the possible solutions to the problems and to provide with *ad hoc* information the decision-makers. During this phase, and especially for the steps 4 and 5, variables have been defined and information and data collected, analyzed and validated in order to support the agri-food companies to overcome barriers and provide them with effective instruments, as well to involve consumers and all stakeholders in the process to enhance their awareness.

All the above-mentioned activities resulted in this doctoral thesis Report preparation and presentation (step 6), in which the research approach and design and main findings are herein presented and will be useful in the decision-making process ahead.

Figure 1: Concept map of Marketing Research, Source Marketing Research an applied orientation, 2019



1.2 The participatory approach to research

During the PhD project, attention was given to the definition of the methodology to be used to develop participation and cooperation among companies and to enhance networking and collaboration with all stakeholders, with the aim of enhance the visibility and competitiveness of the companies at the national and international levels. In particular, participatory approaches, communication strategy, marketing analysis and a questionnaire represent the main methodology developed within the project to achieve concrete results.

Communication and participation have become overused also within the research community. However, the ideas of communication and participation have not been fixed concepts since the first emphasis on communication arose in the late 1950s. The shift in the paradigm within research and development also led to the emphasis on participation and how communication can be used to facilitate participation

among actors involved in the project. With the scope of analyzing the role of communication and participation in the research, it is therefore crucial to examine the main participatory approaches used by scientific communities. In addition of participation, communication was central to secure participatory approaches and to involve stakeholders to be consulted and included in research project decisions. In fact. research practitioners must effectively communicate with the affected parties. In order to facilitate participation, communication should be multi-directional, inclusive, and context- and content-oriented.

Although communication is essential for participatory approaches, there are a number of other integral components that are required to facilitate participation. These include: balancing of power relationships; ensuring fair processes; creating institutional capacity; and facilitating effective negotiation with a trusted, impartial convener (Ramirez and Quarry, 2004).

When analyzing participatory approaches, in the past it was assumed that centralized decision-making with minimal outside inputs was adapted to complex problems. However, in recent decades, there is a growing evidence-based suggesting that participatory processes are effective and efficient means for affecting research and development. Participation is a difficult concept to define and implement because it is viewed differently by various stakeholders, it occurs differently in every setting, has many sources, and happens at different levels and stages within research projects. In its broadest sense, participation can be defined as "transparency, openness and voice in both public and corporate settings" (Stiglitz, 2002, p.165). Its main aim is to give stakeholders a voice in decisions that affect them and allow them to "influence and share control over priority setting, policy-making, resource allocations and access to public goods and services" (Tikare et al., 2001).

The definition of participation used by the United Nations Research Institute for Social Development (UNRISD) is "the organized efforts to increase control over resources and regulative institutions in given social situations, on the part of groups and movements hitherto excluded from such control." (UNISRID Flagship Report, 2016, p.21). In a more specific sense, a participatory process is "an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits" (Paul, 1987, p. 73).

Participation can be used within decision-making for a number of different purposes. Beierle (1999) identifies six main goals for participation: "educating and informing the public, incorporating public values into decision-making, improving the substantive quality of decisions, increasing trust in institutions… reducing conflict… [and] cost effectiveness". These goals relate to both the substantive and normative reasons for participation, as identified by Stirling (2006), and to considerations of social development.

Participation in any given project or decision-making process may have a single goal or incorporate multiple goals. The main goal emphasized by a participatory approach will affect the form the participation takes place. Johnson et al. (2004) defines the type of participation with this goal as 'functional participation'. Ribot (1999) states that participation (and decentralization) can increase managerial efficiency for research projects through: internalizing the costs and benefits of decisions by making those who take decisions those who bear the consequences, rather than a disinterested outsider; reducing administrative costs by use of local people, skills and knowledge; and "matching actions to needs" by using local knowledge and aspirations in project design. Furthermore, Stiglitz (2002) notes that participation of stakeholders in decisions allows for legitimacy of those decisions because they have been decided internally and this may improve efficiency. Decisions can be used for further action or policy without debating the outcomes of the prior process. Thus, participation allows for the "provision of more effective decision justification" and increases efficiency by reducing the quantity of redundant decisions (Stirling, 2006, p.96). There are many goals based on normative considerations. For instance, participation may have the goal of reducing conflict and increasing trust between various stakeholders with conflicting views but common goals. It may also have the goal of empowering stakeholders to own and maintain projects in the future by "building individual and collective capacity to innovate" (Johnson et al., 2004, p.190). Abelson (2006) identifies another core goal for participation is that by facilitating social development it will "contribute to a more educated and engaged citenzry". Due to the communication and knowledge sharing that is inherent in participatory processes, it is possible to increase information, education and empowerment and ownership of research and

development activities. Also, participation is most likely to be sustainable when it emerges 'from below' rather than being prescribed by a top-down approach.

When the scope of the participatory process has been identified, it is then important that all relevant stakeholders are included in the process. Stakeholders' analysis, can also be useful for characterizing the heterogeneity within the system and identifying various groups and interests that need to be engaged with. It is highly important that small and less representative groups are represented in the participatory process, as for example micro and small companies involved in the project. Facilitation of communication between stakeholders is important for improving network between groups as integral core of successful participation. There should also be a consideration of the 'negotiation-dimension' of participation, thus communication should be used to facilitate negotiation where there are necessarily conflicting interests that cannot be used for common interest (FAO, 2007).

According to the regional dimension of the project, local representation to be representative needs to be accountable (Ribot, 1999) and institutionalization of the participatory process can allow for this accountability. However, it should be ensured that representatives of companies and communities are truly representational and potentially powerful groups or individuals should be prevented from dominating participation and there should be country or community ownership of participation.

This ensures that the project will be sustainable in the long run because it allows for empowerment of the people to facilitate their own development in the future at to up-scale best practices. As noted by Hyden (1998), "Development is potentially effective only when it is done by people themselves". But participation itself does not guarantee the positive success of a project, since the outcome of participatory approaches should be carefully taken into account and declined in specific methodologies. Moreover, a mere participation as simple attendance in meetings or events does not imply a win-win situation since being just present at a debate but not being effectively involved in the whole decision-making process does not imply the attainment of an expected result. This is the reason why all the events have been organized through an active involvement of the actors and with a bottom-up approach.

The representativeness and decisional weight of stakeholders, as well as a fair preparation and good understanding of the environment, with its longings and vulnerabilities, should be prioritized.

Also the aspect of responsibility, although with various degrees of intervention, is crucial to cement a sense of ownership among participants, helping in perceiving participation and communication activities as a proper interest to pursue.

Many researchers and practitioners started to regularly use participatory techniques such as the Participatory Rural Appraisal, which will be analyzed further on, to enhance development plans and actively involve members of a community in a proactive and conscious way, while rapidly gathering the maximum amount of information as basic social, economic and environmental data.

Hence, participation could be interpreted in different ways according not only to the results but also to the expectations. At this regard, Oakley (1991) classified three main interpretations of participation: participation as contribution, participation as organization and participation as empowerment. Later on, Mefalopulos (2008) extended Oakleys' interpretations with the identification of passive participation, participation by consultation, participation by collaboration and empowerment participation.

Before deciding the best participatory approach to be used along the entire project, the main approaches have been analyzed. These main approaches are the Rapid Rural Appraisal; the Participatory Rural Appraisal; the Participatory Poverty Assessment; the Appreciative Inquire; the Analytic Deliberative Approach; and the Community Based Adaptation.

Two approaches have been chosen according to the PhD project characteristics and are presented below.

Appreciative Inquiry

This method analyses the fact that in a discussion one tends to focus on the question asked and so to direct the attention to a particular single direction. Also, the Appreciative Inquire (AI) assumes that consultation activities are based on the deficiency model, where actors aim at questioning problems in order to find concrete solutions (Cooperrider et al., 1995).

The AI contemplates five core principles: the constructionist principle; the simultaneity principle; the poetic principle; the anticipatory principle and the

positive principle. The main characteristics of these principles aim at analyzing participation with specific perspectives, such as the fact that one tends to identify truthfulness with believes determining our actions, hence our future relationships. Also, the questions posed tend to regulate future actions, since the redundancy of similar questions implies they are relevant so that can determine future policies. AI tends to stimulate the debate with new ideas helping generating actions, so that what one does today is governed by the image one has of the future. Communication and language are also important in AI, since words invoke particular sentiments and are representative and connotative of a community and their needs. In fact, as analyzed by Goffman (1955), communication is the combination and representation of a group of individuals where a director operates to manage interrelations. Hence, it is important not only to find the right linguistic register but also to bond relationships among participants with sentiments of hope and cooperation, to avoid conflicts and start the onset of changes.

Analytic Deliberative Approach

The Analytic Deliberative Approach is another method used to foster citizen participation to enable environmental policy making and risk management to be more democratic and compelling (Stern and Fineberg, 1996).

In particular, this model helps accomplishing integrated options for strategic and long-term development policies, especially with regard to environment assessment. It also contemplates the necessity of a combination of assessment and dialogue with stakeholders. In fact, managers and decision-makers should find fair and useful tools, to ensure the incorporation of public preferences and inputs into the management process ant technical assessments.

Moreover, a deliberative approach should refer to interactive communication and discussion assuming that the position and roles of participants, as well as political influences must be regarded as non-influential. On the contrary, the importance is stressed more on the weight of the topic proposed and the guarantee of the equal balance among participants and consultations. Also, in an analytic-deliberative approach the representation of the widest viewpoints and opinions is not mandatory since the focus is more on topics

In line with the two analyzed approaches, which have been selected to promote participation along the project, another instrument used for participation elaborated

to enhance inner development was based on standardized methodologies, such as the EASW (European Awareness Scenario Workshop).

The EASW system, which has been elaborate in Denmark, aims at promoting debate, communication and democratic participation among different groups and levels of stakeholders. This system has been firstly used in environmental settings and in 1994 has become integral part of European Commission initiatives. Concretely, EASW system articulates on different and fixed stages where participants should be around 24-28 units composed by citizens, public administrators, technology experts and representatives from the private sector.

Overall, the participation process should take into account the main objectives, giving innovative feedbacks evaluating possible impacts, while suggesting mitigation strategies and monitoring the suggestions made.

Adequate timing should be allocated to the consultation procedure, in order to give access to a broader number of stakeholders.

Thus, four levels of participation have been established:

- Information level: this type of participation is generated throughout media support and with the gathering of public comments; it is a first step of sharing of information, but it contemplates a lack in direct elaboration in the decision-making process.
- Consultation level: this kind of participation is made by public consultation and meetings. At this level, the public is more integrated but not actively involved in the decision-making process.
- Participatory Planning level: the participation in guaranteed trough consultative bodies and ad hoc working groups so that the public can participate in a dynamic and more proactive way.
- Delegated planning level: this last level of participation is made through commissions, delegated and working group which assist and represent the willing of the public having a more decisive role in the decision-making process (e.g. through lobbying activities).

Participative process could be also planned as a social research activity (Durkheim, 1969) and be analyzed according to three mains different perspectives and through the support of ad hoc tools.

The main methodologies to be foreseen are:

- Distributive: this technique contemplates the knowledge of objective attitude, information, data from which it is possible to deduce conclusions about the objective of the study. The reality is distributed and possible to quantify trough statistical analysis. The information obtained is descriptive and objective. The main tools used are Questionnaires Q/A, opinion surveys and interviews.
- Structural: this methodology aims at achieving a subjective knowledge of reality and the main tool used is the analysis of the conversation. With this technique, concepts and ideas are more relevant than the representativeness of the sample analyzed.
- Dialectical: this technique supposes the acquisition of information through the interaction between participants so that the tool used is related to the assembly system (e.g. workshops, meetings, etc.). Dialogue and active participation can differ according to the objectives, but the result is to aim at achieving consensus while also assuming dissent among actors, in order to get more knowledge on an analyzed subject (Xavier Sabate i Rotes, 2008).

The active involvement of stakeholders in the decision-making process is crucial for a dynamic cooperation. The participation of stakeholders should be accompanied by the strengthening of local author cities having the delicate role of taking decisions in complex and conflicting environments.

Local authorities become key players in this challenging and objective-related process, while the active participation of stakeholders is a prerequisite for ensuring the sustainability of the policies discussed and adopted. Moreover, the variety of principles, which rely to participation and to public governance at local levels, are fundamental for achieving sustainable development also at the community level.

In particular, the main principles are related to the concepts of two main methodologies: the “Stakeholder Engagement” and the “Lifecycle of Enterprise”.

With regard to participation techniques, public governance should be regarded as a community system in which different actors and forces interact for the development of the society.

In fact, it is an instrument and a paradigm for increasing the value of the Social Capital, with its complex relationships of trust and cooperation operating within civil society networks and between groups, organizations and governments.

Moreover, the changing needs of public administrations are mainly linked to the increase of complexity in the functions between public and private services. The complexity of the decision-making process and the overall interests, together with demands and expectations of the various actors implied in the model, make the public governance a difficult system to be automatically replicated in every territorial community system.

According to the main definitions of the concept of local governance, five core principles have been elaborated to implement and make the model easily replicable and adapted to every peculiar territory: Openness; Participation; Responsibility; Efficiency; Coherence.

Table 1 summarizes the components for an efficient and inclusive governance, which can be analyzed and resumed in three fundamental components to be achieved as a result:

Internal Governance	Set of models, methodologies and tools (i.e. planning, programming, evaluation and control), which aim at guiding the administrative system towards strategic and result-oriented goals, considering the overall good functioning of different areas constituting an Entity
External Governance	Set of models, methodologies and tools, which aim at guiding decisions on outsourcing of public services and promoting the integration of instrumental bodies and agencies within the in-house system.
Institutional Governance	Set of models, methodologies and tools which aim at guiding and facilitating the cooperation and synergy, not only among the institutional actors not

	bounded by hierarchical relationships, but also between them and the civil society, with the aim of improving coordination and integration of resources and expertise in the designing and implementation of policies and related programs and projects.

Table 1. The principles of the good governance. Source: personal elaboration

1.3 Communication and networking activities

The interaction between participants to the project and with other stakeholders was a sort of development process itself, where the community members and stakeholders assumed the role of development communicators along that process (Bessette, 2004).

In this context, "Participatory Development Communication" has been performed to enhance community participation in project initiatives, which are further showcased in this chapter.

The active participation not only of companies, academia, institutions, decision-makers but also of end-users has been reinforced trough specific communication methodologies. In fact, communication should be chosen, analyzed and shaped accordingly to the characteristics of the subjects involved in the process.

Hence, it is crucial to use specific communication registers to help building up active participation, especially with regard to content transfer and information in research topics.

In particular, the Social Networks Theory or Social Network Analysis (SNA), has been used to shape methodologies for project communication.

In fact, the Social Network Analysis should be considered when analyzing the participation process and, according to the founder of sociometry Jacob Levi Moreno, it represents a solid methodology of the analysis of social interrelations and the tools used to nurture them.

The society is there explored as a network of different degrees of interrelations where each individual interacts with other actors shaping or modifying the behavior of other social participants. The different actors have "ties" between each other linking individuals as they were dynamic "nodes" in a forceful environment (Scott, 2012). To analyze social networks, the SNA utilizes methods that differ from sociology, as statistics and linear algebra, together with more contemporary sociology-related methods. SNA tends to demonstrate that social networks influence collective behavior. In fact, SNA aims at discovering structures of relationships according to scheme-system-based approaches and determine original conditions, while observing consequent actions.

In addition, the use of social media has been secured especially through the creation of the PhD project website and the management of the contents: https://marcheambiente.unicam.it/, which enhanced the project results' visibility in addition to active participation in events, webinars and conferences that will be further presented in chapter 5.

Chapter 2. The agri-food policy framework, companies involved, climate change and circular economy.

2.1 Agri-food frameworks

This second chapter explores current policies related to the topics relevant to the project area of research and presents the companies, which expressed interest in participating in the PhD project. In fact, the companies have been invited by UNICAM and the Cluster in a first stage and have increased in their number during the implementation of the project, always on voluntary basis.

At the European level the main policy frameworks of reference used to assess priority needs for the research on agri-food sectors are the Common Agricultural

Policy (CAP and the Common Fisheries Policy (CFP), while at the national level is the new National Recovery Plan and Resilience (PNRR) when dealing with sustainability and innovation in agri-food.

It is noteworthy to mention that in February 2022 Italy has inserted the environmental protection in its Constitution Charter (articles 9 and 41).

This is a crucial step towards sustainability, socio, economic and environmental protection.

Article 9 is already part of the fundamental principles of the constitution, it contains the protection of the landscape and the historical and artistic heritage of the nation, but with the reform, such protection extends to the environment, biodiversity, ecosystems and animals. The amendment to article 41, on the other hand, establishes that health and environment are paradigms to be protected by the economy, as well as safety, freedom and human dignity. Moreover, institutions can direct public and private economic initiative towards social and environmental ends. This point is crucial in addressing also investments and funds in the agri-food sector at national and regional levels and new opportunities will arise.

Italy has one of the highest biodiversity rate in Europe and in the world, and is the European country with the largest number of agri-food products having labels of designation of origin and geographical indication recognized by the European Union. In particular, the "System of Geographical Indications" of the European Union favors the production system and local economies; protects the environment, the territory and its ecosystems and biodiversity; supports the social cohesion and traditions of communities; and ensure prosperity of local economies.

The adoption of quality labels (e.g. DOP, IGP, Qualità Marche (QM), Prodotto di Montagna, etc) provide consumers with quality and traceability guarantees of food safety.

2.2 Agri-food companies in the PhD project

The national and international topics identified as core policies to be enhanced by regional agri-food companies are the circular economy, agroecology and climate change due to the growing interest of national and international players and of the entire scientific community, and as well as of consumers and end-users.

The identified companies, which joined the project, have been involved through a participatory approach and with proactive involvement in meetings, webinars and communication activities. At the end of the three-years, the companies of the Crater area joining both the project and the Cluster Agrifood Marche, passed from two to nine (+350%).

All these companies fully represent the various elements of the agri-food system and thus have been defined as a "living food basket".

The companies are: Arca, Azienda Agricola Di Mulo, Azienda Agricola San Michele Arcangelo, Azienda Agricola Montemonaco, Borgo Paglianetto, Cooperlat Tre Valli, Isea Agroservice, Mulini & Pastifici 1875 and Troticultura Cherubini. These are all micro- and small-sized companies except from Cooperlat Tre Valli and Isea Agroservice, which can be considered medium-sized ones.

While shaping and organizing development strategies and promotion of these companies, particular interest was given to natural factors and agronomic practices, local knowledge, innovation, socio-economic return, promotion and capitalization of best practices, support in the transition process towards more sustainable agriculture through territorial cohesion, which was promoted as part of the doctorate.

The inner characteristics of the above-mentioned companies are herein presented:

Arca (https://www.arca.bio)

Arca was funded in 1988 and developed in a second run in 2015 thanks to a visionary food and agriculture entrepreneur, who started a new concept of regeneration of soils and agricultural heritage. It lays on the central role of environmental sustainability, communities, economic, social, cultural and bioethical concepts linked to agriculture. In 2016 ARCA Srl was born, one of the first Benefit Companies in Italy. The cultural legacy the associate founders of ARCA take inspiration from is the one of the old endemic model of the multi-purpose farmhouse, archetype of the circular economy, when agriculture and environment were in perfect harmony. Arca cares for the land, guaranteeing the

absence of waste and the re-use of the resources in a fragile hilly context, respecting the time, the seasonability and the good regenerative practices.

Azienda Agricola Di Mulo, Angolo di Paradiso (http://www.angolodiparadiso.eu/azienda/)

Angolo di Paradiso produces dairy products in the Sibillini Mountains National Park, which is a protected natural area. The cows are raised with climate-smart agriculture practices and their well-being is secured through sustainable methods. In particular, the animals are breeded without use of pesticides in the feeds, avoiding the use of antibiotics, milking animals with stress-limiting systems and avoiding the separation of calves from cow. The firm pertains to a mountain territory and was the first companies in the Marche Region receiving the mountain label "Prodotto di Montagna". It has around 50 cows, which raised in free housing and are free to move along the entire structure. The bunks on which they lie down are made of a natural virgin rubber mattress. The shelter facilities are designed in such a way as to promote air circulation, keep dust levels low and ensure harmless levels of relative humidity and gas concentration. Inside the stable there is also a massage station consisting of a rotating brush and a cooling brush, active only in the warm months, consisting of several water showers. The mats on which the cows lie down are scraped every morning to eliminate any faeces and, once a week, the terminal part of the cubicles is sprinkled with a natural powder with absorbing power in such a way as to minimize humidity and avoid bacterial growth. All the walkways are equipped with automatic scrapers that are activated morning and evening. All these precautions are strictly necessary to first preserve the health of the animals and then the healthiness and quality ofraw material (milk).

Azienda Agricola San Michele Arcangelo
(https://www.agricolasanmichele.org/it)

The company is an organic firm of over forty-eight hectares of aromatic clods, with production of vegetables, fruits and wine. It is possible to directly buy fresh products, and the supply chain closes when a part of the crops is transformed by hand, in the internal laboratory, into products that bear the I.C.E.A. and VEGANOK labels. The productions are based on traditional methods requiring adequate times to reach high quality standards.

Azienda Agricola Montemonaco (https://montemonaco.bio/filiera/)

The company produces 100% organic legumes pasta in the Marche side of the Sibillini Mountains National Park, immersed in pure air and using mountain water. It guarantees a traced supply chain from seed to package with blockchain technology and using compostable packaging.
The grinding takes place so that the flour that arrives at the factory can be transformed into pasta with the sole addition of mountain water. The formats of pasta pass through the bronze dies proceeding at low pressure and are then slowly dried at a low temperature. The pasta is portioned and packaged in compostable bags. All the production process takes place with the least number of steps, so much so that they can be counted on the fingers of one hand.

Borgo Paglianetto (https://www.borgopaglianetto.com/azienda)

The Borgo Paglianetto organic winery is located in the heart of the Marche region, in the valley that extends between Fabriano and Camerino. Located in the heart of the production area of Verdicchio di Matelica Doc and Docg. Here the vine represents part of the millenary culture of Matelica. The company was born in 2008 and has 25 hectares in the Alta Valle dell'Esino, representing the only case in the Marche for the unusual north-south orientation, a determining factor for the creation of that particular microclimate that allows the cultivation of grapes of the highest quality. The company certifies not only the grapes but also all the winemaking and cellar processes as organic: the constant search for the quality of the environment is reflected in the quality of the wine being the expression of the territory.

Cooperlat Tre Valli (https://www.trevalli.cooperlat.it/)

The company is a milk plant created in 1985, with the aim of providing consumers with a safe, quality product, subjected to all the necessary checks provided by the Hygiene Office, and then distributed widely. It has been developed by a group of cooperators who had the intuition to create a new company, through a process of aggregation of small dairies and numerous breeders, scattered and fragmented throughout the Marche region, later becoming one of the most important Italian companies in the sector. Trevalli Cooperlat has strong cooperative and social values, and pursues with attention and the utmost professionalism a culture aimed

at developing new product concepts, combining technological innovation and tradition, maintaining and developing a level of excellence in all phases of the supply chain, helping to support a cooperative system of Italian milk through the aggregation of companies, the enhancement of the territory, of people and the creation of shared value of social sustainability. As evidence of the attention to the total quality of its products and production processes, it has acquired numerous national and international certifications, which are regularly renewed according to the most up-to-date safety, environmental and quality standards.

Isea Agroservice (https://www.agroservicespa.it/)

Agroservice is a business reality specialised in research, production and commercialisation of agricultural seeds. Created over 25 years ago, its success is the outcome of a strong credo upholding research as the crucial element, thus offering a vast range of seed-products that blend certified quality with innovation. The company is a leader in the field of scientific research in terms of new plant varieties that better adapt to the needs of agriculturists and transformation industry and to climate change adaptation strategies. In addition to traceability models it has chosen to subscribe to Filiera Agricola Biologica Marche (Bio-Agricultural Crop-growers of the region Marche) through the brand FAB Marche to support the implementation of bio-seeds.

Mulini & Pastifici 1875 (https://muliniepastifici1875.com/site/mulini-pastifici/)

Mulini e Pastifici 1875 was born from the union of different professional experiences in 2014, whose goal was to enhance the work carried out at the beginning of the twentieth century by the Marches geneticist Nazareno Strampelli who selected the variety, well known today, of wheat "Senatore Cappelli ". The company pursues the sustainable agriculture model based on respect and enhancement of the territory and of mankind. Their production focuses on organic pasta and beer deriving from ancient grains that can be found in the Marche region. One of the distinctive elements is to certify all stages of processing and production and to ensure that they are carried out in the same plant, with the help of technology to ensure greater conservation and attention to the health of producers and consumers. The factory today has the size of 8000 square meters on a land of three hectares. For the production of flour, semolina, pasta or beer, the company does not

use any type of chemical product from the first phase to the final one. The storage system is also innovative, based on air-conditioned steel silos (called “bigbags”). Thanks to the use of the latter, the proliferation of bacteria, molds, parasites and toxins is completely eliminated. The company also developed a system to use renewable energy and promoting the Km0 policy.

Troticoltura Cherubini (https://www.troticolturacherubini.it/)

The Cherubini Trout Farm was born in Visso in 1950, a historic town located in the heart of the Sibillini National Park, in an unspoiled valley, on the border between Marche and Umbria, at about 650 meters above sea level and a few steps from the source of the Nera river. There are two main plants using river water in which the entire reproductive cycle of the trout is covered, the hatchery in which the first phase takes place, namely the hatching, in incubators, of the embryonated eggs. Once they have reached the size of a few centimeters, they are transferred to external tanks of greater volume, to then be relocated again to the plant further downstream, the fattening plant. The latter consists of about a hundred total tanks containing trout of various sizes with peaks that reach 12-13 kilograms, for a total production of several tons. Normally this breeding cycle takes place within two years under strict health checks throughout the supply chain that seek the well-being of the trout in the breeding phase and in its feeding, for the safety and guarantee of the product.

2.3 Circular Economy

Circular Economy is an approach that European countries (e.g. France) have applied since last decades. Only in recent years it is gaining increasing attention in Italy, even though historically our nation is one of the most virtuous in recycling and valorizing products and materials, due to the fact that it lacks in raw materials. At the European and national levels policies and funds aim at providing an alternative system to the dominant linear economic model (Ghisellini et al., 2016) by promoting the circular model, in order to achieve sustainability in line with the 17 Sustainable Development Goals (SDGs) adopted by the United Nations in 2015 within the Sustainable Development Agenda 2030.

Circular economy is especially promoted by the European Union (Geissdoerfer et al., 2017; Korhonen et al., 2018) to enhance member states' competitiveness, secure businesses against shortage of resources and providing with new job opportunities and innovative markets (European Commission, 2015).

Since circular economy applies to various and varied contexts (e.g. wastes, bioenergy, eco-design, nutraceuticals, etc.), a unique definition does not apply for all. Among the main accepted definitions of circular economy figure:

1) The '3R' principles of Reduction, Reuse, and Recycling of materials and energy.

2) The circular economy represents an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models (Ellen MacArthur Foundation, 2012).

3) Circular economy is about decoupling growth from resource consumption. It is about designing products [that] are easier to reuse or recycle (Dupont-Inglis, 2015).

4) Circular economy is a closed loop material flow in the whole economic system, in association with the so called 3R principles. Taking into account economic aspects, it minimizes matter without restricting economic growth (Lieder and Rashid, 2016).

But probably the most used definition is the one provided by the European Parliament:

5) Circular economy is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended. It is opposed to the traditional, linear economic model, which is based on the linear paradigm of "take-make-use-dispose pattern" (Figure 2).

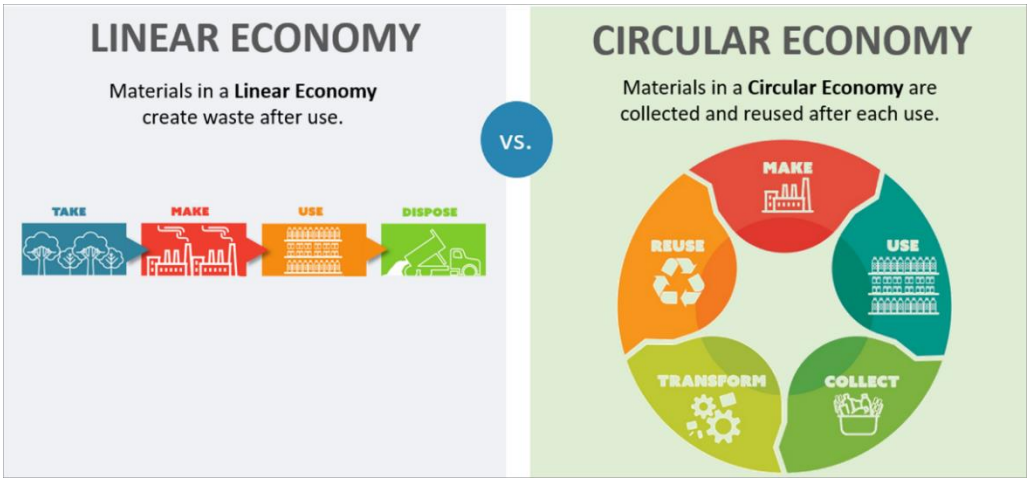


Figure 2. Linear vs Circular Economy systems. Source: Hi-cone, 2022

The concept of circular economy is always related to the definition of the sustainability of an entire economic process. Therefore, the two terms "circularity" and "sustainability" are not synonyms since circular economy is a system aiming at reducing resources and wastes, while limiting greenhouse gas emissions (GHGs) by closing the production loops from a cradle-to-grave approach. On the other hand, sustainability is a "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Report, 1987) and encompasses three pillars (social, economic and environmental).

The bioeconomy concept is one of the core asset of the circular economy, since by definition bioeconomy is "an economy where the basic building blocks for materials, chemicals and energy are derived from renewable biological resources" (McCormick & Kautto, 2013).

With regard to the regulation framework of circular economy, the European Union disclosed in 2015 the publication of the first Circular Economy Action Plan that paved the way to give a new boost to jobs, growth and investment and to develop a carbon neutral, resource-efficient and competitive economy.

The Action Plan set out a policy framework that builds on and integrates existing policies and legal instruments, while helping member states in the transition to a more resilient system in line with SDGs (i.e. SDG 12 Sustainable Consumption and Production).

Some priority areas were identified in 2015 and continue to be added according to increasing challenges (e.g. plastics, food waste and food loss, critical raw materials, bio-based product, etc), and for each area a set of objectives were defined.

Additional steps toward resilience and sustainability were made in March 2017 when the European Circular Economy Stakeholder Platform (ECESP) was launched with a joint initiative by the European Commission and the European Economic and Social Committee (EESC). The Platform has been conceived to exchange knowledge, ideas and information and to capitalize best practices.

In addition, in December 2019 the European Commission launched the new European Green Deal with the aim of reorienting policies and transforming Europe into a fair and prosperous society, with a modern, resource-efficient and competitive economy, where economic growth do not impoverish natural resources. The European Green Deal sets out new important objectives in terms of circularity, and provides with funds and innovation for the creation of jobs. In addition to circular economy, one of the core policies of the Green Deal is the so called "Farm to Fork Strategy" (F2F) [4], which allocates specific funds to address the challenges of food security and sustainability of the agri-food systems. In fact, the agri-food sector itself is the second source of greenhouse gas emissions (IPCC, 2019) and the transition to a sustainable food system is required in terms of climate change mitigation and adaptation strategies. In order to ensure a sustainable production, new green business models should be developed, and the circular economy has a great potential for the farmers and the industry. The F2F strategy aims at increasing the use of the renewable energy obtained from agricultural and waste residues, promoting sustainable and socially responsible production methods and circular business models in food processing and retail (e.g. for Small and Medium Enterprises – SMEs), increasing the organic production up to 25% among others.

In addition, a New Circular Economy Action Plan (CEAP) was released by the EU in March 2020 to consistently reaffirm the need of implementing circular economy application, especially in the eco-design of new products. In fact, it is easier to fully recycle a product that has been conceived to be reused/recycled. Growing attention is given also to consumers and their power in the decision-making process and to

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52020DC0381

the important role also of urban areas (e.g. for ecological corridors, urban farming, etc).

The priority areas have been enlarged and are: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; water and nutrients) Among the main policies figure:

- food waste reduction (strictly connected with the F2F Strategy);
- reusable single-use packaging, tableware and cutlery in food services;
- facilitating water reuse and water efficiency along the entire food value chain;
- developing an Integrated Nutrient Management Plan, to stimulate the markets for recovered nutrients;
- reviewing directives on wastewater treatment and sewage sludge.

In Italy circular economy is growing attention and also the new *Piano di Ripresa e Resilienza* (PNRR) allocates funds for the transition.

The Decree Law 31 May 2021, n. 77, approved by the government and entrusted to the Chamber for conversion (joint commissions for Constitutional Affairs and Environment, dl 3146) specifically dedicates two articles to the circular economy: art. 34 (Termination of the qualification of waste) and art. 35 (Simplification measures for the promotion of the circular economy).

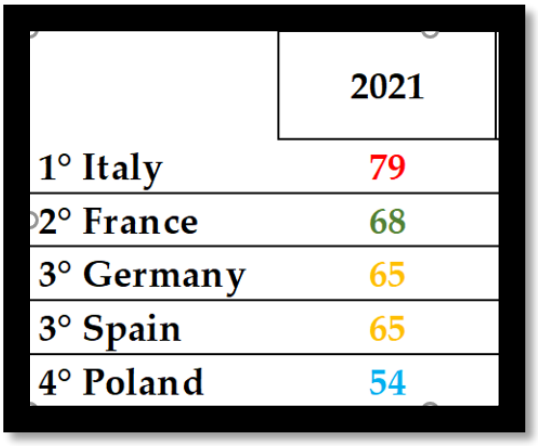
Italy is currently adopting the European directives coming from the Action Plan through a serie of Decree Law (*Decreti Ministeriali)*. The first Law on sustainability and environment protection adopted in Italy was the Law n. 221 of 28 December 2015, the so-called "*Collegato Ambientale*" through which it has put in place some actions aimed at promoting the circular economy (*Decreto Ministeriale n.152 del 26 maggio 2016; Decreto Ministerialen. 140 del 10 giugno 2016, n.140; Legge n. 166 del 19 agosto 2016; Decreto Ministeriale n. 264 del 13 ottobre 2016; Decreto Ministeriale n. 266 del 29 dicembre 2016; Decreto Ministeriale 15 febbraio 2017; Decreto Ministeriale del 20 aprile 2017*).

In 2017, the Bioeconomy Strategy of the European Commission[5] was approved and in 2018 was launched the Italian Circular Economy Stakeholder Platform (ICESP).

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0673&rid=10

Every year the Italian Network for Circular Economy prepares a Report based on the application of the circular index[6]. It is noteworthy to mention the fact that since the first annual report Italy ranks first among other member states for circularity in Europe (Circular Economy Network, 2021).

Figure 3. Circular economy performance index for 2021 (Source: Circular Economy Network Report)



	2021
1° Italy	79
2° France	68
3° Germany	65
3° Spain	65
4° Poland	54

In particular, in Italy the total rate of recycling is 68% when in EU is 57% and the rate of recycling of raw materials is equal to 19.3% when in EU is 11.9% (Circular Economy Network Report, 2021). In 2021, the Report focused on how circular economy contributes to fight climate change. In particular, according to the Circularity Gap Report 2021 of the Circle Economy, which measures the circularity of the world economy, by doubling the current circularity rate from 8.6% to 17%, the consumption of materials can be reduced from the current 100 to 79 gigatons and global greenhouse gas emissions cut by 39% per year.

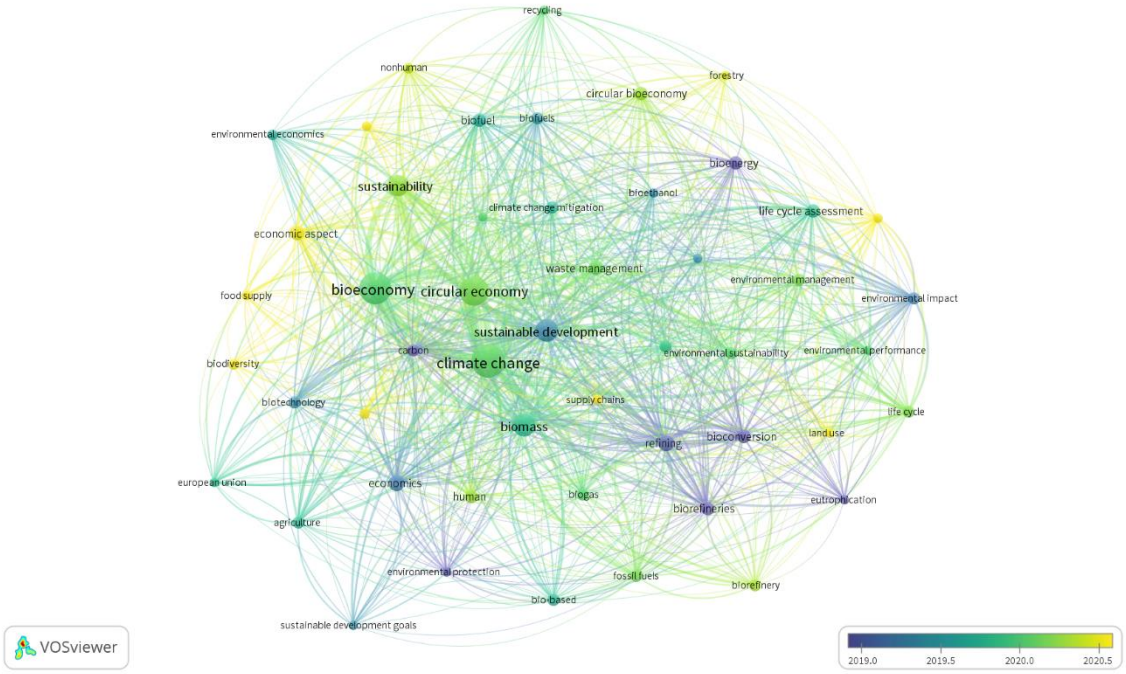
An analysis on lexical terms appearing in the text of the new PNRR from a lexical approach, was undertaken and was useful in analyzing the current interest of the nation on specific sustainability topics. It revealed that the main terms pertaining to sustainability appears in the text as follow:

[6] Circular index is calculated on: efficient use of resources (water, energy, oil, etc.); use of secondary raw materials (production waste, e.g. plastic); innovation in production categories (efficiency); consumption; waste management

- Digital **587 times**
- Sustainable/Sustainability **183 times**
- Transition **167 times**
- Energy and related terms **197 times**
- Circular **38 times**
- Wastes/recycling **51 times**
- Reuse **6 times**
- ECO-DESIGN **1 time**

A bibliometric analysis has been also undertaken through the use of VOSviewer, which is a data-driven software used to create and visualize maps based on network data. In particular, it was firstly defined a scientific set of articles from Scopus thought three words' search "circular economy"; "climate change"; "bioeconomy". The figure 4 is a visual map based on the occurrence of the main keywords present in such selected set of scientific documents, composed of 80 main publications from 2018-2022, which allowed to assess current trends related to the three topics.
The dimension of the circles surrounding the word represents the number of times the analyzed keywords appear in the documents and their relatedness is connected with the number of documents where such words appear together, while the lines represent the link between keywords. A total of 50 items (words) have been identified, when the minimum occurrence of words to be visualized is 5.

Figure 4: Network visualization of keyword items



2.4 Climate Change in the context of the agri-food system

The urgency to act on climate change impacts on agri-food systems[7] has never been clearer as in last decades. Agri-food systems must become more resilient to the current and future impacts of climate change through transformative and system-changing adaptation actions. Furthermore, the recent IPCC reports (the Special Report of Global Warming of 1,5°C and AR6 Climate Change 2021: The Physical Science Basis) and major international treaties, such as the Paris Agreement and its Enhanced Transparency Framework (ETF) under the United Nations Framework Convention on Climate Change (UNFCCC) call for holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial

[7] Agri-food system covers the journey of food (for example, cereals, vegetables, fish, fruits and livestock) from farm to table – including when it is grown, harvested, processed, packaged, transported, distributed, traded, bought, prepared, eaten and disposed of. It also encompasses non-food products (for example forestry, animal rearing, use of feedstock, biomass to produce biofuels, and fibres) that also constitute livelihoods and all of the people as well as the activities, investments and choices that play a part in getting us these food and agricultural products (FAO 42nd Conference document 2021/28 available at https://www.fao.org/3/nf243en/nf243en.pdf).

levels. Thereby rapid, deep and sustained reductions in global greenhouse gas (GHG) emissions are required.

Game-changing climate action at global, regional, national and local levels in agri-food systems is fundamental, while addressing also other environmental, social and economic concerns. Agri-food systems are sustainable, inclusive, resilient and adaptive to climate change and its impacts and contribute to low-emission and circular economies, while providing sufficient, safe and nutritious food for healthy diets, and other agricultural products and services for present and future generations, leaving no-one behind. It is noteworthy to mention the fact that the agri-food systems is the second source of GHG emissions worldwide but, if managed in a sustainable way, could turn to be a cause to become a solution to climate change.

With the number of people facing hunger reaching 811 million in 2020 (FAO, IFAD, UNICEF, WFP and WHO, 2021), and the already tangible impact of climate change and extreme weather events on food security, nutrition and poverty, the urgency to address climate change has significantly increased. The food security and nutrition challenges have further grown with the COVID-19 pandemic and related containment measures. Projections indicate that hunger will not be eradicated by 2030 unless bold actions are taken to accelerate progress, especially to address inequality in access to safe and nutritious food for healthy diets while vigorously addressing climate resilience, adaptation and mitigation.

The 2030 Agenda and its Sustainable Development Goals (SDG) set a universally agreed development pathway. The Decade of Action to deliver the SDGs calls for accelerated solutions to the world's biggest and often intertwined challenges, ranging from poverty and hunger to inequality, climate change and loss of biodiversity and desertification. The UN Secretary General's report 'Our Common Agenda' (UN, 2021)outlines agri-food systems' transformation as a key action area, while the UN Food Systems Summit (FSS), that convened in September 2021, set the stage for global food systems transformation to achieve the Sustainable Development Goals by 2030.

The main documents of reference for the climate change strategy at the international level are based on the three dimensions of sustainable development and shared goals and cooperation towards the 2030 Agenda for Sustainable Development, the

Addis Ababa Action Agenda (UN, 2015) the Rio Declaration on Environment and Development, including their principles, as relevant, the Paris Agreement on Climate Change, including Article 2.1 and 2.2 and the relevant paragraphs of the Glasgow Climate Pact. [8]

To respond to the growing short- and long-term climate, food security, nutrition and poverty challenges while considering also other environmental concerns, including loss of biodiversity, soil erosion and unsustainable use of natural resources, the project facilitated actions at country and local levels, addressing the climate risk and vulnerabilities and drivers of climate change, by opening new pathways for adaptation, climate-resilient and low-emission solutions. Due to many interconnections, climate change cannot be dealt with in isolation but in an integrative way to achieve co-benefits and address trade-offs in other key environmental areas and sustainable socio-economic development. In particular, the Marche Region experiences high rates of soil erosion in line with the national trend, which is one of the highest at the European level. But soil erosion and biodiversity loss have consequences also at the economic level, since, according to ISPRA, more than 1 billion of euro are directly lost every year sue to the loss in the capacity of soils to carbon stock and sequestration (Rapporto di consumo suolo, ISPRA, 2021).

Therefore, it is important to tailoring of climate action in agri-food systems to different contexts, covering rural, peri-urban and urban areas and supporting countries in designing, revising and implementing their country-driven commitments and plans, including Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs), Nationally Appropriated Mitigation Actions (NAMAs), Long-Term Low Greenhouse Gas Emission Development Strategies (LTS), Disaster Risk Reduction plans (DRR Plans) and related targets and commitments in agri-food systems. Moreover, it considers different dimensions of risk, including the risk of non-acting, systemic risks, climate and environmental risk reduction, the specific needs and capacities of people and communities exposed and

[8] Including 1/CP.26 paragraphs 5 and 6 and 1/CMA.3 paragraphs 6 and 7 of the Glasgow Climate Pact decisions, and 1/CP.26 paragraphs 17 and 18 and 1/CMA.3 paragraphs 22 and 23 from the Glasgow Climate Pact CMA decisions

in vulnerable situations, and integrating climate risk management and resilience (Crumpler K. et al., 2021).

Climate Change is a global threat to food security and nutrition and has consequences declined from the global to the local level.

2.5 The latest scientific evidence on climate change

IPCC's Sixth Assessment Report Climate Change 2021: The Physical Science Basis (IPCC, 2021) confirms the unequivocal, unprecedented and irreversible trends of current and future climate risks the planet is facing. The report reveals that impacts of climate change, ranging from heatwaves and heavy precipitation to drought, fire weathers and tropical cyclones are projected to intensify. The report further explains that changes in the climate-impact drivers and related risks vary between regions.

These projections require urgent climate risk management and reduction to build resilience through preparatory and anticipatory actions, such as climate risk and vulnerability assessments, multi-hazard early warning systems, climate-proofing infrastructure and risk transfer systems, and related capacity development for climate change adaptation in agri-food systems. Also, longer-term slow onset changes in climate will affect food production and agri-food systems in many ways and require accelerated adaptation action. The IPCC Special Reports (IPCC, 2019), mention longer-term changes in climate, such as an increasing mean temperature, altered seasonality, combined heat and drought stress, inconsistency in wet season arrival time, heavy rain events, water stress, changes in the occurrence of pests and diseases, and ocean acidification that will have impacts on crop and livestock production, forestry, fisheries, aquaculture and related value chains, livelihoods and ecosystems.

According to the IPCC Special Report on Climate Change and Land (IPCC,2019), forests play a manifold role in relation to climate change, including buffering risks caused by climate change impacts. Changes in forest cover, for example from afforestation, reforestation and deforestation, directly affect regional surface temperature through exchanges of water and energy. Moreover, forests protect

coastal areas and are sources of renewable materials and energy that substitute non-renewable ones, hence contributing to bioeconomy.

The Special Report on Climate Change and Land also reveals that 21-37 percent of total greenhouse gas (GHG) emissions could be attributed to the food system. These are from production, processing, distribution, preparation, and consumption of food, including food loss and waste. Given the diversity of food systems, there are large regional differences in the contributions from different components of the food system. Carbon sequestration, reductions in GHG emissions and emissions intensity in the agriculture, forestry and other land use (AFOLU) sector and agri-food systems are needed for holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels and complying with the UNFCCC Paris Agreement.

Meanwhile, some land-related actions are already being taken that contribute to climate change adaptation, mitigation and sustainable development. These actions include but are not limited to sustainable food production, sustainable forest management, reduced deforestation and forest degradation, soil organic carbon management, ecosystem conservation and restoration, and reduced food loss and waste. Some climate response options, including the conservation of high-carbon ecosystems such as peatlands, wetlands, rangelands, mangroves and forests, have immediate impacts. Examples that take more time to deliver but provide multiple ecosystem services and functions include afforestation and reforestation as well as the restoration of high-carbon ecosystems, agroforestry, and the reclamation of degraded soils. As indicated in the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate (2019), human communities in close connection with coastal environments, small islands (including Small Island Developing States, SIDS), polar areas and high mountains are particularly exposed to ocean and cryosphere change and related impacts, such as ocean acidification, sea level rise, extreme sea level, shrinking cryosphere and permafrost thaw. Many marine species have already undergone shifts in geographical range and seasonal activities in response to ocean warming, sea ice change and biogeochemical changes to their habitats. This has resulted in shifts in species composition, abundance and biomass production of ecosystems, from the equator to the poles. In many regions, declines

in fish and shellfish stocks due to direct and indirect effects of global warming and biogeochemical changes have already contributed to reduced fisheries catches.
The Glasgow Climate Pact (2021) noted with serious concern the findings from the IPCC Sixth Assessment Report, including that climate and weather extremes and their adverse impacts on people and nature will continue to increase with every additional increment of rising temperatures.

2.6 Agri-food systems and climate change

Agri-food systems already face the challenge of sustainability providing sufficient, accessible, affordable, safe and nutritious food that contributes to healthy diets, other raw materials, processed products and services to a growing and urbanizing global population. At the same time, agri-food systems and related livelihoods are affected in the short- and longer-term by the intertwined impact of degrading ecosystems, biodiversity loss and climate change, as well as competition over access to natural resources. Climate change, along with other drivers, is already undermining the recent progress made in promoting sustainable rural livelihoods and fighting against hunger and the triple burden of malnutrition. The increasing frequency of weather extremes as part of climate change poses multiple challenges: they increase risk, affect all dimensions of food security and nutrition: availability, access, utilization and stability, and add pressure on land and water resources and fragile agri-food systems and ecosystems (FAO, IFAD, UNICEF, WFP and WHO, 2021).
Allowing agri-food systems actors to continue producing, processing, marketing, and consuming food and providing other products and services requires a range of efficient climate resilience and adaptation actions built on healthy ecosystems and the sustainable use of natural resources. At the same time, agri-food systems are also called to address concerns related to GHG emissions, especially carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).
The shift and disruptions in production potential induced by climate change may also cause changes in the trade of agricultural commodities. Factors shaping the volume and composition of trade include e.g., yields under changing climatic

conditions, changes in the suitability of agricultural land, access to energy and water for irrigation and demand and consumption patterns. In the short-term, by moving food from surplus to deficit areas, trade can be important for addressing production shortfalls due to extreme weather events. Conducive trade policies can also be part of climate change adaptation strategies, as shaping the volume of trade can stabilize regional changes in productivity and food price volatility caused by the changing climate (FAO, 2018).

The need to maintain food production in the face of climate change is a fundamental pillar of the United Nations Framework Convention on Climate Change (UNFCCC). The 2015 Paris Agreement additionally recognizes 'the fundamental priority of safeguarding food security and ending hunger, and the particular vulnerabilities of food production systems to the adverse effects of climate change'. FAO, with its mandate to end hunger and poverty, and enhance the sustainable management of natural resources, is one of the key contributors to achieving this priority. Furthermore, FAO recognizes the multilateral understanding agreed by countries through the Glasgow Climate Pact at the UNFCCC COP 26 to boost efforts in enhancing ambition and action in relation to mitigation, adaptation and finance in order to overcome the challenges of climate change. At COP26, the governments also agreed to continue working on Koronivia Joint Work on Agriculture (KJWA).

Also at the regional level, climate action starts with participatory identification of existing good practices in agri-food systems and jointly creating innovative solutions to climate change with the aim to go beyond business as usual in addressing climate challenges. Calling for close multi-stakeholder collaboration, including science, research and advisory services, these practices and solutions should be tailored to the diverse range of regional, country and community contexts. Moreover, it is key to develop capacities of country and local level agriculture innovation systems and their actors to generate, co-create adapt, disseminate, and adopt innovations.

Science- and evidence-based technological, financial, policy, social and institutional innovations focusing on climate actions are needed across agri-food systems. These solutions often come as packages, e.g., the upscaling of a new technology may require conducive policy and legal frameworks, targeted financing,

closing of the digitalization divide, information and communication technology, social acceptance, and sound governance and institutions. Sometimes the answer may lie in adopting a new approach rather than a single technology, for example, an ecosystem-based, agroecological or climate-smart agriculture approach, as there are a diversity of pathways to promote sustainable agri-food systems. Engaging and exploring Indigenous Peoples' food systems and integrating local and indigenous knowledge and practices with science-based solutions and innovations is also vital. For transforming agri-food systems, policies supported by good governance and appropriate legal and institutional frameworks should lower barriers and stimulate public and private investments, and the adoption of good practices and innovations. A critical look at current policies may be needed, including on their risk to promote incentives that undermine climate and other environmental concerns.

Accelerating agri-food systems transformation calls for innovative financing mechanisms. This requires for example, assessing investment-related risks, and applying appropriate risk-mitigation mechanisms (Limketkai, B et al., 2020). Incentive frameworks and innovative ways of financing climate action need to be explored, including approaches for carbon market and new systems for paying for ecosystems services. These will also require measuring, reporting and verification (MRV) systems, baseline setting and capacity development on the ground. Furthermore, considering and exploring opportunities for blending different types of financing, including grants and credits from public and private origins, insurances and micro-financing may become more feasible.

Recently, more emphasis has been put on behavioural sciences that provide new insights on lowering the barriers and raising the incentives for individuals to take necessary climate action (UN, 2021). Engaging agri-food systems actors from the outset of planning of climate change interventions is needed, to better understand their values, motivations, limitations and competing pressures.

Thereby investments in human capital and capacity development for innovation systems, as well as policies and regulations minimizing such risks are required.

Chapter 3. Analysis of the Marche Region and the inner characteristics of agri-food sectors and companies involved

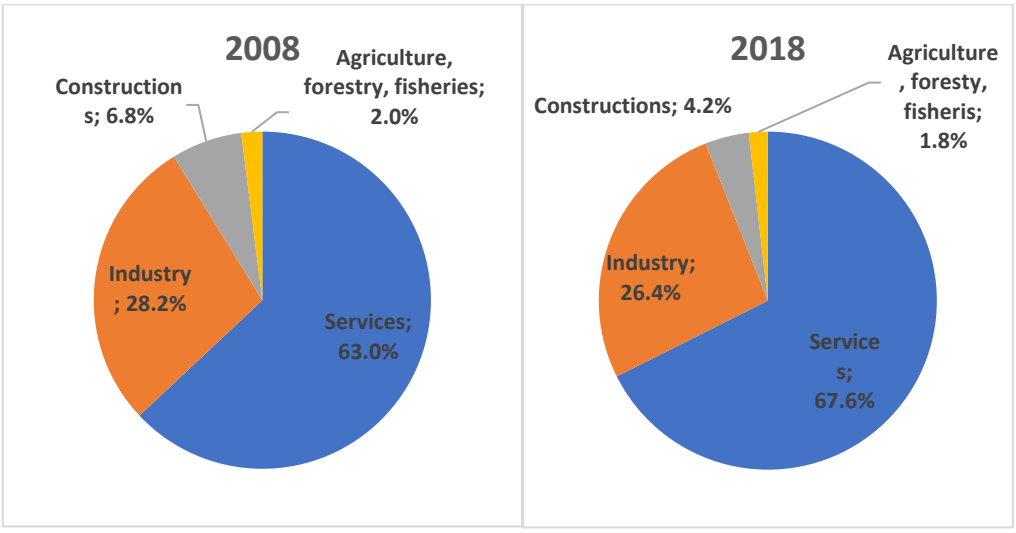
This chapter presents analysis on the Marche territory with attention to its socio-economic and environmental peculiarities by mean of qualitative and quantitative data collection, validation and elaboration.

During the PhD analysis of the companies, participation to meetings and visit to companies have been crucial in the understanding and assessment of the territory through a SWOT (Strength, Weakness, Opportunity, Threat) analysis application.
The Marche Region resulted as a "plural" region already in its name, which is also a sign of the great wealth and rich biodiversity of its territories and, consequently, of its agri-food products.
But this plurality can also be a factor of weakness when not supported by a territorial and entrepreneurial governance that knows how to networking, avoiding that every territory, every food and wine product, remains confined to many niche markets that are not communicating with each other. Only through adequate governance Marche's food and wine can be a single market made up of many local excellences - whether small, medium or large.
A recent photograph of the agri-food sector of the Marche region, especially as regards the statistical data available for the Ateco A sector (agriculture, forestry and fishing), sees a post-Covid-19 situation that is not easy to analyze due to the lack of available and complete statistical data , especially as regards to production and distribution data, while data relating to the demographics of companies result quite exhaustive and updated. The collection and validation of data from the agri-food sector require greater harmonization of the data and more active collaboration at national and regional levels.
A statistical analysis made through the opensource data of the Chamber of Commerce of the Marche was useful to estimate the demography of the agri-food companies in the Region, which will be further presented in Chapter 4.
When analyzing the sector more generally, it generates an added value of 1.8%, compared to other national activities, and counts 2.8% employed in the sector at a

regional level (source Marche Region based on ISTAT processing, years 2018 and 2019).

Concerning the added value of the principle economic macro-sectors in the Region compared to the national dimension, the figure below (figure 5) shows the trends over a 10-year period.

Figure 5: Distribution of the added value by macro-sectors. Years 2008 and 2018. Source: elaboration on "Le Marche in cifre, 2020".



There are 6,783 farms in the region, that are 3.2% of Italian farms, while the Utilized Agricultural Area (UAA) is 471,004 hectares, equal to 3.7% of the national total (ISTAT, 2016).

Among the forms of qualification of excellent products, the European PDO, PGI and TSG certification mark stands out, which are applied for the certification of 38 food and wine products: 16 agri-food products and 21 wines. The Region also has the regional brand "QM-Guaranteed Quality of the Marche", which certifies products and supply chains, to which numerous companies have joined, and the label pf mountain "Prodotto di Montagna", which gives value to such difficult but rich territory.

In detail, in the Marche the products registered as Protected Designation of Origin (PDO) are 26, while the products with Protected Geographical Indication (PGI) are 9 and the products that can be labeled as Traditional Specialty Guaranteed (TSG) are the 3 National TSGs (MiPAAF data, 2019).

The Marche region is rich in agri-food excellence, which are often promoted through tools made available by national and EU legislation.

As regards to the fishing sector and the economy of the sea, the Marche, with 173 km of coastline, has one of the heaviest weights at national level on the regional entrepreneurial fabric with an incidence equal to 4.5% on the economy (Incidence of companies in the marine economy out of the total economy of the region: 4.5%, data source MiPAAF, 2019). The Marche are the third largest navy in Italy and the fleet captures about 11% of the national catch. It is one of the most active regions, even worldwide, in the production and marketing of mussels from mussel farming plants and also has a high Blue Tourism index of + 1.7% (CNR, 2019).

The multiple agri-food activities are declined in the region not only according to the sectors of activity but also according to the pedoclimatic characteristics of the region.

The companies, in fact, carry out their activities in territories which differ in terms of their characteristics, even if interconnected, ranging from the mountains to the hills to the coast. It is extremely important to take this triple aspect into consideration when defining and addressing territorial development policies and interventions, since each individual territory needs specific attention compared to the others.

Furthermore, on all three types of territories mentioned above, due and simultaneous attention must be paid to three productive sectors with numerous overlaps, namely agri-food, environment and tourism, which are interconnected and should become a unicum of the Italian living style (or Made in Italy) as show in Figure 6.

Figure 6: The Made in Italy concept

Community and national policies, relating to the new European programming in the agri-food and environmental sector, with particular reference to the regulatory framework of the 2021-2027 programming of the Common Agricultural Policy (CAP) and the Common Fisheries Policy (PCP), see the implementation of specific support through a defined period of ecological transition in agriculture and particular attention to the "Farm to Fork" approach of the European Green Deal

Particular attention must be paid to producers, especially small businesses and small-scale fisheries, and to the development of rural areas through the simplification and modernization of the instruments to be adopted. The agricultural model needs a paradigm shift and it is important to place the farmer and the fisherman at the center of the change, since they have a key role in the implementation of new resilient agri-food models.

With regard to the agricultural sector, Italy is the third Member State in Europe by number of farms and the fifth by Agricultural Area Used (UAA). The future of agriculture, but also of food, sees the participation of various stakeholders and the involvement of consumers in the transition process towards more resilient agriculture and fishing is also important.

The challenges of the agri-food sector are many and focus, on the one hand, on economic and social development and, on the other, on environmental issues related to the sustainability of the sector and the fight against climate change through adaptation and mitigation strategies. The climatic, economic and health crises have put a strain on the system but have also made it possible to identify potentialities with positive effects on the territory.

The answers that the challenges solicit must be shared between institutions, the agricultural world, trade associations, the world of research and citizens and must always be in line with European programming.

Consumers are increasingly attentive to the quality and sustainability of food and the value of the territory is a driving force for the development of quality local products with a view to human and environmental well-being. Above all following the pandemic, the value of food has also been rediscovered as an instrument of psychophysical well-being, where possible quality and local foods have been preferred. This approach is in line with the current One Health strategy.

It is also appropriate to reassess the ethics of the income of agri-food products, which are increasingly influenced by price fluctuations, due not only to macroeconomic factors and climate change, but also to the pandemic and which affect the sustainability, especially of small producers.

Climate change is a growing problem that needs attention since, even if the agricultural sector is the second source of pollution with the release of greenhouse gases into the atmosphere, it can also be part of the solution through actions and good practices of mitigation and adaptation.

Particular attention must be paid to achieving the Sustainable Development Goals (SDGs) and to sustainable agricultural practices, such as Conservative Agriculture and, more generally, Agroecology, which aims at conserving soil fertility, preserving biodiversity and limiting erosion. In fact, Italy is the first state in Europe for its richness in biodiversity, but also for the erosion index of soils and coasts; therefore the need to increase the resilience of the territory is increasingly urgent. Soil protection must go hand in hand with responsible management of water resources, since water consumption in the agricultural sector of the Mediterranean area can reach more than 60% of the water available for human consumption.

The various opportunities that arise from sustainable approaches in the sector must also be developed from a circular economy perspective, aimed above all at the bioeconomy, the use of renewable energy but also innovation and digitization of the entire agri-food system. As reiterated by the third Annual Report on the circular economy (Circular Economy Network, 2021), in fact, Italy ranks always first in Europe in terms of circularity, demonstrating that it has a great potential especially in the agri-food sector. The Marche is an example of this virtuous approach, with several pilot projects.

In fact, the reuse and recycling of raw materials have always been part of rural traditions since historically Italy does not have many raw materials. Ancient knowledge, which in recent decades has brought to light the value of traditions, are extremely useful in the fight against climate change if combined with innovation.

Examples of innovation in the agricultural sector are hydroponic crops, digitalization in irrigation, IT systems for forecasting weather, as well as biotechnologies. As far as traditions are concerned, particular attention is paid to the rediscovery of ancient grains which are more resilient to climate change; in the

Marche various productions in this area have proved to be very profitable. Particular attention must be paid to increasing the agricultural area intended for organic crops since Europe, for the new CAP programming, has foreseen a share of at least 25%. However, the sustainability of the system also involves responsible consumption and the fight against food waste throughout the production and after-sales cycle. The consumer plays a key role, also through responsible purchasing choices that reduce the consumption of animal proteins in favor of legumes and cereals. In fact, the latter, in addition to being nitrogen fixers and therefore useful for the regeneration of soils, have a much lower environmental impact (carbon footprint) than intensive farming. It is necessary to promote the Mediterranean diet, which has been an intangible heritage of humanity for ten years, as proclaimed by UNESCO; in this the Marche region, with its diverse and sustainable culinary traditions, is in line with international sustainability policies.

In order to convey the values of the entire agri-food system from a sustainability perspective, decisive actions are needed to raise awareness and inform consumers. Training paths and sharing of best practices must be encouraged because too often the connection between the various players in the system is lacking. Support actions for producers, such as training courses, technical assistance for participation in tenders, workshops, can be useful for sharing a common vision and for making the company fabric more reactive and cohesive.

The collaboration between the public sector (Universities and Research Centers) and the private sector must promote the strengthening of the system through the transfer of knowledge and applied research. Attention must be paid to the processes of internationalization and technology transfer and to the enhancement of training and know-how also with a view to strengthening the entrepreneurial fabric of the region.

3.1 Questionnaire

The questionnaire has been realized during the second year, and has been further on used to respond to the request of the Chamber of Commerce of the Marche Region in providing an analysis of the agri-food sector in the region. It consists in an empirical analysis (stakeholder interviews). It has been particularly useful, since during the third year was used to produce and deliver a technical document upon

the request of the Marche Region commissioned for the Marche Chamber of Commerce.

The questionnaire was formulated for the purpose of an understanding from the inside of the current situation of the agri-food sector, which is the second economic sector by percentage weight on the activities in the region, and with particular reference to the period after the 2016 earthquake and after Covid- 19. Particular attention was paid to the strengths and criticalities, but also to aspects related to sustainability. The questionnaire is open-ended and allows a qualitative analysis, with the aim of identifying the areas to be implemented to provide support to businesses following the crisis resulting from natural and health events.

The questionnaire was administered to 3 sample companies, specifically to a medium-large company and two small companies and to one Cluster. The companies have been chosen among the ones participating in the PhD on a voluntary basis and the questionnaire remained anonymous according to the request of the Marche Chamber of Commerce. The questionnaire was prepared and administered during the second year after the pandemic, questions have been elaborated on a personal research intent and have been answered online on written basis. Consultative processes inside the companies helped in answering the questions, which remain anonymous.

In the Marche small companies represent the majority with more than 84% of employees employed in companies with up to 9 employees, also because the companies are often family-run. Companies in the agri-food sector, including those producing food and beverages, have seen constant growth in the last decade (Marche Chamber of Commerce, 2022).

The medium-large company is a company in the pasta sector of the Marche hinterland (Crater area), connected to the territorial fabric and attentive to sustainability and the rediscovery of ancient traditions and ancient grains of high nutritional value. The second company, small in size, is located in the coastal area and always represents the pasta sector but on a very small scale; particularly focuses on innovation and sustainability, with particular reference to circular economy practices within the company. The third company, with a family size, is located in the Sibillini mountains and is a dairy company that pursues sustainability by

focusing on animal welfare, the quality and sustainability of feed and the quality of the final products.

The questionnaire allows to outline some main needs, such as certainly greater ease of access to tenders and mechanisms for more direct access to initial credit for companies, with a consequent de-bureaucratization of all administrative procedures that create important obstacles to the implementation of virtuous activities. Collaboration between all public and private stakeholders should be encouraged and consumer awareness should be encouraged with a view to exchanging skills, enhancing products and accessing information.

Finally, the questionnaire was administered to the Agrifood Marche Cluster with the aim of obtaining a broader view of the entire sector of the regional agri-food system.

The following are the 16 responses to the questionnaire collected from the companies identified of small, medium and large dimension and the Cluster Agrifood Marche, which provides a broader vision of the sector. The text reported is the transcription of the answers received.

Questionnaire distributed to the two small-scale companies identified (The answers to these questions have been incorporated in a single answer for harmonizing purposes, but always with transcriptions):

Question 1: From 2016 (post earthquake) to date, which main changes have been observed within your company?

We started with the idea of developing a traditional farm but then we realized that there was the need and the opportunity to make innovative improvements and changes, therefore we focused our attention on processes that improve the quality of the products but also the economic and environmental sustainability. We also suffered damage during the earthquake but we were able to access national and regional funds, although with difficulties due to long bureaucratic processes, and we secured the company and made improvements.

Question 2: To date, what have been and what are the main strengths and weaknesses of your company?

Let's say that it remains very easy for us to do research and innovation and communicate it, while it is more difficult for us to find human resources who want to share innovations and ideals with us. Our strength reside in the consumers who since 2010 have shown an increase attraction to our farms, which according to their perception provide more security than the large agri-food industry. Bureaucracy and administrative delays are the major weaknesses.

Question 3: What interventions do you consider a priority to address the critical issues of the company?

We are not talking about critical issues but rather about opportunities and optimization. Therefore, the greatest value is time and we try to give it to those who share our interests. For the purposes of market competitiveness and time optimization, we have recently invested in the digitization of orders.

Question 4: In your opinion, what should be the main tools to enhance your products at regional and national levels?

Communication on social networks will certainly allow to quickly and better identify stakeholders and customers. More communication is needed to sensitize consumers because only a small percentage is attentive to the value and quality of products, in fact many do not realize the high management costs that a small company has to face to guarantee to the market a high quality products.

Question 5: Do you think that public operators and trade associations have made adequate tools available to deal with critical issues?

Yes, but there is good room for improvement since the tools are often reduced only to call for tenders that require a significant initial economic investment.

Question 6: Do you think it is important to have a greater collaboration between the public and private sectors?

Absolutely yes, we already successfully collaborate with several universities and it is in our interest to collaborate more.

Question 7: Do you think that greater collaboration with universities and research institutions can be useful for obtaining more adequate tools to access innovation and development?

Absolutely yes, we already collaborate with several universities with some success and it is our interest and willingness to collaborate more

Question 8: What interventions did you find most useful from the public sector? Have you used it, and if so with what results?

For us, the Rural Development Programme (RDP) was a great opportunity. Thanks to RDP Measure 16.1 we are innovating processes that will allow us to achieve important results. Also, through Measure 16.1 during the period of Covid-19, we were able to access aid for the food home deliveries, limiting costs also for the consumer.

Question 9: Have you encountered difficulties in accessing the aid systems for businesses and companies promoted by public operators?

The bureaucracy is consistent and impede access to funds and we need to lighten the system. Especially in this pandemic situation, there have been difficult moments but now the situation has improved as a result of our efforts.

Question 10: Do you think that access to information and collaboration between the various stakeholders in the agri-food sector is adequate?

No, it is difficult to access information and it is difficult to understand what are the calls for tenders and the potential of the sector, there is no horizontal communication that allows information to be exchanged between operators.

Question 11: What are the medium and long-term changes you have observed as a result of Covid-19?

As far as we are concerned, Covid-19 forced us to change our projects in a consistent way. The positive aspect that we expect from consumers is a greater attention to local products and in any case to the so called Made in Italy. The possibility of selling at home was another point in favor even if part of the market was lost during the lock-down.

Question 12: What interventions do you consider a priority for the "recovery" of the agri-food sector in the near future?

There is the need to focus on the sustainability of all processes and, as regards to the agri-food sector, to try to improve the quality of life of primary operators, which consequently will certainly lead to more sustainable products where sustainability is related to socio-economic, environmental and organoleptic concepts. The possibility of obtaining funds that can be used immediately upon winning tenders, thus reducing the risk to invest for companies and, therefore, without an initial investment by the company.

Question 13: Did you have easy access to the aids made available by the public operator as a result of Covid-19 and if so, what interventions did you consider most useful for your company?

We have not benefited from Covid-19 aids. We believe that an important help could come from the voucher given to customers to buy directly on farms or vouchers given to restaurateurs to buy directly on the farm. There is always too much bureaucracy to access funds.

Question 14: From your point of view, what are the main barriers in adopting sustainable practices in the agri-food sector?

Costs to face represent barriers and this is the reason why a good communication must be made with respect to the virtuous companies that undertake these sustainable paths. Initial investments should also be canceled or limited.

Question 15: Do you believe that more information and incentives are needed in the adoption of sustainable practices to make your company more competitive on the market?

There is the need for knowledge transfer and to create awareness among stakeholders on what may be the opportunities and even the costs in order to further evaluate what to plan. There is also a need for greater consumer awareness of the value of food products.

Question 16: Do you consider the role of the added value of territoriality to be important as a long-term sustainable approach to consumers, also as a consequence of Covid-19 modifications in habits?

Absolutely yes. We believe that in this period of Covid-19 a part of dignity has been restored with respect to national products and we think that the sustainability process that is being activated and promoted, also at a political level, will be a driving force for the sector. It is vital to have an effective communication between stakeholders and groups. The territory must be enhanced to avoid the closure and relocation of companies.

Answers from the medium / large company:

Question 1: From 2016 (post earthquake) to date, which main changes have been observed within your company?

There have been many changes in our company in recent years and some only indirectly attributable to the earthquake because in those years a completed shift of responsibility began. After the earthquake, it was decided to double the covered area of the production plant with an investment of over 3 million euros and to hire another 20 employees within a year by starting the production of other types of pasta such as the semolina pasta. The goal was to give a clear signal of hope to citizens, and also to keep the community united starting from work.

Question 2: To date, what have been and what are the main strengths and weaknesses of your company?

We believe the strength is that, despite the fact that the company has grown in numbers and value, it has never departed from its principles and values which are those that continue to guarantee the satisfaction of consumers. We were born many years ago as an artisan pasta factory with the dream of making egg pasta that was comparable to homemade pasta. Today we produce almost 500q of pasta a day, but the quality of the product remains the same, thanks to selected Italian ingredients, a transparent production chain and an artisanal processing method that enhances its aroma and flavor, that starts from a triple slow mixture, drying at very low temperatures in static cells, bronze drawing.

Question 3: What interventions do you consider a priority to address the critical issues of the company?

Despite many difficulties and low margins of a market that continues to maintain decreasing trends, we continue to grow and invest. We did it to improve the supply chain with suppliers, so as to guarantee the tracking of the supply chain, we are automating some activities, such as logistics, by looking at the opportunities of Industry 4.0 plan, we work on staff training, on the sales force and on a capillary control of processes to guarantee the best and highest quality of the product. We invest to increase our presence on new international markets and we have invested to recover an ancient grain of the Hammurabi variety that we have re-cultivated and with which we produce a wholemeal pasta that has unique organoleptic characteristics and that has revolutionized the world of pasta. Thanks to the new enabling technologies, the goal is to make processes that go beyond the intrinsic realization of the product, in order to be able to present ourselves to the market with a renewed and increasingly competitive offer.

Question 4: In your opinion, what should be the main tools to enhance your products at regional and national levels?

It would be advisable to further enhance the "Made in Italy" products and therefore the appreciated agri-food differences of the various territories and regional traditions, especially on international markets, also protecting and collaborating with the countries concerned to avoid counterfeiting by the so-called Italian Sounding products. I hope that regional and national institutions will organize concrete matching opportunities with buyers from the most strategic countries and distributors, favoring participation in international trade fairs, also in aggregate forms of companies in a specific territory, through direct contributions to support the expenses for participation in the fair. It is clear that the pandemic has greatly limited travel and trade fair activities but, in terms of promoting not only Italy as a tourist destination but as a widespread territory of quality products. We believe that we can do more since business opportunities are constantly expanding and developing.

Question 5: Do you think that public operators and trade associations have made adequate tools available to deal with critical issues?

It is difficult to judge. We believe that the conversation is too often formal and not very continuous. Entrepreneurs should be listened to and involved more in practical discussion and decision-making processes because none of us have time to spend in sterile and redundant initiatives, but we are willing to make a valuable contribution to collectivity.

Question 6: Do you think it is important to have a greater collaboration between the public and private sectors?

As mentioned, dialogue among stakeholders can and must improve. On some public occasions I have had the opportunity to say that too often the times of politics do not coincide with those of the economy and that entrepreneurs are used to develop idea alone because when they have a problem they try to solve it as quickly as possible. On certain issues the problems are common and concern many actors. The public could intervene on this more effectively and with better long-term planning. The infrastructural network is an issue to be solved by institutions, for us who were proudly born, work and want to continue to operate in rural areas in the hinterland.

Question 7: Do you think that greater collaboration with universities and research institutions can be useful for obtaining more adequate tools to access innovation and development?

Universities are an essential driving force on the territory and we too have positive collaborative relationships with the University of Camerino which has led us to collaborate with mutual satisfaction on various occasions. The dialogue between companies and universities and the launch of research projects should be constantly subsidized and stimulated, especially in an area such as that of the Marche Region, which offers a very fragmented entrepreneurial landscape composed mainly of small businesses. What is missing is to give students the opportunity, once they have graduated, to stay in the area to start productive activities that ensure work and development in the area in which they were trained. In the food sector in terms of enhancing the supply chain also as a vehicle for promoting the territory and therefore as an incentive for tourism in the hinterland, there is a lot to do, but structural ideas and projects are needed, not impromptu initiatives which are then lost without producing significant results.

Question 8: What interventions did you find most useful from the public sector? Have you used it, and if so with what results?

We have taken advantage of some incentives to improve the logistical efficiency of the company and we have equipped ourselves with a photovoltaic system that allows us to reduce energy costs. Some "Industry 4.0" measures have been a precious opportunity to facilitate some investments, but something else would be needed.

Question 9: Have you encountered difficulties in accessing the aid systems for businesses and companies promoted by public operators?

For a medium-sized company like ours, the role of consultants who assist us in this sector is essential, they offer us opportunities and allow us to evaluate costs and returns. The relationship with the Public Institutions (PA) is never taken for granted and times are often long and uncertain. Bureaucracy is a big Italian problem that so far no government has managed to improve despite the proclamations, and this also discourages foreign investors

Question 10: Do you think that access to information and collaboration between the various stakeholders in the agri-food sector is adequate?

In the agri-food sector, there is a great liveliness of trade associations that are close to the entrepreneurs in a proactive and competent way and this is a best practice. Often entrepreneurs themselves do not give strength and value to the trade association as an element of development and growth.

Question 11: What are the medium and long-term changes you have observed as a result of Covid-19?

Our sector has never stopped the production because it was considered essential, yet we found ourselves in difficulties, of which partly expected and partly unprecedented. For example, the procurement of safety devices that have always been a rule for us, have suddenly become a difficulty as for finding masks. Then transport and logistics have undergone an increase in costs which for a sector with very low margins like ours have created great difficulties in addition to the cost of raw materials, which is also subject to fluctuations. But the most significant change

in the medium and long term is certainly what we observe on consumers. Its consumption habits and choices are radically changing and we will have to prepare for new paradigms.

Question 12: What interventions do you consider a priority for the "recovery" of the agri-food sector in the near future?

It is unavoidable for our country to have an infrastructure plan that improves road and rail connections not only on the coastal ridges or near the large centers of northern Italy but also to facilitate connections with the hinterland. The completion of the SS77, for example, has given new life to tourism and the Umbrian economy which has found an important outlet towards the Marche, but I would like to point out that the network of secondary connections that connect to that new artery have remained the same as 30 years ago resulting in difficulties and delays in deliveries. The Italian system need development and recovery as well as a strong and concrete relaunch of education and training according to the renewed needs and global market trends, and a clear guidance and vision towards a solid digital conversion and innovation, in support of the national production system.

Question 13: Did you have easy access to the aids made available by the public operator as a result of Covid-19 and if so, what interventions did you consider most useful for your company?

Although in a very reduced way compared to the actual cost, we were able to take advantage of the tax credit for the sanitation of the workplace and for the purchase of personal protective equipment. On the contrary, we have given to the employees, a bonus in paychecks for the commitment and sacrifice during the lock-down and the sense of belonging shown to our company even when being afraid of contagion was the rule for us too.

Question 14: From your point of view, what are the main barriers in adopting sustainable practices in the agri-food sector?

The main barriers are almost always economics, since even through the adoption of sustainable practices in the production system the increase in costs (raw materials, transports etc) do not correspond in an increase in sales prices to maintain pre-existing margins. This is mainly due to a market for agri-food

products that is experiencing significant deflation and to a distribution and commercial system in the hands of a few large national chains that, despite the qualitative conversion of products or processes, hinder the increase in prices. At the same time, all those initiatives that are in the interest of the environment and the future should be encouraged, such as the use of clean energy, the conversion of the fleet towards ecological methods, car sharing between employees, etc.

Question 15: Do you believe that more information and incentives are needed in the adoption of sustainable practices to make your company more competitive on the market?

Surely! Economic incentives help especially in sectors with low margins that of pasta, but I am convinced that even better social recognition of what companies do for the adoption of sustainable practices would facilitate some choices of entrepreneurs.

Question 16: Do you consider the role of the added value of territoriality to be important as a long-term sustainable approach to consumers, also as a consequence of Covid-19 modifications in habits?

My family has set up the whole company starting from the sense of belonging to our territory, renouncing to give the pasta factory its own name as usually happens in this sector. We also support many initiatives in favor of the revitalization of the territory from a cultural, artistic, social, sporting point of view, and we favor the relationship with local suppliers to favor the business and therefore the work in the regional hinterland. This will continue to be our path and on these values we believe we can create our competitive advantage in an increasingly competitive and difficult market, even in the long run.

Answers to the 15 questions addressed to the Agrifood Marche Cluster

Question 1: From 2016 (post earthquake) to date, which main changes have been observed within the Cluster?

Very diversified needs have arisen among the participating actors, often oriented towards process and product innovation. Following the 2016 earthquake it was

essential to focus on a new corporate business model (for example, enhancement of food by-products, "revisited" farmhouses, etc)

Question 2: To date, what have been and what are the main strengths and weaknesses of the Cluster?

The Cluster has the possibility of aggregating companies, universities, trade associations and research bodies with the aim of promoting projects with high added value for the targeted regional area. The weak point is the low number of agricultural and agri-food enterprises participating in the Cluster and the absence of dedicated human resources within the Cluster structure. This does not help in favoring an effective, organic contamination process in tune with regional smart specialization strategies.

Question 3: What interventions do you consider a priority to address the critical issues of the company participating in the Cluster?

Investments in 4.0 technologies, income support of the agri-food entrepreneurs and increase in the possibility of creating partnerships aimed at promoting products from the territory and therefore the health of consumers.

Question 4: In your opinion, what should be the main tools to enhance products at regional and national levels?

Financial instruments with a bottom-up approach, national and European structured and organized planning, active role of companies, associations and public research bodies.

Question 5: Do you think that public operators and trade associations have made adequate tools available to deal with critical issues?

The dialogue between national and regional contact points are misaligned given the heterogeneity of governance and organization of regional clusters and greater collaboration is needed.

Question 6: Do you think it is important to have a greater collaboration between the public and private sectors?

Yes, collaboration is fundamental above all in the planning of territorial policies aimed at enterprise innovation and competitiveness, in order to bring out the criticalities of enterprises before the construction of regional or national policies.

Question 7: Do you think that greater collaboration with universities and research institutions can be useful for obtaining more adequate tools to access innovation and development?

Collaboration with universities, research bodies and businesses is fundamental for the development of an economic model, but it is even more important to enhance this process while respecting the needs of businesses.

Question 8: Do you think that companies experience difficult access to business aid systems promoted by public operators?

The company, especially the SME, is often not structured to access public funds as the level of competence and internal know-how is not always available and possible.

Question 9: Do you think that access to information and collaboration between the various stakeholders in the agri-food sector is adequate?

Not always, sometimes it is fragmented and unorganized, especially in a territory made up of small realities. This is one of the future goals of the Cluster.

Question 11: What are the medium and long-term changes you have observed as a result of Covid-19?

Lack of confidence in politics, greater risks of termination for the company, new ways of relating and working, changes in research and innovation themes.

Question 12: What interventions do you consider a priority for the "recovery" of the agri-food sector in the near future?

Greater listening to private operators by regional policy, greater need for innovation 4.0 and smart innovations, lowering of taxes for businesses while at the same time favoring cutting-edge economic development, respect for youth employment.

Question 13: How would you evaluate access to the aid made available by the public operator as a result of Covid-19 and what interventions did you consider most useful?

Even if aids have been given, sometimes even important for some sectors, they have not been sufficient or well organized. Furthermore, many economic sectors have remained out of any type of aid.

Question 14: From your point of view, what are the main barriers in adopting sustainable practices in the agri-food sector?

The company committed to an economic path with an environmental value means that it will most likely offer the market a product that intrinsically contains a service to protect the environment and human health. The consumer is not always informed about this aspect and is not always willing to pay more, especially when the perception of an ongoing economic crisis is high.

Question 15: Do you believe that more information and incentives are needed in the adoption of sustainable practices to make companies more competitive on the market?

Yes

Question 16: Do you consider the role of the added value of territoriality to be important as a long-term sustainable approach to consumers, also as a consequence of Covid-19 modifications in habits?

Yes

3.2 Analysis of the Questionnaire and suggested interventions

The Questionnaire was helpful in the preparation of the Chapter on the agri-food sector commissioned by the Chamber of Commerce of Marche Region[9] and was particularly helpful in providing guidelines for the institutional decision-making

[9] Una regione in metamorfosi e la necessità di delineare percorsi evolutivi I risultati dell'analisi congiunta degli Atenei marchigiani. Rapporto di ricerca promosso dalla Camera di Commercio delle Marche, Luglio 2021. EUM. Isbn 978-88-6056-760-4

process. In particular the main outcomes of the chapter and the questionnaire led to some considerations.

Companies and businesses need assistance from the regional government to increase their competitiveness and access to national and international markets.

The definition of good governance contemplates not only a fair access to European, national or regional standards, laws or regulations but it also made up of soft law, best practices, codes of conduct and self-discipline. This applies also to the food and wine sector, where the institutions, which represent companies, regional and local governments, and universities in the area must identify guidelines for the adoption of managerial and entrepreneurial best practices, not binding for companies but accountable to their stakeholders and to the policy (for example, when participating in tenders). It is crucial to assess the socio-economic and environmental dimension and their impacts, specifying whether they have implemented these best practices or the reasons that led to not implementing them (i.e. comply or explain).

The approach to these best practices should be differentiated for small and micro enterprises, on the one hand, and medium-large enterprises on the other. The former should be encouraged, on the one hand, to network and create connections, focusing on new technologies and digital, beyond the territorial and product dimension, overcoming the old logic of industrial districts; on the other hand, they need to borrow from larger companies the virtuous practices of sustainability and adoption of Environmental, Social, and Corporate Governance (ESG) standards, dialogue with stakeholders, growth of human capital, protection of intellectual property. The latter should relate to the former through mentoring paths, with a view to mutual understanding, integration and enrichment.

Finally, all the actors involved (institutions, companies, associations and foundations, universities) should intensify their lobbying efforts to better connect the region to the great national circuits of innovation and culture, taking advantage of both events of regional importance (e.g. Tipicità is a best practice), and events outside the region.

Among the activities undertaken during the PhD, attention was given to networking, resulting in new national and international cooperation as presented in detail in the previous chapter.

With regard to Covid-19 pandemic, it has put a strain on the production chains, especially livestock, with greater social and territorial impacts and entrepreneurs are faced with new challenges in order to relaunch businesses. The scientific community agrees that the pandemic crisis has resulted in farmers becoming aware of the vulnerability of their farms to health emergencies, while for the average consumer this crisis has led to an increase in sensitivity towards the origin of the products and a greater propensity towards the Made in Italy and local food, considered safer. The pandemic crisis should represent an opportunity to further sensitize consumers to the use of national foods produced according to management techniques that are attentive to human health, animal welfare and, more generally, to the protection of the territory and natural resources.

The possible areas of intervention of governance in support of the agri-food sectors can be declined the following main areas of intervention:

- ✓ Simplification of access to funds for innovation and adequate support, especially for small farmers
- ✓ Training of practitioners and workers in the sector
- ✓ Support for business networking activities and collaboration with universities
- ✓ Improvement of productions
- ✓ Sustainability, also with reference to unconventional productions
- ✓ Communication of the excellence of the productions, also through brands and quality certificates and with claims that can be affixed on the label
- ✓ Support for new and/or innovative sales methods

As analyzed, the manufacturing companies in the agri-food sector are almost exclusively micro enterprises. This dimension often lead to difficulties to be overcome by almost all companies, especially while they need to participate in call for tenders that support and finance innovation. This often results in abandoning the possibility to participate due to the complexity of the requests and the lack of specific dedicated staff. This difficulty is even stronger when it is necessary to report costs on the funded project, as also underlined in the interviews, in particular in the answers to the question posed to companies "*Have you encountered difficulties in accessing the fund and aid systems for businesses promoted by public*

operators? "(Small companies: *the bureaucracy certainly does not come to meet us and we need to lighten the system*; medium-sized company: *The relationship with the PA is never taken for granted and the times are often long and uncertain. Bureaucracy is a big problem)*; and the Cluster: *The company, especially SMEs, is often not structured to access public funds as the level of competence and internal know-how is available and possible*).

As analyzed, companies strongly request administrative simplification by local authorities. Simplifying administrative actions really means trying to achieve the goal set by international community and guarantee fair access to funds and innovation for the good of the community. It is crucial to develop and fully adopt the New Public Management, which aims at developing efficiency within the Public Administrations and increases the sustainability approach, such as the reduction of waste.

The starting point of administrative simplification must be the redesign/revision of "business" processes, which consists of monitoring the various intermediate steps in the creation / provision of a good / service, identifying unnecessary or redundant steps and configuring the new actions.

In this context, the implementation of information technologies (e.g. e-government services), accelerates more the implementation of administrative simplification with a more efficient service and wider citizen / user satisfaction. Administrative simplification is often considered synonymous of the administrative reform, but is rather an overall change in the administration system aimed at making its action more efficient, rapid and economic for the recovery, support and relaunch of the territory itself.

Therefore, the need emerges to codify rules, manuals, guides and instructions, tools, training materials for the preparation and participation to calls and to standardize the criteria for entering information and make the call for proposals more accessible, participable, properly usable, to citizens or businesses who wish to participate.

Calls are difficult to understand, the end user is forced either to request additional information, burdening again the information desks or offices that manage the call, or to be subject to further requests for clarifications or additional documents. The resulting social cost in terms of time and resources, public and private, is evident:

a cost that could be reduced by adopting a simpler, clearer, coherent language that is not subject to interpretation depending on the user. The intent of these analysis is to encourage and convey the awareness and providing with effective solutions the institutions.

To resume, the analysis of the questionnaire suggests to:

- simplify as much as possible, compatibly with the laws and regulations governing the procedures, the requests for tenders and, above all, the reporting procedures for the settlement of the envisaged amounts. In this regard, it is emphasized that a further difficulty represented above by small companies is the need to anticipate the costs of innovation activities supported by the tenders (Interventions considered to be priority: "*The possibility of obtaining funds immediately usable upon winning tenders, thus reducing the risk and, therefore, without an initial investment by the company that sees the expenses return too long after")*; therefore, advances and payments for progress (periodic reports) are hoped for, as it is already the case for National (e.g. the MIUR PRIN call) and European (H2020) calls.
- Publish together with the call, as it is usually done by the European Commission, a guide to reporting that gives clear instructions, especially for the reporting phase and for the timeline of the documentation.
- Plan the establishment of a "listening desk" (telephone, e-mail, online, in person), where the Region is available to guide companies that find reporting difficulties and in recommending the most correct paths. Therefore, not only fair and due checks on the correctness of the use of the funds disbursed, but also suggestions and advice in progress and during the reporting on correct and appropriate procedures, in an institutionalized manner.

The promotion and enhancement of a territory and its food and wine products needs training and expertise. Training is a key mechanism in the creation of professionals in the agri-food and Ho.Re.Ca. sectors. University devoted and dedicated to learning the Italian culture of food. The goal of training young professionals capable of being themselves the driving force for the growth of the Marche Region is a

keystone for increasing the competitiveness of all sectors, and in particular of the agri-food sectors. There are "classic" training offers in the sector, both in universities (degree courses) and in higher institutes. Recently, “innovative” offers have been added such as, for example, the Degree Course in Gastronomic Sciences of UNICAM, which is a multidisciplinary and transversal course.

Not only trainings but also the creation and construction of networks with local actors, entrepreneurs, trade associations, cooperatives, organizations, institutions, etc. is fundamental. Networking activities are built through direct contacts, visits to the company, organization of events, sharing a path aimed at enhancing and promoting excellence, especially food and wine, and our territory.

From the answers highlighted in the questionnaire it is clear for companies that the process of enhancing the quality of their products, their territoriality and their uniqueness in the market need ad hoc communication and dissemination activities of such values, in order to attract consumers. But such conscious communication must be entrusted to professionals who, with a solid scientific culture, know how to promote the product and therefore the territory itself, telling about its uniqueness in an easy language.

To provide with updated and effective trainings, it is proposed to activate and finance a series of courses, also in an international key, intended for both non-graduates and graduates (summer and / or winter schools , seminar cycles, training courses, professional refresher courses, first and second level masters), which include lectures, educational trips, guided tours, laboratory experiences, bringing together the stakeholders of the entire agri-food chain, such as farmers, producers, companies, consumers, scientists, cooks, oenologists, through a holistic and integrated approach.

These training processes will give visibility to the actors involved and over the years will generate professionals who are able to consciously enhance and promote Marche's products in Italy and abroad. The international declination, with courses held in English, of some of these will attract foreign learners to the Marche, who will become ambassadors of Made in Marche agri-food in their countries of origin.

This approach will only enhance the food and wine product linked to the territory and therefore the territory itself by implementing food and wine tourism, including international, which, in the post-Covid era, will be guided (already it is) by

guidelines that look at the beauty of the territories. uncontaminated and to the wholesomeness of food with an approach that will change from “GLOBAL” to “GLOCAL”.

Another issue perceived by companies and highlighted in the questionnaire is that companies rarely collaborate with each other and / or are integrated into common activities or paths ("*there is no horizontal communication that allows information to be exchanged between operators*"), ("*Do you think that greater collaboration with universities and research institutions can be useful for obtaining more adequate tools to access innovation and development*?" Small companies: "*Absolutely yes, we already collaborate with several universities with some success and it is our interest collaborate more* "; Medium company: *" Universities are an essential driving force on the territories* "; Cluster: " *Collaboration with universities, research bodies and businesses is fundamental for the development of an economic model, but it is even more important to enhance this process in compliance of the needs of businesses* ").

To facilitate such collaboration on common goals it is important to structure also the call for tenders. To date, various approach have been pursued, such as the Supply Chain Tenders and the Operational Groups, which support mutual and cooperative integration into excellent supply chains. Access to international market could be secured through collaboration of all companies and stakeholders, together with Universities and Research Centers. Integration and promotion of the territory and products should be developed also through integration of the local systems (e.g. travel agencies, tour operators, hospitality, cultural enterprises, museums, etc.). It is therefore necessary to rethink tourism in an "experiential" key on the basis of thematic channels (e.g. naturalistic, cycling, thermal, lyric tourism, etc.) to enrich the offer in sectors where integration achieves pro-competitive effects, suggesting to the consumer the idea of being able to have multiple possibilities in a given territory calibrated on his tastes and preferences but where, ultimately, the food and wine component is pivotal.

Another limit in achieving cohesion is the compartmentalization of the calls between different Departments of the Region, which should be overcome to allow cooperation among all the agri-food sectors, namely agriculture, fisheries and aquaculture and forestry. To give an example, in the agri-food sector a “logical”

supply chain includes farms (which produce raw materials), processing companies, distributors, points of sale, consumers. In some calls from the past, depending on the Measures, if a processing company could participate, a farm could not participate, and vice versa.

3.3 Improvement in productions

The food industry is evolving with the focus of achieving two main objectives, namely to produce foods that have a high nutritional value and are at the same time respectful of the environment and safeguarding the planet's resources. A great effort is therefore needed towards the modernization of the food supply chains to develop new, improved, functional food products that are at the same time respectful of the Italian gastronomic and cultural tradition to ensure that these are accepted and received by the Italian consumer, who values the quality and traceability of foods. Italian quality products also have a great attraction in the foreign market that can be reached even by small producers, more easily if organized, to have a critical mass necessary to achieve visibility and facilitate all operations related to product distribution logistics.

The improvement of the nutritional quality of food products must be achieved starting from modifications of the formulation (enhancing both local resources and more sustainable and alternative food sources (e.g. legumes, algae, snails, insects, etc.), of the production process (less water and carbon footprint, greater efficiency) and the choice of packaging (e.g. biodegradable plastics) for the creation of products that have high sensory and nutritional quality and are more sustainable. Great attention must also be paid to the recovery and revaluation of production waste in a circular economy perspective. Great interest must be paid to the formulation and development of functional foods to meet the needs of vulnerable groups of consumers (the elderly, children, with Covid-19 or chronic degenerative diseases, allergic people, etc.) or subject to particular dietary patterns (vegans, celiacs, diabetics, etc.). The nutritional effectiveness of innovative products must also be verified in relation to the bioavailability of nutrients as a function of the ingredients used and the production process.

An excellent opportunity can be a review of the typical products of the Mediterranean diet from an innovative perspective, with the development of food products that meet the needs of the modern consumer and allow for improved adherence to this type of diet. This would also make it possible to promote local / indigenous foods and gastronomic preparations as a source of nutraceuticals for a healthy lifestyle and a sustainable food system. A further effort should also lead to greater promotion of typical Italian and regional food products, which could also be achieved through the establishment of international learning and exchanges between university for knowledge transfer.

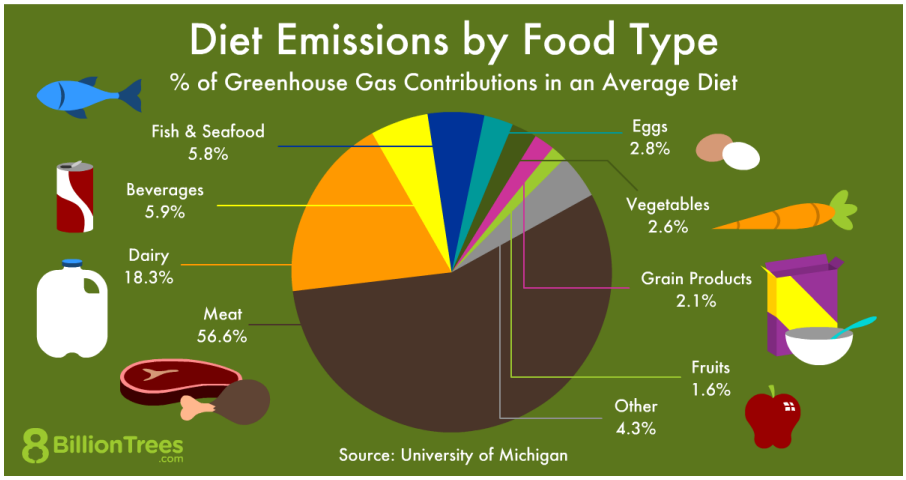
As regards to animal production, it is proposed to support the characterization of products, including fish (trout) from the hinterland, in order to highlight their nutritional qualities though ad hoc communication and dissemination and to encourage the "One-Health" approach by strengthening the interaction between the medical, veterinary, wildlife, agronomic, hunting, naturalistic components, in the investigation, intervention and risk management and communication phases. In is also suggested to support entrepreneurs to raise the level of corporate specialization in their business in order to improve economies, production and commercial efficiency. For the latter aspect, the search for different forms of sales (e.g. direct sales, distributors, farm holidays, home deliveries, online sales) can represent a solution to mitigate and diversify risks. In addition, it is important to develop specific protocols for the safety of companies through the preparation of manuals and dedicated guidelines for strengthening the biosecurity of farms, an aspect that is still not enough contemplated and to implement the use of "precision farming" tools, in particular of sensors in farms, which will allow for constant monitoring of the conditions of the livestock environment and therefore of its safety conditions.

3.4 Sustainability considerations

“Sustainability” is a key word that pervades the entire manufacturing sector, and it is quite felt by consumers when it refers to food. It is well known that the water footprint (how many liters of water are needed to obtain a kg of food) and the carbon footprint (how many kg of CO_2 equivalent gases are produced to obtain a kg of food), which together make up the environmental footprint, are increasingly

recurrent in information regarding sustainability. The carbon foot print is presented in figure below (table 2).

Table 2: The food footprint



Interest in the sustainability of food has gained greater attention by consumers, who are attentive to these issues, and even companies believe that an important game will be played on this front in the near future (see questionnaire above), even if they are worried about the connected increase in production costs. Therefore, it will be important to make funds available for companies that want to undertake a path towards sustainable production, including the encouragement of all those initiatives undertaken in the interest of the environment and the future, such as the use of clean energy, reconversion of land and productions, modernization of the vehicle fleet towards ecological methods, car sharing between employees, etc.

With regard to agricultural productions, the efforts of dissemination and information on the nutritional qualities of cereals and legumes and, more generally, of foods of plant origin must be strengthened. It is quite known that the amino acids intake contained in foods of animal origin can be found also on a balanced diet with mix of cereals and legumes. Furthermore, above all legumes are nitrogen fixers, therefore they regenerate the fertility of the soils. Some varieties of pulses are known, sometimes really of ancient origin and sometimes so-called ancient, which

have numerous advantages: higher protein content than modern grains, gluten free index, high digestibility, high content of numerous minerals and vitamins. Therefore, calls for tenders in such productions should also be imagined to support production and, above all, information activities for consumers on these products and their virtues.

Furthermore in terms of calls, the production of proteins with low environmental impact and high yields, such as insects, should not be overlooked. There are both regulatory and cultural barriers to direct consumption of these protein sources, but they can be used as flours for feed production. They have very important advantages, such as, for example, a percentage of protein in the body composition higher than any other type of animal raised for food purposes, a very low need for land per unit of weight produced, as well as a conversion factor between feeding and efficient product. Obviously, it is not hoped to divert important quotas of production, and therefore of support resources, in these directions, but not to neglect these innovation areas.

Communication of the excellence of the productions, also through quality brands, labels, certifications and claims should be developed.

As also highlighted in the questionnaire ("*What should be the main tools to enhance your products at regional and national level?"),* the role of communication and dissemination is essential.

Communication is needed at various levels and shaped according to different audience and is extremely important to communicate the excellence of the products. Its support is particularly necessary for small and micro companies, which alone do not have the strength to manage these processes in-house.

The excellence of the products can be highlighted on the label, to which ever increasing shares of consumers refer, through two approaches: quality certifications (POD, Marche Quality, etc.) and / or nutritional and health benefits (Regulation (EC) No. 1924/2006). It is considered important to support training courses, even of short duration, to inform producers on the importance and methods of obtaining claims (certainly easier to affix on the label, in some cases, even if no less important than the Quality Marks). Moreover, specific calls to support companies in the aforementioned paths would certainly help.

As pointed out in the questionnaire by companies: *"What should be the main tools to enhance your products at regional and national level?" ("Communication on social networks will certainly allow us to quickly identify stakeholders and customers." "I hope that the regional and national institutions will organize concrete matching opportunities with buyers from the most strategic countries and distributors, favoring participation in international fairs, even in aggregate forms of companies in a specific territory, through direct contributions to support the expenses for participation at the fair. It is clear that the pandemic has greatly limited travel and trade fair activity but, in terms of promoting not only Italy as a tourist destination but as a widespread company of quality products, I believe that we can and should certainly do more.* "

In fact, companies wish and need support to expand communication, also by supporting the implementation of online sales methods, and contributions for participation in trade fairs, possibly with a reward mechanism for joint participation by several companies, especially of small and micro dimensions.

Furthermore, it is clear that Italian agri-food represents in the new millennium what fashion was (and continues to be) towards the end of the previous one. Made in Italy dominates more and more also at the table and not only the fashion industry. The Made in Marche must increasingly become a relevant and known part of the Italian agri-food sector in Italy and abroad.

It is therefore proposed to support the structuring of one or more "*cittadelle del gusto*" (city of taste), to enhance the typical local food products, similar to what happens in other areas of the region for the footwear and fashion sector. Structures that do not overlap or replace existing shopping centers, but that integrate with these to host, not necessarily on a permanent basis but also in the forms of the temporary store, the best local productions, while acting as a place of sale, showroom and on-site consumption (or take-away) such as street food, and being also for a for discussion.

In line with this path, the PhD activities also focused on the definition of such place of taste sharing. At the regional level it was suggested to create a "cittadella del gusto" where the productions take place (therefore in the high hill and mountain areas), both in structures to be built with innovative and eco-sustainable techniques,

and also by recovering and restoring existing buildings, entire villages or parts of them (especially in the Crater area).

These should also host creative hubs, coworking spaces, training events, cultural and creative start-ups, also with a social vocation, with initiatives specifically dedicated to innovation, digitization and digital and social media marketing for the benefit of the supply chain and territory rather than individual agri-food companies.

Thus, these fora could act as a pole of attraction for tourist routes, first of all proximity, but then also of national and foreign flows towards inland areas, allowing them to better support their enhancement through itineraries of trekking, cycle tourism, horse riding and other experiential uses.

Chapter 4. How Covid-19 impacted globally on the agri-food sector

It is noteworthy to affirm that the global pandemic, that affected particularly Italy, disrupted and modified the activities and the timeline of the research undertaken during the first year of the PhD, which were adapted and reoriented according to the delicate moment. In particular, an analysis on how the pandemic impacted on and how companies reacted to it was undertaken. Such analysis is presented herein in this fourth chapter, firstly from a global and lastly from a regional perspective. This chapter presents an analysis of the impacts on food security from a general to a more local dimension. Thus, the understanding of the global dimension (e.g. developing countries) from an international perspective was preparatoy to the analysis of the national scenario, although OECD countries and LDC countries react to the pandemic with different institutional approaches.

The health and economic crisis caused by COVID-19 has led to shortages of labour for on-farm production, harvesting and on-farm processing, restrictions on movement, road closures, and limited access to markets for purchasing inputs and selling products.

At consumers' level, the crisis has affected food buying patterns with consumers in many low-income countries purchasing only staple carbohydrates and non-perishables, resulting in increased food waste at retail level. The closure of much of the hospitality industry and schools has also resulted in a loss of markets for producers.

When analyzing the consequences of the ongoing pandemic, it caused enormous challenges for the stability of agri-food systems and the welfare of households which are also part of such systems.

At the same time, efforts have been made at national and regional levels to redress the negative impacts of the pandemic through investments to "build back better", representing an enormous opportunity to make significant and lasting impacts on the longer-term resilience and sustainability of agri-food systems, especially in the context of climate change and future health crisis.

In fact, the current COVID-19 pandemic, despite the enormous costs in terms of socio-economic impacts, represents also an opportunity to revisit our collective thinking around how the agri-food system works and how it can be made more resilient to future shocks. Moreover, COVID-19 might represent an opportunity to rethink the global food system and to strengthen domestic food supply chains, while recalling the importance of producing locally and building resilience to additional threats due to climate change and possible future health crisis.

The COVID-19 impacted the agri-food system in various ways, ranging from the production and processing of food to its distribution and consumption with a rapid onset. The pandemic has added additional pressures to food systems and world food security, and has, more than ever, uncovered the interconnections and interdependencies between agriculture, society and the economy (Lioutas & Charatsari, 2021). Deep covariant economic shocks caused by the pandemic have been affecting the cash flow and financial liquidity of producers, small and medium agri-businesses to financial institutions through a multitude of pathways, including inhibited production capacity, limited market access, loss of remittances, lack of employment, and unexpected medical costs, to name a few (FAO, 2020g). Rural and small-holder farmers and small fishermen, whose economies rely greatly on agricultural activity, have been the hardest hit due to limited mechanization and high labor intensity in agriculture (Rasul, 2021).

COVID-19 has proved to be a health crisis with multiple impacts on food and social systems, and economic development. In an effort to control the disease, world governments have imposed lockdowns that have shuttered many businesses, restricted travel within countries, closed borders to trade in some food products, imposed social distancing requirements and curfews that have disrupted economic activity and forced businesses and schools to close. The results have been spikes in unemployment, loss of income and livelihoods, a widening of inequalities, disruptions to social protection programmes and above all major disruptions of food systems and supply chains, as labor, transport, trade limitations, and uneven food prices in localized contexts (see, e.g. Klassen and Murphy, 2020; Clapp and Moseley, 2020; Laborde et al., 2020).

For these reasons, COVID-19's impact on the world's economy and on global food security is being described in dramatic terms. The World Bank forecasts that the

global economy will shrink by more than 5%, which would be the deepest recession since the Second World War.

Without policy measures to decrease the impacts of and increase the resiliency to threats posed by the COVID-19 induced economic crisis, potential reductions in national food availability may be far worse than previously seen and may persist longer. The unprecedented challenges stemming from this global crises require innovative strategies and approaches to agriculture, fisheries and food systems that address COVID-19 and climate-related threats (Rasul, 2021). COVID-19's disruptive forces can be leveraged to accelerate the transition to more sustainable food systems. In order to secure pandemic- and climate-smart agri-food systems, countries should learn from existing best practices and innovate to leverage on and align their COVID-19 responses with existing policy frameworks that promote resilient, inclusive, and climate-friendly agriculture systems.

4.1 General overview of Covid-19 and Food Insecurity

The risk to food security currently does not only come from disruptions along supply chains and food price inflation at retail level, but also from the severe effects of the measures adopted to combat the pandemic on jobs and livelihoods. As a matter of fact, the primary risks to food security are at the country level: loss of incomes and remittances are still creating strong tensions and food security risks in many countries, where social safety nets are less well-developed and COVID-19 is leading to a severe increase in poverty and hunger (Laborde D. et al, 2020). Such risks are in addition to the food instability hampered by the effects of climate change, and thus the global food security requires more attention at the national and international levels and needs to align to the new Green Deal.

Globally, restrictions have already affected only in 2020 at least 10 per cent of food imports in 54 countries, and up to 80 per cent of imported food in some cases (FAO, 2020). Such trade measures are intended to ensure sufficient domestic food supply for the exporting countries. However, their impact on trade partners can be precisely the reverse. What is more concerning is that when the impacts are overlaid onto global maps of hunger, it becomes clear that those affected are in parts of the world where severe hunger is already concentrated. At the global level, low-income

countries are also least able to cope. As UNCTAD notes,[10] around 20 per cent of income is spent on food in these countries; nationally, they spend more than five times the share of merchandise export revenue on food than developed economies, do making them vulnerable to shocks both in terms of a collapse in exports as well as tighter import markets. For many developing countries, the economic consequences of COVID-19 are being more devastating than the disease itself.

Livelihood coping, such as spending savings or reducing non-food expenditures, also deteriorated during this period, with 500 000 more households using crisis or emergency livelihood coping strategies (e.g. selling house or land, selling productive assets) in August compared to April. As lockdown measures gradually eased, 900 000 less households are reporting challenges to access markets and grocery stores (August 2020) compared with the beginning of the lockdown (April 2020) (GNAFC, 2020).

While the current circumstances are exceptional, the vulnerability of food systems[11] to disease-related disruptions and climate was clear long before the COVID-19 crisis. Food systems have in fact been repeatedly destabilized by shocks, from the 1970's oil crisis to the 2007-2008 commodity price spikes, as well as the SARS and Ebola outbreaks.

The COVID-19 pandemic has simply additionally laid bare the massive vulnerabilities of global food systems to shocks.

COVID-19 is having a profound impact on the whole process from field to the fork. It is affecting food production, global trade, consumption and disposal of food.

The evidence suggests that the impacts on the food supply chain are still to be felt widely, but unevenly. The impacts are likely to be largest in dense urban and rural peri-urban areas. Given the properties of the novel coronavirus, which is transmitted most easily via human contact, greater population densities tend to facilitate its spread. It is also going to be felt the most in developing countries where smallholder

[10] https://unctad.org/news/covid-19-and-food-security-vulnerable-countries

[11] A food system encompasses the entire range of actors and their interlinked value-adding activities involved in the production, aggregation, processing, distribution, consumption and disposal of food products. Food systems are composed of subsystems (e.g. farming systems, market systems, waste management systems, and input supply systems) that interact with other systems (e.g. energy systems, trade systems, and health systems). As such, a structural change in the food system might originate from a change in another system. For example, a change in political leadership or pandemics like COVID-19 may have an impact on investments in food systems.

farmers, often from economically difficult backgrounds, are bearing the brunt of numerous challenges: reduced trade, the closure of village marketplaces and domestic travel restrictions pose a very real threat to their livelihoods. They also create the potential for a dire situation where food goes to waste while others go hungry. The informal sector is in grave danger, mainly because of the lack of regular income, and farmers and other immigrant workers were severely affected during the closure.

Due to global trade disruptions COVID-19 is likely to increase food prices, both as a cause and consequence of food shortages. Restrictions on food supply chain logistics are expected to increase transaction costs and thus consumer prices. Speculative hoarding may occur and trigger price increases. Higher food prices are, in turn, likely to signal impending shortages. These effects can compound each other in a vicious cycle likely to cause social unrest (Bellemare, 2015).

Currently it is more important than ever to make sure that high quality and quantity of food arrives at its destination avoiding food losses and do so with as little environmental impact as possible. This means rethinking food systems for the future to ensure they are not only resilient to sudden shocks but are sustainable, circular and inclusive for all parties, no matter their size.

Maintaining the flow of food and commodities throughout the supply chain should be ensured with the contribution of all stakeholders. Producing more food in a sustainable way and prevent from food wastes should be warranted. Enhancing the confidence of consumers is also essential for food safety and security (FAO and WHO, 2020). A paradigm shift from industrial agriculture to diversified agroecological systems and to reduced levels of food loss and waste is more urgent than ever. Actions are required globally and locally to maximize the use of the food we produce.

4.2 How Covid-19 has impacted food production and consumption habits

The pandemic is having a profound impact across the entire food supply chain, especially at farm level, where production has been affected by a reduced availability of seasonal workers, seed shortages and food losses. In March-May of 2020, there were widespread media reports of food items being dumped or ploughed

back into the fields because of either collapsed demand or difficulties in getting these foods to markets (Yaffe-Bellany et al., 2020) Farmers without adequate storage facilities, including cold storage, found themselves with food that they could not sell. As borders closed and demand for certain food items dropped, food producers reliant on selling their crops via distant export markets were highly vulnerable, particularly those producing perishable food and agricultural products, such as fresh fruits and vegetables or specialty crops (Clapp and Moseley, 2020).

Additional impacts have been found in milk production - farmers have been forced to dump milk because demand from restaurants and coffee shops plummeted under lockdown-, in food processing industries - where necessary social distancing measures have partially reduced the efficiency of operations -, and in transport and logistics.

Transportation restrictions have made it difficult for farmers to obtain seeds and fertilizers to plant new crops, or to send the ones they harvest to local food markets, which have closed in some places. While bulk shipments have not seen any major disruptions, air freight has been severely disrupted. In addition to that, protectionist trade policies, even temporary ones, a fall in ethanol production and feed demand have deeply influenced the food scenario.

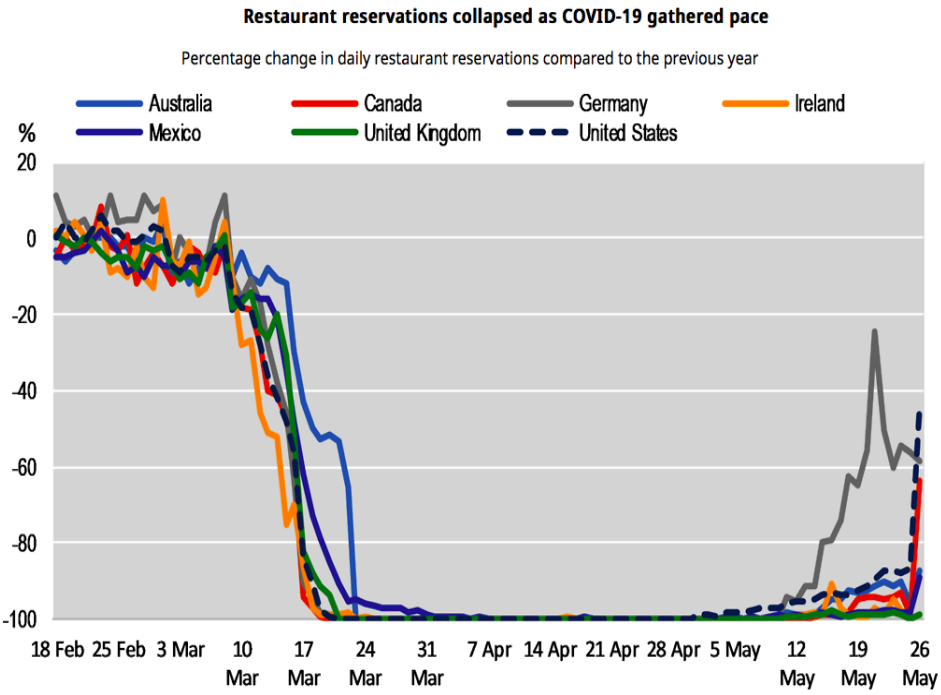
One of the main outcomes of COVID-19 disruptions has been the creation of simultaneous surpluses for producers and shortages for consumers. As the global food supply chains are very long, comprising of many stages – each of them with its own vulnerabilities- if one or some of these stages fail, food supply and demand are deeply affected.

On one hand farmers and producers have been submerged in products they could not sell nor harvest, creating loss and waste. On the other, consumers have been unable to acquire the food they needed or preferred to buy unusual food such as non-perishable products, creating changes in the food demand and insecurity.

Not all sectors and products have been equally affected, and different products have experienced disruptions at different stages of the supply chain, but it can be affirmed that food environments have been deeply altered and the context, thus the way people engage and interact with the food system to acquire, prepare and consume food, has deeply changed.

For example, sales of food away from home (consumed in hotels, restaurants, catering and cafés) have collapsed. For this reason, high levels of food waste have been found in the hospitality industry and shortages in consumer food stores.
The closure of restaurants and food stalls has meant that people who relied on foods prepared outside the home for their meals suddenly had to go shopping and prepare food at home. But because of rigidities in supply chains, foods that previously were produced and packaged specifically for food service were not easily repackaged for retail sale and home use.

Figure 6. Restaurant reservations collapsed as COVID-19 gathered pace. Source: OpenTable.com, 2020



Data include online reservations, phone reservations, and walk-ins at restaurants, estimates are based on a sample of approximately 20 000 restaurants. Panic purchasing behavior, which characterized the first months of lockdown, has led to the accumulation of basic (rational) goods or an accumulation of unnecessary (irrational) goods which have led to a shortage in the supply chain. Consumers were looking for more durable products such as canned, dried, and frozen foods.

As a consequence, a peak in the second half of March, weekly sales of frozen foods were 63% higher than the year before in France, while sales of frozen and packaged foods have in particular increased dramatically: packaged foods were 56% higher year-on-year in Germany. Similar demand spikes were seen in other countries (OECD, 2021).

A study performed by Aldaco et al. (2020) indicated that COVID-19 had an impact on the overall food loss and waste generation and resulted in 12% higher creation of food waste on the household level. But the changing in the consumers' habits, as the preparation of food at home, could be analyzed as a positive trend since a part of the population not suffering from economic crisis modified its behavior by choosing quality foods, such as food produced in sustainable ways.

A growing attention to quality as a source of health and wellbeing could represent an asset when boosting CSA practices at the national levels.

Another risk Covid-19 led to was the declining dietary quality, if we consider the world and not only Europe, due to a reduced access to high-value foods, higher food prices (especially for nutritious, perishable foods) and the higher consumption of ultra-processed foods. A reduction in demand for perishable food items (such as meat and eggs, fruits and vegetables) due to their relatively higher cost (as compared to staples) has been observed mainly in urban areas in both developed and developing countries. In some cases, reduced demand due to lower income has pushed prices lower while movement restrictions and reduced supply in urban areas tended to push prices higher. Sometimes the two effects tended to counter-balance each other keeping the prices of such items stable or led to decreasing prices. Simulations from the International Food Policy Research Institute (IFPRI) have shown that merely a handful of additional export bans could cause as much as a 35 per cent spike in global prices for certain commodities (IFPRI, 2020).

The current food production and consumption situation remains extremely volatile: although after initial disruptions markets and food supply chains are stabilizing in part due to government support and action, structural deficiencies in countries with food crisis remain with related disruptions to agricultural production and other parts of the food supply chain. Therefore, it is crucial to adopt sustainable approaches to food production and consumption patterns.

Another aspect to take into consideration is the food waste, which has increased due to pandemic restrictions and is one of the core aspect also of food instability. In particular, the crisis is undermining the right to food and stalling efforts to meet Sustainable Development Goal (SDG) 2: "Zero hunger."

In this context the possibility to increase the prevention from Food Loss and Waste (FLW) becomes a reality in the short-term (e.g. when restaurants and schools are closed) and in the long-term could represent an asset for production and trade systems, since especially farmers should re-adapt their production facing a dramatic decline in incomes. Food loss and waste reduction and prevention practices refer to actions that can help mitigate the decrease - at all stages of the food chain from harvest to consumption- in mass of food that was originally intended for human consumption, regardless of the cause (HLPE, 2014). In developing countries, the bulk of loss happens at production and post-harvest stage, as opposed to industrialized countries, where a large amount of food is wasted at the retail and consumption end.

If we maintain business as usual, the amount of FLW will grow from today's 1.3 billion tons per year (FAO 2011) to 2.1 billion tons by 2030 (Hegnsholt et al. 2018) and even more by 2050 (Searchinger et al. 2018). Although some amount of FLW will always exist because it does not pay for producers or consumers to incur the costs of eliminating all FLW, it is evident that food loss and waste represent a burden in terms of sustainability. FLW has the potential to improve the efficiency of operations along the agri-food chains by reducing the vulnerabilities in post-harvest and processing stages, for example through improved storage and distribution (e.g. metal silos and ad hoc distribution centers or market hubs that are compatible with COVID -19 restrictions such as physical distancing) or through the adoption of more efficient farm machinery that can ensure good harvests. Efficiency of operations can contribute to an improved resilience of food systems and of food value chain actors to market fluctuations, which were exasperated by Covid-19.

At the production stage, improving efficiency in the use of inputs through sustainable intensification can deliver both adaptation and mitigation benefits (Waddington et al., 2014). For example, alternative wetting and drying for rice cultivation, which is a sustainable intensification method that reduces irrigation

volumes can result in increased yields, which may potentially contribute to enhanced food availability.

At the retail level, the efficient use of resources may imply improved refrigeration and refrigerant systems, which have been identified as substantial contributors to direct greenhouse gas emissions from supermarkets (Garnett, 2011). Reducing refrigerant leakage and improving energy use in the retailing, marketing and distribution of food are examples of an efficient use of resources that can be applied in the post-harvest stages of the food value chain.

One of the major sustainable systems agri-food sector is currently adopting at regional and national level, and in line with international policy framework, is the Climate-Smart Agriculture (CSA), which in combination with FLW strategy can provide with effective solutions. Its link between sustainable agriculture and support to farmers to react to climate change is the key element to take in consideration for going against the COVID-19's consequences on agriculture and farmers' loss of income due to the pandemic. In fact, CSA is a holistic approach promoting the wellbeing of the environment and the communities related to the agri-food systems, while guaranteeing the resilience of the system to threats such as climate change and economic crisis. CSA contributes also to food and loss and to the sustainability of the agri-food sector, especially with regard to the current socio-economic alterations due to the pandemic. Sustainable productions, healthier foods, fair access to markets, mitigation and adaptation strategies together with prevention from food losses in the entire agri-food value chain, should be considered a valid solution to cope with the on-going global crisis and preventing from economic incertitude.

More practically, the implementation of CSA rests on three axes: the assessment and application of sustainable technologies and practices, the creation of a supportive policy and institutional framework and the formulation of investment strategies, which are achieved through five methodological action points (FAO, 2016, 2019).

Expanding the evidence base involves determining present and projected climate change impacts and key vulnerabilities on existing agricultural production systems, identifying and evaluating best climate-smart practices in regard to said impacts (aligned to national-specific challenges and objectives), assessing institutional and

financial frameworks needs, as well as identifying costs and barriers of practices implementation.

Supporting enabling policy frameworks, such as national agricultural development plans, allows to fill in policy gaps and modify existing policy measures when necessary to enable full coordination between different institutions, while taking into account diverse national development priorities in order to optimize trade-offs and CSA applications.

Strengthening local and national institutions can foster cross-sectoral dialogues and reinforce policy makers' and other stakeholders' engagements in considering and enabling emerging policies and coordination to facilitate CSA practices applications.

Enhancing financing options is central to the effective applications of CSA practices for which the principal sources of funding are national sector budgets and official development assistance. However, developing innovative financing mechanisms to promote agricultural investments through climate finance as well as leverage on key national policy instruments to connect national and international sources of finance are key to CSA implementation successes.

Lastly, the implementation of CSA practices on the field requires the incorporation of local producers' traditional knowledge of the specific environment and ecosystem of implementation and their active involvement in the identification and application of best-suited CSA practices. The adoption of platforms for knowledge sharing and capacity development, as well as the promotion of trainings, are used as effective and context.

Additionally, CSA combined to FLW reduction measures contribute to make food systems more resilient also by preventing an erosion of nutrient quality along the supply chain. This in turn promotes and enables more diverse dietary choices, enhancing the resilience of the population as nutrient rich foods are generally in short supply in low-income settings (Global Panel, 2015). COVID-19 has shown how food systems should be able to cope with a variety of changes, as disturbances in food systems can be internal or external, sudden or gradual; and how, by becoming resilient, a food system is then able to minimize food insecurity in a changing environment with recurring disturbances (Tendall D.M. et al., 2015).

Improved and increased food availability is also one of the major outcomes of the combined action of CSA and FLW reduction practices.

On one hand CSA has the potential to increase food production under unfavorable climate regimes and to improve the food security conditions of millions of people while reducing GHG emissions (De Pinto A. et al, 2020). On the other hand minimizing food loss and waste of already produced food can increase food availability especially for the most vulnerable ones and can help to close the 'food gap' - the difference between the amount of food produced today and the amount necessary to meet future demand increase- by 12%. Reducing food waste enhances the productivity of all scarce natural resources — land, water, fisheries and minerals for fertilizing. More food will be consumed per unit of natural resource used.

Food recovery and redistribution - through food banks or solidarity networks - should also be considered as a food waste reduction practice and as an additional way to improve food availability and contribute to food security. Covid 19 has underlined the need for efficient Emergency Food Assistance and nutrition interventions, having led to the closure of schools - which implies that millions of children are no longer accessing proper food and nutrition (Torero Cullen M., 2020) - and having contributed to a massive fall in in remittances – which means that a higher number of people is falling into poverty.

Both CSA and FLW reduction practices promote the recycling and valorization of waste from the agri-food sector through a "circular agriculture economy" approach which proposes a viable model for the current linear economy "take-make-waste" approach by minimizing the amount of external inputs for agricultural production, closing nutrient loops and reducing negative impacts to the environment by eliminating discharges (i.e. wastewater) and surface runoff.

Under the lens of the circular economy, agriculture can offer a multitude of opportunities from the primary production using precision agriculture techniques, to the recycling and utilization of agricultural wastes and materials (i.e. reuse of plastic containers), or creation of the agri-food system as presented in the next chapter dedicated to the AgrI-fiSh project.

CSA and the reduction of FLW mutually reinforce a food systems approach and pursue efficiency and resilience in tandem. Resilience without efficiency and

improved productivity can in fact pose problems for food security in the long term (Global Panel, 2015).

Table 3: Contribution of CSA and FLW reduction to food system efficiency per stage of the value chain in the context of Covid 19. Source: adapted from http://www.fao.org/climate-smart-agriculture-sourcebook/production-resources/module-b10-

Value chain stage	**Contribution of CSA and FLW reduction to food system efficiency in the context of Covid-19**
Production	Both CSA and FLW reduction measures promote sustainable soil management practices to improve carbon storage (e.g. conservation agriculture), the diversion of animal waste for reuse (e.g. organic fertilizer, biogas production) and improve water-use efficiency (e.g. through alternate wetting and drying in rice systems)
Transportation	They both promote investments in adequate infrastructure and aim at improving coordination within the value chain to reduce transportation distances
Processing	They both reduce energy use (e.g. they promote investments in upgraded energy-efficient processing; use renewable energy sources, where possible)
Distribution and retail	They encourage supermarkets to take measures to minimize refrigerant leakage and reduce energy use
Consumption	They promote sustainable consumption and encourage the use of more energy-efficient cooking methods
Disposal	They promote investment in improved landfills and more efficient waste collection systems

Not only sustainable practices are required to face the instability produced by the pandemic but also an enabling policy framework to help in the recovery. Recent policy-oriented assessments of food system function (Balineau et al. 2021) are critical of the practice of financing isolated projects that excessively concentrate on production and which neglect other aspects of holistic system function, such as logistics, distribution, consumer preferences, and market governance. More systemic analyses of food markets take a “farm to table” perspective, extending

from producers to consumers. Efforts to strengthen supporting institutions along the length of value chains are important in this respect. Also at the European level, the Farm to Fork strategy of the Green Deal stressed the importance on a producer-consumer perspective and allocated specific funds to projects in line with the strategy.

The pandemic has rekindled debates about risks associated with international supply chains. Available evidence, however, does not suggest that economies would have fared better in the absence of global value chains, as lockdowns also affected the domestic value chains through input supply and other disruptions (OECD 2020). Furthermore, while international value chains may be more vulnerable to some kinds of disruption, contributing to the propagation of economic shocks across geographic and sectoral boundaries, they may also help firms and countries to recover faster, as they respond to broader pools of supply and demand. Economies defined by both long and short value chains will be more resilient than more limited configurations and the local dimension could represent an asset.

For both long and short value chains, resilience can be fostered through better risk management strategies at the firm level (OECD 2020). Some general policy objectives for this include stimulating risk awareness by value chain actors, building greater transparency in nature/governance and operational status of the value chain, and promoting agility in value chain actors, enabling them to quickly respond to sourcing or other challenges and to diversify productions.

More at a general level, governments can help build more resilient value chains by collecting and /or distributing information on potential concentration and bottlenecks upstream (both in global, and regional/subnational value chains), as well as by developing "stress tests" for essential supply chains. Furthermore, capacity building investments around risk awareness and response could be targeted to value chain actors at different critical nodes of important value chains, especially those in volatile settings.

Finally, governments can help ensure a conducive regulatory environment, through such policies as maintaining stable trade policies and regulations. The economic costs of cross-border trade restrictions are increasingly well documented, with increased exposure to food price volatility being documented for many regions. Governments' well-meaning attempts to stabilize prices through periodic trade bans

and other controls often result in destabilizing prices, the opposite of the intended effect. Government policy stability can address one source of uncertainty which otherwise has negative repercussions on the investment incentives facing private sector actors in agricultural economies (Sitko et al. 2017). Other policy options for reducing price instability include regulating the playing field for traders, investing in transportation and other physical infrastructure, encouraging food consumption diversification, improving access to rural financial markets to improve farmers' ability to store and/or traders' capacity to absorb surplus production, and promoting the development of market-based risk management instruments to stabilize regional maize prices.

4.3 Focus on the regional dimension of the pandemic affecting the agri-food sectors

The analysis of the global dimension, with regard to the pandemic, has paved the way to a further comprehension of the consequences entailed in Italy, with focus on the Marche region.

Such analysis has resulted in an article "How one year of COVID-19 pandemic impacted on the agri-food systems: an Italian case study", which is currently under peer review process for the Journal of Agriculture and Food Economics.

The study intended to analyze the situation of the agri-food systems in Italy over a one-year time of the pandemic caused by the virus COVID-19, with focus on the North-Center Marche Region.

In particular, the study presented the economic situation prior to the pandemic, with analysis of quantitative and qualitative data on the most relevant sectors of the agri-food systems, and compare them to the most updated data and trends. The scope was to investigate from a socio-economic dimension the impacts on the agri-food sectors and estimate the alterations occurring in the production and consumption, during and after the lockdown of the economic activities. Attention was given to the statistical meaning of data in relation to the modification of the entire value-chain and in the consumers' habits, in a given and severely hit territory (Marche Region) over a one-year time. The analysis mainly presents and compare two-years

momentum (2019-2020) of the economy and the demography of the agri-food companies at the regional level and showcases the current trend (2021), and look over the production and consumption paths at the national level. The study could be particularly important in supporting the decision-makers and the producers in shaping a post-pandemic strategy, in order to have future sound-specific statistics and instruments to cope with the related present and future economic crisis, and to address solutions in a more sustainable way.

The situation of the agri-food sector in Italy after the spread of COVID-19 and the related socio-economic restrictions has received increased attention, especially due to the numerous and repeated closures of the economic activities and the territorial restrictions, which started in March 2020 and lasted for more than one-year time.

According to the Institute of Services for the Agricultural Food Market (ISMEA), during the first two months of the total lockdown in Italy (March-April 2020) the agri-food sector showed a contraction along the entire value chain, from the primary production phase to the retail sales one. This was mainly due to the imposed total blockage of the Ho.Re.Ca. (Hôtellerie, Restaurant, Café) sector, the elimination of tourist flows on the internal market, and the severe contraction in food exports.

According to the National Agency for Tourism of Italy (ENIT), foreign tourism for 2020 dropped by around 50%, resulting in an estimated loss of around 30 billion euro of food consumption out of 250 billion euro of total food consumption, with half of the total due to foreign tourism in Italy.

The measures undertaken to contain the spread of the COVID-19 pandemic had important consequences, including food production and supply chain disruptions, consistent food shortages, disrupted access to inputs and services, food losses, and loss of employment and incomes. At the European level, the trade of food commodities among Member States has been disrupted and imports and exports have encountered repeated closures, due to national and international trade restriction policies (Gray, 2020). At the global level, the pandemic has influenced some food supplies more than others, both in exports and imports (Nakat & Bou-Mitri, 2021), and the most severe impacts have been registered for fresh food, such as fruits and vegetables. For example, in Canada fruits and vegetables have been the most impacted as produce growers and distributors were forced to move food supplies from food service to the retail channel (Richards & Rickard, 2020).

Therefore, as mentioned COVID-19 could still present an opportunity to address multiple long-term objectives for the national recovery, including the return to a strong local food system, the increase in adoption of policies to reinforce the resilience of the agri-food systems to future health crises, and the implementation of sustainability and food security especially related to food availability, food quality and food loss and waste reduction. In addition, the pandemic forced food companies to re-evaluate risks and opportunities and to redefine priorities, and to adjust not only productions but also the entire food value chain (Hamid S. & Mir MY, 2021).

When compared to other European Member States, the Italian agri-food production sectors demonstrated high resilience to the critical situation by guaranteeing a steady food supply to final markets during the lockdown. Nevertheless, severe difficulties occurred particularly in the fruit and vegetable sectors, since the finding of foreign labors for harvesting operations in the scheduled calendars was arduous, due to travel restrictions from other countries, resulting also in food waste. For dairy and meat products, the closure of the Ho.re.Ca. canal entrained serious problems, as well resulting in a decrease of such food demand. These problems resulted in an increase of the prices of the agri-food sectors, especially for raw material provisions. Moreover, the Ho.Re.Ca. stoppage in March-April 2020 caused a 93% drop in the turnover of food retail sales, with estimated losses of more than 34 billion euros, and the growth in retail sales (+3.1%) only partially offset the losses in non-domestic consumption (ISMEA, 2020b; 2020c; Coluccia B. et al., 2021).

The study aimed at elucidating about the situation of the agri-food sector focusing on an overall analysis of the main food productions touched by the negative effects of the pandemic at national and regional levels.

The methodology used is mostly data oriented when analyzing production trends, while a more qualitative approach is undertaken when analyzing consumers' behaviors and socio-economic implications for the agri-food sector.

4.4 Socio-economic trends in Italy

An overview of national statistics and socio-economic trends in the agri-food sector during the lockdown has the scope to be a starting point to analyze and better assess the principal sectors and categories affected by the pandemic and to monitor the trends over the year. In fact, the major gaps identified though a sector specific statistical analysis of available data, will help in a further analysis of the regional dimension in the Marche Region. Thus, the results of the agri-food statistical analysis presented herein could serve as a canvas for the definition of the main policy and economic interventions, particularly at the regional decision-making process.

Among the main agri-food economic activities, fisheries and wine sectors encountered major difficulties due to the closure of the Ho.Re.Ca. and the changing in consumers' habits, who privileged nourishments for domestic use, such as non-perishable foods and more economic products. This trend led to economic losses in wine productions and a decrease in fisheries provisions.

In fact, the lack in the fish demand from restaurants resulted in the decrease in fishing activities, with consequent economic losses especially for small-scale fisheries, which in Italy accounts for more than 80% of the total fish catch (ISTAT, 2021), while the wine sector faced the collapse of the demand in traditional client countries, with severe repercussions also on the management of wine stocks for next year harvest.

Despite the economic crisis in Italy and the closure of the Ho.Re.Ca. sector, one of the positive aspects of this critical period related to consumers and their change in food habits, when analyzing the overall national trends. In fact, according to Coldiretti, which is the main Italian association of agricultural entrepreneurs, the household spending on food products has continued to grow during the lockdown in Italy compared to 2019 (+11%).

From a health perspective, according to the study conducted by the University TorVergata (Di Renzo L. et al., 2020), consumers abandoned the so-called "junk" food, with a reduction in the consumption of salty snacks, carbonated and sugary drinks, processed meat, baked goods and packaged sweets, preferring ingredients for home cocked meals. This trend has continued also in the post-pandemic, and it

is expected that in the future there will be a modification in the citizens' approach to healthy and quality food, which will result in new market opportunities for producers.

The local dimension has been privileged by consumers with a national overall increase of 6.5% in economic value of food purchase in small shops compared to 2019 (IlSole24Ore, 2020).

Despite these positive trends, a part of citizens also faced a new dimension of poverty, due to the loss of jobs caused by the pandemic, and encountered problems in buying quality food, such as foods rich in important nutrients for the human health (e.g. proteins).

More in detail, when analyzing the retail sales sector, if we compare April 2020 to April 2019, the retail sales in the agri-food sector recorded a +6.1% in the economic value and +2.9% in the volume, of which for example large-scale distribution +6.9%, discount shops +9.3% and small shops +11.2% (elaboration on ISTAT and Coldiretti data, 2020).

More into detail, retail sales of packaged food products in 2020 had an increase of +18% compared to the same period of previous year (March-May) and, overall, it increased by a further 3% compared to the first month of the emergency (February). This trend is due to the necessity to store non-perishable food during the lockdown period as a psychological sense of security perceived by citizens.

In general, in Italy the major trends of consumers in 2020 compared to 2019 have been: an increase in home deliveries (+160%); a recovery of the local businesses, that also quickly organized home deliveries; a significant change in purchasing habits by consumers who have changed their food routine preferring cereals, legumes and ingredients for home-made cooking (e.g. flour, eggs, oil, cheese, tomatoes, etc.); a steady purchase of medium-low cost wine (elaboration on ISTAT data, 2020).

When analyzing the overall agri-food sectors in Italy, after a negative performance in the added value (-1.6%) when comparing to the year 2019, the pandemic caused an additional contraction. In fact, in 2020 the production in the agri-food sector decreased in volume (-3.2%) and in the added value (-6%). In particular, the negative effects of the pandemic had a serious impact on the secondary activities of agriculture (-20.3% in volume). Only for the forestry sector there was an increase

in production (+ 0.4%) and in the added value (+ 0.7%), while for fisheries the decrease accounted for -8.8% in the production and -5.3% in the added value (ISTAT, 2021).

Furthermore, the pandemic has led to adopt restrictive measures for the export of food (i.e. cereals), with important repercussions on companies and on price trends not only on national but also on international markets. For the food industry the production index in 2020 decreased by 5.3%, compared to March 2019 (elaboration on the National Institute of Statistics - ISTAT data, 2020).

4.5 Analysis of trends in the Marche Region's agri-food system

In 2019 the agri-food sector in Italy (agriculture, forestry, fisheries and food industry) compared to 2018 marked an overall increase in the added value of 1.0% at current prices and 0.1% in volume, while in the second quarter of 2020 it had a reduction of the added value of 4.8% compared to the same period of 2019 (ISTAT, 2020).

The agri-food sector accounted for 4.1% of the added value of the entire national economy in 2019, of which 2.2% in the primary sector and 1.9% in the food industry (ISTAT, 2019).

When analyzing one of the most affected sector, the fishing sector in 2019 had an increase in production with + 1.7% and in the economic added value with +1.6% compared to 2018, while in 2020 the demand in volume of caught fish decreased by 30% compared to the same period March-May of 2019 (data elaborated on ISTAT, 2020).

Therefore, despite the difficulties caused by the restrictions, the Italian agri-food sector managed to consolidate its weight within the national economic framework in 2020 (ISTAT, 2021).

In the Marche Region the added value of the agri-food system compared to the total economic national value accounted in 2018 for an economic value of 1.8% (Marche Region data, 2019).

In 2019 the overall value of the agri-food sector estimated over the total of all the regional economies accounted for 17.7%, resulting the second most important economic sector in the region (Infocamere, 2019).

In spite of pandemic restrictions, the regional agri-food exports resulted in a loss of only 0.5%, if we compare the years 2020 to 2019 (data elaboration from ISTAT).

A current statistical analysis of the agri-food sector of the Marche Region shows a post-COVID-19 situation that is not easy to analyze, due to a lack of updated statistical data available especially for production and consumption in the Ateco sector A (agriculture, forestry and fisheries). Therefore, the study takes into consideration the Ateco sectors which showed significant alterations and presents the most updated statistics, taking into consideration quite more than a one-year time of reference (December 2019-March 2021).

In order to assess socio-economic impacts, the demography of agri-food companies has been analyzed focusing also on gender evaluation according to the international policies on gender balance, and the analysis of the employment rate has been important in monitoring the impacts on active labour.

As shown in Figure 7a, it is possible to detect a decrease in the number of active companies in the Ateco A (-3.09 %), that accounts for a loss of 803 units, if we compare data between the end of March 2021 and the end of December 2019; specifically 25,968 companies active in the agriculture, forestry and fisheries sector as at 31/12/2019, and 25,165 active companies as at 31/03/2021 (data from the Chamber of Commerce of Marche, June 2021).

A significant decline has been analyzed also in the number of active companies lead by women in the agriculture, forestry and fisheries sector (Figure 7b), with a decrease of 4.7% (345 companies lost between December 2019 and March 2021), timely no. 7,386 companies as at 31/12/2019 and no. 7,041 companies as at 31/03/2021 (Chamber of Commerce of Marche, June 2021).

As regards to the number of employees in the Ateco sector A (Figure 8), due to the pandemic there was a significant loss (-6.68%) in their number during the first lockdown, going from 23,472 units in the fourth quarter of 2019 to 21,903 units in the third quarter of 2020. Thanks to the reopening and the financial aid provided by the Italian government, their number recovered in 2021 with 22,619 units in the first quarter of 2021 (Chamber of Commerce of Marche, June 2021).

Comparing to the same time period of reference (December 2019-March 2021), it is significant to estimate a recovery in the number of employees, with a general loss of - 3.63% (Chamber of Commerce of Marche, June 2021).

When analyzing the main sectors which encountered major alternations in the Marche Region, specifically cereals and fisheries, the time period of reference is the first lockdown of the activities. This has the scope to better assess the alterations in the production patterns also related to import and export trends. In particular, the analysis on cereal productions relates to the consequence of exports alterations, while the analysis on fisheries refers to the closure of the Ho.Re.Ca. sector.

As shown in Figure 3.a, one of the sectors that has experienced a significant decline due to the decrease of exports and despite the significant national demand, is the cultivation of cereals (Ateco A 01.11.1), with a decrease of 2.33% in the number of companies going from 17,002 at 31/12/2019 to 16,606 at 30/09/2020 (Chamber of Commerce of Marche, November 2020).

For the same time-period, for fishing activities in marine and inland waters and related services (Ateco A 03.11, Figure 3.3b), there was a decrease of 1.86%, specifically from 592 companies to 581 (Chamber of Commerce of Marche, November 2020).

If we analyze the sector more in general, the agri-food sector generates an added value equal to 1.8% compared to other national activities and counts 2.8% employed people in the sector at regional level (source Marche Region based on ISTAT processing, years 2018 and 2019).

There are approximately 6,800 farms in the Marche Region, accounting for 3.2% of Italian farms and the overall Utilized Agricultural Area (UAA) is approximately 471,000 hectares, equal to 3.7% of the national total UAA (ISTAT, 2016). In the Marche Region, the UAA dedicated to organic agriculture accounts for 22.5% over the total (CREA, 2020), and this is a positive trend when aiming at achieving the European goal in the Green Deal of 25% of organic agriculture.

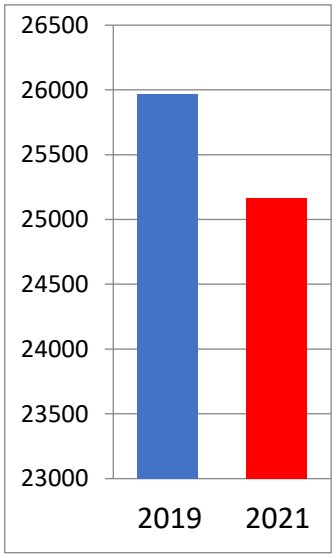
In the Marche Region companies are especially small-medium enterprises and the small-scale dimension is prominent in the territory, accounting for around 94% for micro-companies up to 9 employees (Infocamere, 2019).

The Marche Region has peculiar pedoclimatic characteristics and the agri-food companies are scattered from mountains, hills and the cost. As previously shown,

the lockdown caused major problems for companies, especially for the most vulnerable and for the ones aligned to exports. This means that resilience should be boosted at the regional level and in line with the national situation of recovery from the pandemic.

Figure 7. Demography (no.) of agri-food companies by category in the Marche Region (Source: elaboration on Dataset Chamber of Commerce of Marche)

a Agri-food companies



b Agri-food companies lead by women

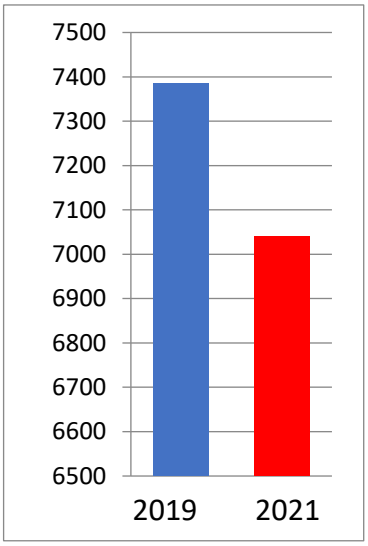


Figure 8. No. of employees in the agri-food sector in the Marche Region

(Source: elaboration on Dataset Chamber of Commerce of Marche)

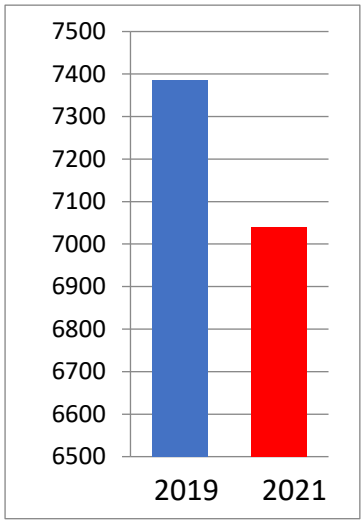
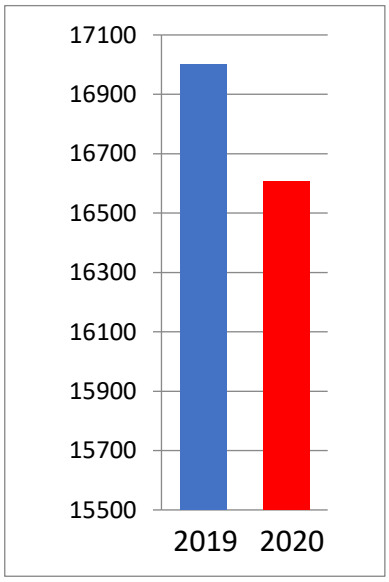
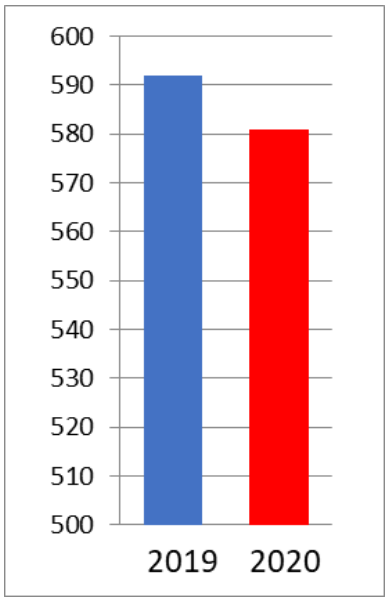


Figure 9. Demography (no.) of agri-food companies by sector in the Marche Region (Source: elaboration on Dataset Chamber of Commerce of Marche)

a Cereals



b Fisheries



The analysis on statistical data allows to better assess the main gaps to overcome in the regional agri-food sector, being a starting point for the definition of the main future interventions to be undertaken by policymakers.

In particular, as presented in the figures 7, 8, 9, the principal difficulties have been encountered by firms, especially employees and women working in the agri-food companies. In fact, as shown in Figure 7.b, companies lead by women have suffered

the most with a loss of around 5% of companies. From a social analysis, this could represent the negative result of the closure of schools as an indirect cause, where women had to choose between work and family cares. Also, the national restrictions lead to some closure of activities which led to a significant loss of jobs in the Marche Region, especially during the lockdown (around -7%). Therefore, the economic subsidies given after the first lockdown in Italy have been useful in restoring the situation, with a new gain in jobs of around 3%. As shown in Figure 9 the most affected sectors in the Marche Region have been the cereal production, mainly due to the loss of exportations in other countries, and the fishery sector, due to the closure of Ho.Re.Ca. and the alterations in consumers' habits.

The research on the trends of the agri-food system in the Marche Region led to some personal consideration presented hereinafter.

For the agri-food sector, the long-term response at national and regional levels should support producers and the entire system in building self-reliance for the sake of food security, which entails shortening supply chains, in order to reduce current vulnerabilities, while strengthening local food systems to reduce dependence on imports. The return to a more robust local food supply and a shorter supply chain, where possible, can build resilience for current and future global threats.

The pandemic highlighted the importance of the local dimension of food provision and transformation so that the traditional agriculture systems, currently adopted in the Marche Region, are receiving increased attention in the context of sustainable food production at the national level (e.g. organic, conservation agriculture, agroforestry).

Thus, it is crucial to maintain and foster more sustainable systems by supporting producers in the transition. This can support the recovery of the agri-food system, while also reflecting important cultural values and regional traditions. Expanding on this point, it is important to build value chains that are complementary to agriculture and fisheries, such as agro-tourism or products linked to local culture and traditions. Local knowledge and innovation in the agriculture sectors need to be linked and enhanced to build resilience to future health crisis and to climate change.

Analysis on data showed that small-scale companies, especially those managed by women, encountered significant problems. Thus, it is important to shape innovative

and easy-to-use financing mechanisms, especially conceived for the most vulnerable, that integrate agriculture and health challenges, such as COVID-19. Both private and public sector mechanisms are central to implement a sustainable post-COVID-19 long-term recovery. Among the possible solutions, it is fundamental to review the bureaucracy process to access funds and temporarily lessen taxes; fiscal and monetary policies are needed to support farmers and households, provide insurance, scale-up social protection and prevent from job losses in the agri-food system.

The use of delivery systems, oriented to the sustainability of packaging, needs to be integrated also in the agri-food sectors with the scope to reduce barriers for the smallholder farmers in reaching consumers and end-users, though specific financial mechanisms such as the ones provided by the Measure 16.1 of the PSR (European Rural Development Plan).

The agri-food system in Italy is articulated and fully integrated with the principles of the Mediterranean Diet, which is a sustainable approach to food production and consumption. The new scenario in the consumers' demand of healthy and high-quality food resulted in the adherence to the Mediterranean Diet and thus, in the opening of new scenarios for producers in the agri-food system. These cultural values helped in the tightness and recovery of the national and regional agri-food system despite the threats of the pandemic. Since the COVID-19 crisis will not remain a one-off, it is crucial to address research and policies in the long-term run, in order to cope with future instability within the sector.

In table 4 policy recommendations are summarized according to a sustainable development analysis.

Table 4: Summary of policy recommendations for supporting a green recovery in the Marche Region, Source: personal elaboration

CLIMATE-ADAPTIVE SOCIAL PROTECTION FOR THE RURAL AREA	**ENABLING CONDITIONS FOR A RESILIENT AGRICULTURAL TRANSFORMATION**	**SUPPORTING OTHER GREEN INVESTMENTS IN THE BROADER RURAL ECONOMY**
• Combine agri-food sustainable	• Invest in more resilient agri-food systems	• Promote the adoption and

productions' promotion with social protection		extension of alternative energy in agricultural value chains
• Invest in opportunities linked with the rise of digital advisory services (such as precision agriculture)	• Promote the development of complementary financial markets	• Support supply chain management innovations
• Invest in expanding the evidence base on what works where	• Support innovation in the agri-food system	• Invest in a circular economy for agricultural waste recycling
	• Support private sector's ability to respond to green opportunities	• Reduce food loss and waste across value chains
	• Promote trainings on sustainable agriculture and access to regional and EU funds	
	• Promote the collaboration between stakeholders, research and academia	
	• Promote access to funds by limiting the bureaucracy	

Chapter 5. Circular Economy application with AgrI-fiSh Project and dissemination activities

This chapter presents an innovative research project, which is not related to the PhD but, due to the interconnection of the circular economy approach and the collaboration with some agri-food companies in the Marche region, was further on incorporated in the PhD representing an additional output.
In this chapter communication and dissemination activities and the research period abroad are also presented since they represent an integral part of the PhD expected activities and results.

During the first year of the PhD and thanks to a deeper understanding of the strengths and weaknesses of the agri-food sector in the Region, a personal idea of project was elaborated, accepted and further developed thanks to the expertise of the Tutor. In particular, the personal idea arose from the necessity of linking agriculture to fisheries sectors within the Region and abroad, since these two sectors are too often saw as separate activities. During the elaboration of the idea, I managed the application to national and international call, wrote the applications and coordinated the partners involved.
The AgrI-fiSh project not only involves three Counties but also some companies of the Marche Region and thus fully inscribes in the PhD outcomes.
The innovative project was elaborated and submitted to European and national calls during and after the pandemic. In 2021 the project was submitted to the international

Call PRIMA following Horizon regulation and selected in December 2021 among the first best 20 projects over a competition of more than 183 projects, receiving funds for more than 570.00,00 euro.

The project AgrI-fiSh "Circular economy application: from the field to the net. Sustainable and innovative feeds from agricultural wastes for a resilient and high-quality aquaculture" is coordinated by UNICAM and partners are the Italian National Research Council CNR- IRBIM, the University of Valencia (Spain) and the University Ibn Khaldoun University of Tiaret (Algeria).

The AgrI-fiSh project will contribute to the transition to a more resilient agro-livelihood system through an innovative and circular farming system, which promotes an efficient use of biological and natural resources with productivity increase. New potential for farms, agri-food systems and local markets will arise from the valorization of wastes issued from organic and climate-smart agriculture (CSA), to be used for the creation of high-value feeds for a sustainable aquaculture. Nutraceutical potential of such agricultural wastes (i.e from wine making, legumes and cereals), in combination with other components (whey, medical herbs) to create feeds for aquaculture, will foster animal and human health with consequent benefits for environment, local economies and consumers. Food production has to deal with a growing world population. According to FAO, aquaculture is among fastest growing food production sectors worldwide and has become the main source of proteins for human consumption since 2016, as a consequence of the marine overfishing and depletion of wild fish stocks (2020 World Fisheries and Aquaculture, FAO). But intensive aquaculture represents a threat for climate change and biodiversity. Thus, the project aims to present a solution by setting a virtuous system, limiting negative impacts (e.g. antibiotics) and introducing sustainable local farming approaches. In fact, agricultural wastes reuse has multiple benefits. Economically, agricultural wastes represent a cost for farmers (disposal and transport); the project is a concrete and profitable solution for their wastes' management. The amount of waste from food processing is estimated to be about 15% of total production (Eurostat); particularly, wine making wastes have a high incidence in terms of volume, i.e. about 8% of the total (Eurostat, 2018). From literature such wastes, especially grape seeds, have demonstrated nutraceutical

potential in animal and human well-being.[12] In addition, sustainable cultivation of legumes improves soil fertility and limits use of water in agriculture. More, the project will boost organic agriculture, while contributing to European goal of 25% of land dedicated to organic farming, and increase ecosystem services provided by sustainable agriculture and aquaculture.

The project aims to achieve a social impact. Indeed, the transfer of the processes developed from the laboratory dimension to the pre-industrial scale constitutes a starting point for future entrepreneurial opportunities, with new employment generation. The development of research activities will involve young researchers, who will acquire technical skills; as well, capacity building and knowledge sharing activities with farmers and stakeholders will be aligned with research. Trained researchers and farmers will acquire more professional skills and, thus, gain employment opportunities. The project will contribute to cooperation, knowledge sharing and capacity building enhancement among the partners and the different supply chains, such as wine making and agriculture, milling, feed production, aquaculture, which will mutually benefit from the support of the research community.

The overall objective of the project is to reinforce the resilience of local agri-food systems face to climate change, through capacity building and cooperation among the actors involved in the agriculture and aquaculture sectors, while aiming at creating a circular model, which will effectively contribute to increase ecosystem services, biodiversity and farmer's incomes. The scope is also to provide with evidence-based the long-term sustainability of the project, and promote a sustainable inland aquaculture in rural lands as an effective and cost-saving activity, thus promoting farming diversification (legumes, cereals, wine) in regions characterized by degraded soils, like north of Africa and South of Europe. The project is built on interconnected research activities, to support the sectors transition to sustainable agriculture and aquaculture and to the circular economy model proposed herein. The circular model is applied to conceive innovative feeds, with high-nutraceutical values and low environmental impact (from cradle-to-grave), for

[12] M. Frombaum et al., Antioxidant effects of resveratrol and other stilbene derivatives on oxidative stress and bioavailability: Potential benefits to cardiovascular diseases, Biochimie, 2012, Pages 269-276

aquaculture productions starting from the reuse of agricultural wastes and with the combination of natural antimicrobial substances deriving from sustainable agriculture. The project itself contributes to achieve socio-economic impacts by scaling-up research activities from laboratory dimension to adoption of a circular model adaptable and replicable according to inner territorial needs and features, while generating new socio-economic opportunities. Agriculture and aquaculture are directly linked, enhancing their mutual potentials in a circular process, reinforcing the sustainability of local communities, promoting knowledge transfer and creating an innovative sector of employment. Moreover, such combination constitutes and effective approach for the rehabilitation, development and the maintain of local populations in abandoned arid inland, such as in Algeria. The circular economy approach will be applied within the project to the following principal sectors of research investigations: grape, cereals and legumes production, dairy products and medicinal herbs.

Consequently with the scope, the specific objectives are:

1) Definition of innovative feeds (bioproducts) with a low environmental impact through the partial/total replacement of animal protein and lipid components with organic agricultural wastes (at least 70% of the composition) ;

2) In-depth knowledge of the bioactive compound contents of bioproducts, mainly of grape seeds from various local grapes (Italy, Spain and Algeria), and legumes;

3) Valorization of organic agricultural wastes and reduction of the costs of disposal through the creation of sustainable and quality feeds, whit at least 20% lower costs);

4) Improvement of animal welfare by strengthening the immune system of fish by the bioactive compounds contained in the new feed and consequent reduction in the use of antibiotics;

5) Creation of a virtuous and circular local system that strengthens collaborations in the agri-food sector;

6) Creation of a sustainable and economically favourable and competitive system that supports small-farmers in implementing organic productions, especially of legumes;

7) Empowerment of local communities, with attention to gender and youth dimensions, strengthening the training system through direct collaboration at multiple levels (schools, universities and young entrepreneurs).

The project encourages local productions and rural development by promoting new agri-food systems capable of limiting negative impacts on ecosystems and on territories, guaranteeing high production standards and promoting the quality of the final product. According to market analysis, consumers show a greater sensitivity and insistently request local, healthy, sustainable foods for their diets (J.Aschemann-Witzel et al., 2020). To date, also as a consequence of COVID-19, the concept of food quality and well-being is considered a fundamental requirement, together with the traceability of products. Thus, the project will secure a quality protein intake from high-quality fish and promote the cultivation of sustainable agriculture, especially of legumes and cereals.

In Europe, aquaculture is a key component of the Blue Growth agenda to support sustainable growth in the sector. It represents 42% of the total value of fisheries production in EU, where Spain is responsible for 28.2% of the EU's total output in tonnes live weight of farmed aquatic organisms and Italy for 12.6% (Eurostat, 2018). Fish products supply around 20% of protein intake and minerals in developing countries and more than 50% in the poorest countries of Africa (FAO, 2018). The high socio-economic value of freshwater species in northern Africa is demonstrated: 46% of fish and 27% of plants used provide direct socio-economic benefits (IUCN, 2015).

In Maghreb countries (e.g. area in Kroumiria region in Algeria), inland aquaculture is increasing in production and provides an important input to the livelihoods of many thousands of people (D. E. Z. Abderrafik Meddour, 2017).

The final aim of the project is to contribute to the EU and national strategies in mitigate and adapt to climate change, reducing the environmental foot print of the agri-food sector through ad hoc strategies and models, and create new social and economic potential and competitivity at the local levels, while protecting biodiversity.

The inception of the project will see a testing phase of the pilot model in the Marche Region, along with pedoclimatic characteristic and inner production systems and a second one, in Algeria and Spain, where the model will be reproduced and adapted according to the specificity of each region (cultivars, fish species, territories). During the two phases all the partners will be involved in the development of the

main activities with a mutual perspective and according to their inner technical expertise, territorial realities and socio-economic needs, in order to enhance inclusiveness among all the actors involved. Participation will be secured though knowledge sharing, training and mobility, which will be helpful also in determine common potentials, and prevent and overcome possible barriers in the implementation of the model. Wastes from climate-smart and/or organic agriculture will be privileged to promote sustainability from the basis until the final stage. Analysis on the potential of whey and medicinal plants, which are rich in bioactive compounds, to be added to the feed will be also crucial in limiting the use of antibiotics, and used in improving growth, immune system and disease resistance in fish.

The scale-up of the model will contribute to make the agri-food system more resilient thought the adoption of innovative solutions to prevent from biodiversity loss, soil erosion and socio-economic instability. Through integrated production processes, which involve the cooperation of different production sectors, and the transformation of wastes through new biotechnological and chemical approaches, it will possible to return wastes as a resource by increasing its added value and limiting the disposal cost by farmers. The project aims to promote a greater development of territorial potentials through an active cooperation among the multiple actors of the research and agri-food sectors, enhancing the territorial excellence and exporting best practices.

The model is an innovative and mixed farming system and a concrete and applicable example of circular economy at regional and national levels, which focuses on the valorisation of the local dimension of the farming and territorial-specific production systems. It will serve for a better management of natural resources throughout the development of a virtuous system, which will help in reducing discards and pollutants and develop a more efficient use of natural resources, while limiting the use of antibiotics and pesticides along the entire process, with a circular system defined as “from the field to the net”.

The model will improve the Mediterranean agroecosystems’ resilience with focus on the concept of productivity and quality valorisation, and the maintaining of the well-being of the environment and the population. In fact, not only the wastes, especially issued from agroecological activities, will be used as quality materials,

due to their nutraceutical potential, but also the testing of the final product (i.e. innovative feeds) will enhance the nutritional quality of the fish. Further on, consumers will find in the market a higher-level product not only for their well-being but also for the well-being of the environment and the local economy. Consequently, producers (farmers and fishermen) will benefit from this virtuous system in terms of revenues and decrease in their vulnerability to climate change, since this model will guarantee yield prosperity and biodiversity abundance, while reducing the environmental impacts by promoting sustainable agriculture and aquaculture, and limiting the costs of adoption of the system. Moreover, to respond to current environmental challenges in the Mediterranean area, the proposed model aims at identifying and undertaking innovative practices suitable for the aquaculture production and in line with SDGs, (2, 12, 13 and 14) and circular economy objectives, through adaptation and mitigation strategies.

Benefits will be multiple both for the agriculture sector, which will limit the costs of the disposal of the wastes via the reutilization of by-products and discards, and for the aquaculture sector, which will reduce the costs of production, the use of natural resources and increase the resilience and the added value of the final products. Aquaculture is gendered and in the fisheries' sector women often are employed only in post-harvest and product transformation activities. Only in Europe women employed in aquaculture accounts for around 29% of the total (STECF, 2015), thus the creation of a new system on territories could boost their entrepreneurial opportunities and diversify job offer.

The innovative model is easily replicable and will be crucial for pursuing sustainability and creating new business initiatives in the agri-food sectors; due to high-degree of novelty it will represent an asset for national economies and for further investments in the sectors (1° innovation). The standardization in the use of medicinal plants and whey (LABs) as components of fish feeds for food quality and security issues will become a protocol (2° innovation).

AgrI-fiSh, which starts from the definition of an innovative technological model and goes up to the demonstration of such model through its application to the industrial system, is a novel concept that fits into the socio-economic and environmental sustainability. It promotes R&I and puts in place territorial practices and development in a circular economy perspective. Tangible impacts foresee

integration of aquaculture with agriculture with dynamic territorial continuity and rural development, with mutual benefits. More, there will be an increase in the high-quality products offer through a differentiation for markets with promotion of organic agriculture and sustainable aquaculture. Final products will be the result of a more sustainable production that limits use of animal feeds for aquaculture, lessen the use of pesticides in agriculture and antibiotics in aquaculture and promotes a sustainable use of natural resources.

Moreover, the promotion of such efficient system also in rural areas could multiply benefits and help people in marginal drylands to produce more valuable foods, reduce the pression on pastoralism and create jobs, among many other benefits. In particular, the development of this innovative system, with high environmental compatibility, will limit the environmental negative impacts of the agri-food sectors in most vulnerable ecosystems. Sustainable agri-practices will be boosted with the direct increase in agricultural area under productive and sustainable agriculture.

Key outcomes of the project relate to the diffusion at national and regional levels of new sustainable production technologies and will represent a new opportunity for farmers and fishermen, producers and the market, with the additional possibility of using environmental certification systems (e.g. EMAS, labels), that will increase the added value of the productions. Being a highly innovative project, the promotion of the territory as a whole and with its excellences is guaranteed through the dissemination of best practices among the partners and the communities. The project foresees active collaboration both from the scientific community and the private sector with direct positive effects on civil society and on the market at regional and national levels. In order to evaluate the project, mid-term and result indicators as well as key socio-economic and environmental performance indicators, both quantitative and qualitative, will be used trough collection, validation and harmonization of data ex ante and ex post, in order to assess the effectiveness of the project activities.

The AgrI-fiSh project is currently gaining high media attention (articles in EconomiaCircolare.com, CronacheMaceratesi, Unicam Press) at the regional and national levels, resulting in further high potential of dissemination of its results.

Table 5: Main outputs of AgrI-fiSh

Expected contributions for the Call	Expected contribution of the AgrI-fiSh project
Adaptation of agriculture to climate change	The project will sustain the transition to a more resilient agri-food system by creating a local and circular model, valorizing wastes, increasing production of legumes and cereals in a sustainable way and preventing from soil erosion. Food security and biodiversity conservation will be fostered creating quality food through a virtuous systems.
Developing sustainable productive agro-ecosystems	The project will create a zero waste farming system with their valorization through a circular model aiming at creating a specific quality Label. It will help in decrease the use of chemical inputs promoting agroecology principles, and using medical plants and BALs to limit the use of antibiotics.
No. of innovations in farming systems developed, enabling sustainable and efficient agriculture and food systems	- Creation of sustainable feeds, with use of organic wastes (from 50 to 70%) replacing the animal components with plant components (from 50 to 100%); - Standardized protocol for the use of medicinal plants and whey (LABs) as components of fish feeds for food security and well-being; - Creation of a new circular system define from field (agriculture) to net (aquaculture); - Creation of innovative feeds with raw components (wastes) more convenient for farmers/ fishermen (decrease of costs from 15 to 30%);
Increase in incomes of smallholders adopting innovations	The circular systems enhances the local dimension and stakeholders' collaboration, thus limiting transport costs. Farmers will limit the disposal costs of agri-wastes, which instead will become a resource. Using such sustainable wastes, the feeds will be more convenient (at least 15% less). The final product (fish) will be of a higher quality and will produce more revenues (at least 10% more).

5.1 Main Dissemination and Communication activities within the PhD period

Dissemination and Communication can be considered horizontal activities of the entire PhD project and were crucial in attaining results and developing new relevant collaborations. These activities were specific activities in line with the PhD and its outcomes.

As previously analyzed, the companies identified joining the project have been actively involved through a participatory approach, *ad hoc* meetings and

communication activities, which during the second year took place entirely online due to the pandemic, and in a mixed version during the third year according to national rules.

The companies increased in their number and an association (Isola della Sostenibilità) was involved in communication and support activities and participated in the Ministry MiPAAF Call "Avviso pubblico per la concessione di contributi per la ricerca in agricoltura biologica" (https://www.politicheagricole.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/16433), which is still in its final review by the Ministry since March 2021.

The whole research activities, the questionnaire and the networking activities resulted in dissemination and communication materials.

In particular, the questionnaire served as a tool for preparing the official document for the Chamber of Commerce "*Una regione in metamorfosi e la necessità di delineare percorsi evolutivi. I risultati dell'analisi congiunta degli Atenei marchigiani. Rapporto di ricerca promosso dalla Camera di Commercio delle Marche. EUM, 2021*", aimed at defining the new strategies of the agri-food sector following the pandemic crisis. In particular, I was in charge of the research and writing of the chapter 6 on the agri-food sector " *Il Sistema Agroalimentare*" as leading author among others(pagg. 89- 106).

Among the main events, webinars and courses, I was in charge of, these are presented below.

On 14 October 2020, a national event presenting the PhD project was organized, during the Sustainable Development Festival promoted by Asvis entitled "Agroecology in the territory of the Marche Crater", during which the companies presented their activities and the main results. This event achieved high participation of the public and important regional and national press coverage on different media press. (e.g. https://www.centropagina.it/macerata/agroecologia-territorio-cratere-marchigiano-evento-online-universita-camerino/)

During the lockdown period, a webinar entitled "Climate-Smart Agriculture for a sustainable diet" was prepared and presented in the context of the initiative promoted by SAS Unicam "*Un dottorando in 40 minuti*".

In 2021, I have been in charge of the preparation of the contents and organized a Seminary for the UNICAM courses of " *Scienze Gastronomiche*" and "*Ambiente e gestione sostenibile delle risorse naturali*", in which I also took part as speaker and moderator.

In 2021, I have organized and presented an event during Tipicità 2021 "Circolarità e rigenerazione *nel settore agroalimentare*" (https://www.tipicita.it/project/circolarita-e-rigenerazione-nel-settore-agroalimentare/), which had important press cover and saw the participation of international audience, such as United Nations (https://www.corriereadriatico.it/fermo/tipicita_oggi_convegno_agroalimentare_green_fermo_ultime_notizie-5930342.html). This event was important in securing the collaboration with FAO, which resulted also in a publication as leading author in which UNICAM is herein presented, and the collaboration with the web magazine EconomiaCircolare.com.

In 2021, I have organized and participated as a speaker in another dissemination event for "Tipicità in Blu", presenting the case of an alien species and the related climate change thematic " *Il Sarago di Gomma*" (https://www.facebook.com/watch/live/?ref=watch_permalink&v=236403281788984)

In addition in 2021, I have participated as speaker in the technical meeting "Green Loop" organized by the Municipality of Morro d'Alba (https://www.qdmnotizie.it/morro-dalba-green-loop-festival-lancia-il-progetto-vinum/)

Lectures and courses on sustainability, circular economy, alien species and the Mediterranean Diet have been prepared and performed in the Schools "Liceo Classico indirizzo Linguistico Giacomo Leoparti" of Macerata and in the "Istituto di Istruzione Superiore Panzini" of Senigallia.

Among the main technical interventions figure the attendance to "Cibo e Nutraceutici: parola chiave Caratterizzazione", Camerino 9 July 2019. Title of presentation: "Sustainable Diet and Circular Economy"; and to "La chimica degli alimenti e i giovani ricercatori: i nuovi approcci in tema di qualità, sicurezza e aspetti funzionali di ingredienti alimentari", Milan 22-23 September 2019. Title of the presentation: "Circular Economy for a sustainable diet, the concept of quality".

5.3 Period abroad

From 1 December 2021 to 10 March 2022, during the period of exchange abroad at the premises of the University of La Laguna ULL, I have been involved in the

preparation of the Erasmus+ Call Topic 2 for the preparation of the contents of an international Mooc "Promoting One Health through raising sensibilization/awareness and service learning towards environmental contaminants impacting food safety and human well -being". In addition, I have supported research on food contaminants and their regulation at the European level and supported the research activities of the team under the supervision of Prof. Armendariz.

5.4 Publications

During the PhD the following publications have been realized and published. In publications from 1 to 6 my technical contribution refers to environmental and economic analysis in line with the PhD topics:

1) Optimization of espresso coffee extraction through variation of particle sizes, perforated disk height and filter basket aimed at lowering the amount of ground coffee used. G Khamitova, S Angeloni, **G Borsetta**, J Xiao, F Maggi, G Sagratini, ..., Food Chemistry 314, 126220 12 2020
2) Phytochemical profile and biological activities of crude and purified leonurus cardiaca extracts. S Angeloni, E Spinozzi, F Maggi, G Sagratini, G Caprioli, **G Borsetta**, G Ak, ... Plants 10 (2), 195 4 2021
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4) Effect of roasting, boiling, and frying processing on 29 polyphenolics and antioxidant activity in seeds and shells of sweet chestnut (Castanea sativa mill.). AM Mustafa, D Abouelenein, L Acquaticci, L Alessandroni, RH Abd-Allah, ... **G. Borsetta**. Plants 10 (10), 2192
5) Influence of Freezing and Different Drying Methods on Volatile Profiles of Strawberry and Analysis of Volatile Compounds of Strawberry Commercial Jams. D Abouelenein, AM Mustafa, S Angeloni, **G Borsetta**, S Vittori, F Maggi, ...Molecules 26 (14), 4153

In addition, two articles are in their peer review process, of which one as leading author (6) Ahmed M. Mustafa et al., Polyphenols, Saponins and Phytosterols in Lentils and Their Health Benefits, Pharmaceuticals; 7) Borsetta et al., "How COVID-19 impacted globally on the agri-food sector: an Italian case study", Journal of Agricultural and Food Economics).

Another additional publication, realized as leading author for FAO, should be mentioned, since a part is dedicated to a UNICAM activity. It will be published in 2022 (Borsetta G. et al., Climate change in the agri-food sector: challenges and opportunities from the global to the local, FAO 2022).

Chapter 6. Results and Conclusions

This dissertation has highlighted the main current policies and trends related to sustainability and innovation in the agri-food sector. Participatory approaches and communication methodologies and their use in research projects, as well as the climate change and circular economy framework helped in addressing needs and future development, declined from the global to the regional and national sectors.

The main results achieved are linked to the definition of the agri-food system in the Marche Region and the development of its fundamental role within the national and international scenario.

Some of the major agri-food companies have demonstrated high interest in the PhD activities and have reinforced their cooperation with the University of Camerino and with the Cluster Agrifood Marche and additional ones have reached the project. Active participation to events and meetings resulted in a growing interest also of important national companies, such as Angelini which, on voluntary basis, showed interest in the project and started a collaboration with UNICAM.

Thus, cooperation between regional companies has been a concrete result of the participatory approach.

They have been actively involved in national and international webinars, meetings and symposia, which helped in reaffirming and creating new collaborations among different stakeholders.

A major result obtained within the project has been the cooperation with the Food Agriculture Organization of the United Nation (FAO), as well as with ASVIS, FIDAF, Tipicità, Angelini and the National Research Council (CNR-Irbim).

An additional result, which arose from the PhD activities and was not expected, was the creation of a new innovative project with new partners. This idea resulted in the winning of the Horizon 2020 - PRIMA selection with the AgrI-fiSh project, which

gave sustainability also to the research activities undertaken during the PhD and provided with new opportunities the University of Camerino and the project partners.

Among other major results eight publications provided with additional results the PhD project.

In conclusion, taking in consideration the results of research and the main research questions identified, which have been presented along the chapters, it is possible to affirm that thanks to the PhD activities some agri-food companies of the Marche Region acquired visibility and entered into a new international dimension. The main scientific results in terms of policy resulted in a general enhancement of the entire agri-food system and the growing attention of the regional institutions and research bodies to the activities carried out by UNICAM., with consequent new collaborations in projects.

However, some limits to the research have been encountered, not only due to the pandemic but also to a lack in active involvement of a major number of agri-food companies. Thus, in the future it will be necessary to develop more in dept market analysis and enhance networking activities, in order to reach out a great deal of companies.

Acknowledgements

I would like to sincerely thank Professor Sauro Vittori since he gave me the opportunity of attending this PhD course, he strongly supported, drove my research activities, supervised and inspired all my work. I would like to thank Professor Gianni Sagratini for his important support, involvement in activities and advices and for facilitating my period abroad. I also would like to thank Professor Giovanni Caprioli for his constant availability and support to research activities and Professor Filippo Maggi for his availability in collaborating and exchanging knowledge. I would like to thank Professor Adele Finco for her professionalism and availability in exchanging research topics and advices.

I also would like to thank all my PhD colleagues for being always friendly and supportive not only in research activities but also in life in Camerino.

I would like to thank Professor Carmen Rubio Armendariz for her strength, enthusiasm and for accepting me in her brilliant and international team at the University of La Laguna and all colleagues/friends in Tenerife.

Certainly, I cannot forget all the experts I met during the PhD, in particular my thanks go to former colleagues in CNR- IRBIM, the Tipicità team and particularly to Dr. Alberto Monachesi, all the agri-food companies involved and in particular to Bruno Garbini, and Dr. Giuseppe Marconi who welcomed me in his team and supported the activities, all the SAS colleagues, the colleagues from the Unicam Research Office and in particular Dr. Natascia Alessandrini for her constant availability, and Dr. Sara Buti for her support in the creation of the website.

Lastly, I would like to thank my family and friends who supported me in this journey back and forth, and this very first time to myself for the willingness and strength of pursuing my passion for research and changing life for the better.

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