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PLATFORM-BASED SUSTAINABLE STARTUPS IN AGRIFOOD INDUSTRY: CLASSIFICATION AND IMPLEMENTATION

MASTER DEGREE IN
MANAGEMENT ENGINEERING

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Abstract in English

During the last century environmental, social and economic challenges has been intensified. Since the AgriFood system is a key industry in the development of every country, improving this sector is the main tool to address these challenges and raise the level of sustainable development. Along with this, the last 20 years have witnessed the strongest evolution of digital technologies around the world that allowed to develop such kind of business model as platforms. Thus, implementing the model as platform-based economy in the AgriFood industry can be seen as a solution for sustainable prosperity not only inside the sector but also in the world.

The aim of this work is to create enrich the existing literature and fill the gaps related to the principles and state of the platform-based economy in the AgriFood industry, taxonomy of sustainable platforms in the sector, their contribution to the sustainable development and, finally, barriers and enablers that influence the successful implementation of platform-based economy in the AgriFood system.

To address above mentioned topics, the database of AgriFood sustainable startups was developed and its descriptive analysis was performed. The next research contribution is the clustering analysis of startups and their further analysis that enabled to develop classification of platforms in the studied sector and understand how they create sustainability. Finally, by conducting and processing semi-structured interviews, the thesis investigates what are the challenges in the adoption of the platform-based model and which are the factors that facilitate their success in the AgriFood industry.

The current research has practical implications for companies since it provides a tool to better position themselves in AgriFood platform-based market and assess their sustainability impact. Furthermore, the research is valuable for policy maker since it provides a roadmap for strategic planning and development the AgriFood platform ecosystem.

Abstract in Italian

Nel corso dell'ultimo secolo le sfide ambientali, sociali ed economiche si sono intensificate. Poiché il sistema agroalimentare è un settore chiave per lo sviluppo di ogni Paese, il miglioramento di questo settore è lo strumento principale per affrontare queste sfide e innalzare il livello di sviluppo sostenibile. Oltre a questo, negli ultimi 20 anni abbiamo assistito ad una forte evoluzione delle tecnologie digitali in tutto il mondo che ha permesso di sviluppare un modello di business come le piattaforme. Pertanto, l'implementazione del modello come economia basata su piattaforme nell'industria agroalimentare può essere vista come una soluzione per una prosperità sostenibile non solo all'interno del settore ma anche nel mondo.

Lo scopo di questo lavoro è arricchire la letteratura esistente e colmare le lacune relative ai principi e allo stato dell'economia basata sulle piattaforme nell'industria agroalimentare, alla tassonomia delle piattaforme sostenibili nel settore, al loro contributo allo sviluppo sostenibile e, infine, barriere e fattori abilitanti che influenzano l'implementazione di successo dell'economia basata su piattaforme nel sistema agroalimentare.

Per affrontare i temi sopra menzionati è stato sviluppato il database delle startup sostenibili di AgroFood e ne è stata eseguita l'analisi descrittiva. Il prossimo contributo di ricerca è l'analisi di clustering delle startup e la loro ulteriore analisi che ha permesso di sviluppare la classificazione delle piattaforme nel settore oggetto di studio e di capire come creano sostenibilità. Infine, conducendo ed elaborando interviste semi-strutturate, la tesi indaga quali sono le sfide nell'adozione del modello platform-based e quali sono i fattori che ne facilitano il successo nel settore agroalimentare.

La ricerca attuale ha implicazioni pratiche per le aziende poiché fornisce uno strumento per posizionarsi meglio nel mercato agroalimentare delle piattaforme e valutarne l'impatto sulla sostenibilità. Inoltre, la ricerca è preziosa per i responsabili politici poiché fornisce una tabella di marcia per la pianificazione strategica e lo sviluppo dell'ecosistema della piattaforma agroalimentare.

1. Introduction

The Agri-Food system is an integral part of people's lives. It not only enables to fulfil basic human needs by providing the primary sources of nutrition and energy but also it is a one of the most valuable sectors in the economy of all countries in the world, especially, developing countries. The AgriFood industry makes up 4% of global gross domestic product (GDP) and can reach about 25% of GDP in some developing countries (Gautam et al., 2022). The studied system includes international enterprises which produce around 11 million tons of food per year (FAO, 2021) and provides 25% of employment only in food production stage. The last number rises for developing countries and can be equal up to 60% (World Bank Group, 2021).

However, currently the AgriFood industry as well as the world experiences the challenging times. The number of people in the world is growing by about 70-80 million people per year. From the agriculture and food supply standpoint, it means considering that each person strives for an increase in consumption, with absolute food consumption due to population growth, relative consumption also grows. Even though new technologies and innovative techniques are implemented in the agricultural sector day by day natural resources base is dwindling and facing the difficulties to satisfy rising consumption demand (FAO 2017). Furthermore, agricultural production and its effect on land use has a negative environmental impact that manifested in emissions of greenhouse gases (GHGs) (FAO, 2017). Agriculture generated 10.3 % of all CHGs emissions in 2019 (European Union, 2021). Comparing with manufacturing sectors, the studied industry also makes 2,7% waste (Eurostat, 2018). As regards the economic and social aspects, pervasive economic growth during the last 30 years haven't still resolved the poverty and hunger problem: nowadays approximately 2.1 billion people live in poverty where 700 million in extreme poverty. And due to the highly concentrated, commodity market nature of the industry and the limited access to new technologies and the market from the rural areas, the profitability of farming activity, which is the main source of money in low-income countries, is being significantly reduced.

In order to address these challenges it is required a systemic solution that creates more sustainable and inclusive market in the AgriFood industry and reshapes the actors, relationships, norms, and incentives that drive market dynamics and outcomes (IDH Farmfit, 2022).

Platform-based economy can serve as one of possible ways to reorganize agricultural and food systems by enabling direct digital connections among all actors of the AgriFood supply chain. According to European Commission, collaborative platform is a model that "create an open marketplace for the temporary usage of goods or services often provided by private individuals" (European Commission, 2016). The positive economical,

environmental and social contribution of the platform model implementation in the AgriFood sector was highlighted by different authors such as Shakhovskoy et al., Simatupang and Sridharan, Sacchi et al., Joiner and Okeleke. Furthermore, based on the analysis of the particular countries' or companies' experience, the further suggestions for the model adoption were formulated.

Therefore, the goal of the thesis is to understand the current state of the platform-based economy in the AgriFood industry and which platform's types are used there, how firms can contribute to sustainability through this model and how to create the healthy environment for its development.

To begin with, the analysis of the researcher's contribution to the topic will be conducted to identify the state of the art and reveal the current literature gaps in Section 2. Firstly, the introduction to the sustainability and sustainable development will be presented in the literature review. Secondly, the concept of sustainability in the AgriFood industry will be analyzed highlighting its current challenges and collaborative economy as a solution. Later, the definition of platform will be defined and, finally, the analysis of platform-based economy in the AgriFood industry will be performed

Then, in order to fill the gap of the current literature related to the topic the research questions will be formulated highlighting their relevance in Section 3.

Section 4 provides the framework and methodology used for addressing the research question. As regards the first research question, the construction of the AgriFood sustainable platform-based startups database and its descriptive analysis will be performed. As concerns the second research question, k-medoids clustering analysis based on multiple attributes will be exploited to create a platforms' classification. Later, the semi-structured interview will be carried out to validate of clustering results. The third research question will be addressed by the analysis of the AgriFood sustainable platform-based startups database in terms of generated sustainability framework based on the 2030 Agenda for sustainable development. Finally, the coding of the data collected through semi-structured interviews will be performed to answer the fourth research question.

Section 5 presents the results of the above-mentioned analyses. Particularly, it includes the overview the platform-based economy in the AgriFood industry, the taxonomy of AgriFood sustainable platform-base startups, the contribution of different platforms' clusters into sustainability and a list of barriers and enablers impacting on the development of platforms-based economy in the AgriFood industry.

Finally, Section 6 and 7 sums up the main finding of the current research and highlights its limitation and theoretical and practical implications.

2. Literature Review

This section reports the state of the art in literature dedicated to the topic and reveal the current literature gaps. Firstly, section 2.1. presents the introduction to the sustainability and sustainable development using past researches. Secondly, section 2.2 describes the studies related to the concept of sustainability in the AgriFood industry highlighting its current challenges and collaborative economy as a solution. Finally, the definition of platform is defined in Section 2.3 and the analysis of platform-based economy in the AgriFood industry is presented in Section 2.4. considering existing literature.

2.1. Introduction to Sustainability

2.1.1. History of Sustainability

The solution to the environmental problems of mankind today is associated with the concept of Sustainable Development. What is "sustainable development"? Why is there a situation in the world of the need to revise the further path of development? What led to the emergence of the concept of sustainable development? In order to answer these questions, it is necessary to turn to history.

The prerequisites for the emergence of sustainability appeared more than two hundred years ago on the basis of economic disciplines, when calculations were made about the growing population of the Earth in the coming centuries (Dixon et al., 1989). According to Thomas Malthus, who wrote "An Essay of the Principles of Population" in 1798, which initiated the formation of a consciousness of sustainability innovation and the concept of environmentalism. This document contains judgments that gave rise to the idea that since the human population is growing exponentially, and meanwhile food is in arithmetic progression, this will eventually lead to human need and poverty. However, the economic models of that time were not taking into consideration because they developed slowly (Freeman et al., 1973).

Also, one of the early adopters' strategic points which inserted the fetus of the concept of sustainable development was generated by socio-economic prerequisites which are:

- The dominance of the "philosophy of consumption" (Christian, 1891). For many centuries, mankind adhered to the "resource" path of development, the principles dominated: "man is the king of nature"; "consumption for the sake of prosperity" (Barnett, 2007). In the course of the history of its development, mankind has used the natural environment as a source of resources to meet its growing needs (Hodakov, 2021).

- The dominance of resource-depleting technologies, which was determined by: the priority of economic benefits; the illusion of inexhaustible resource potential.
- Inadequacy of the pricing mechanism for natural resources. That is, a situation has arisen when the prices of resources do not reflect their true value. The result of this method of management was the depletion of the resource potential and the degradation of the natural environment (Johnson et al., 1980).

In the second half of the 20th century, the situation began to change cardinally. One of the first significant works was "The Limits to Growth" which were introduced by The Club of Rome in 1972. Members of this society introduced to the world a new method of "system dynamics". The report "The Limits to Growth" marked the beginning of a number of reports of the Club. In these works, one can find in-depth development of issues related to economic growth, development, learning, the consequences of the application of new technologies and global thinking. Scientists modeled a computerized model of the world "World 3" and introduced a set of certain indicators into it. Thus, the hypothesis was put forward that if the population, industrial production and environmental pollution continue to grow exponentially in the future as well as in the past. The conclusion was that since the world is physically finite, the exponential growth of these three key phenomena must eventually reach a limit. Giving a report in 1972, they predicted that the limit would happen in one generation. Later The Meadows-Forrester and Messarovich-Pestel models laid the foundation for the idea of limiting resource consumption at the expense of the so-called industrially underdeveloped countries. The method proposed by scientists was demanded by governments for forecasting and, accordingly, for actively influencing the processes taking place in the world.

The first major breakthrough on a global scale was the UN Conference on the Human Environment at Stockholm in 1972. The emergence and growth of environmental crises and catastrophes of anthropogenic origin were the reasons for the appearance of the first works of scientists who tried to draw the attention of the public and states to the need to revise the relationship between Mankind and Nature. These problems showed that there are lots of contradictions in the views on the development process among industrialized and developing states in the world: some wanted greening, work to cleanse the planet, others wanted economic development, overcoming poverty (Boyle, 1995). The Stockholm Conference was the first platform that brought together representatives of developed and developing countries to discuss the human right to a "healthy and productive environment".

Currently, there are numerous options for defining the concept of sustainable development, each of which contributes to the specification of this term. One of the most successful is the definition given by the World Commission on Environment and

Development which were met in 1984 and only 900 days later the consequences of that meeting.

The main point of formation of the concepts of sustainable development was the Brundtland's report in October 1987 which showed to the world all the points that humanity needs to consider, develop and change. The "Our Common Future" book acts as a dictionary for the modern sustainable world forming which includes a clear explanation and the main definition of Sustainable development concept. The definition sounds like "Sustainable development is development that meets the needs of the present without compromising the ability of future generation to meet their own needs" (Brundtland, 1987). This definition is widely used and is considered authoritative.

Later Borowy, (2013) mentioned that it was a key moment in the world change while all the countries in the world are in the process of destroying rather than to think about improving.

The Brundtland Commission's mandate was to:

- "Re-examine the critical issues of environment and development and to formulate innovative, concrete, and realistic action proposals to deal with them;
- strengthen international cooperation on environment and development and to assess and propose new forms of cooperation that can break out of existing patterns and influence policies and events in the direction of needed change; and
- raise the level of understanding and commitment to action on the part of individuals, voluntary organizations, businesses, institutes, and governments" (1987: 347).

The Brundtland Commission Report recognized that human resource development in the form of poverty reduction, gender equity, and wealth redistribution was crucial to formulating strategies for environmental conservation, and it also recognized that environmental limits to economic growth in industrialized and industrializing societies existed. The Brundtland Report claimed that poverty reduces sustainability and accelerates environmental pressures – creating a need for the balancing between economy and ecology.

An important event after this meeting, which also influenced the course of the transformation of the world, was the UN Conference on Environment and Development, which took place in 1992. At the "Earth Summit" 5 new pacts were signed by more than 120 representatives of different countries. This document initiated the definition of

"sustainable development" as a comprehensive policy for the 21st century. The signed pacts contain 27 principles for the further development of the environment and define "the rights and duties of nations in their pursuit of human development and well-being". Thus, the Rio Declaration is a document containing a large number of references to the concept of sustainable development, which combines economic growth and environmental protection. The Earth Summit was the largest gathering of world leaders in human history for that time and were decided to do it every 10 years to follow the improvements. Like a big consequence of this Summit the Agenda 21 was created.

The most impressive example of international environmental policy is the Kyoto Protocol. This document was adopted in 1997 at the Third Conference of the Parties to the UN Framework Convention on Climate Change in Kyoto (Japan) and in 2005 entered into force after ratification by states, which account for 55% of world CO emissions. The Kyoto Protocol includes mainly European countries. Russia and Japan, while the United States and Australia withdrew from it for economic reasons, and most other countries did not sign it. The goal of the Kyoto Protocol is to reduce greenhouse gas emissions by 5.2% below the 1990 level for developed countries in the 2008-2012. The Kyoto Protocol provides for market-based emission reductions:

- clean development mechanism - developed countries receive credits by investing in projects to reduce emissions in developing countries;
- joint implementation - countries receive credits by investing in emission reduction projects in developed countries;
- international emissions trading - countries buy and sell emission offsets among themselves.

It should be noted that emission reductions will be costly for developed countries. The benefits of mitigation efforts will only be evident in the long term, while the costs of such mitigation will have to be borne now.

The breakthrough of the 21st century was the definition of the main Millennium Development Goals (MDGs) between 2000 and 2015 which were supervised by the Sustainable Development Goals (UN, 2000). The United Nations Millennium Declaration, signed in September 2000, commits world leaders to combat poverty, hunger, disease, illiteracy, environmental degradation and discrimination against women. The MDGs flow from this Declaration. Each MDG has targets set for 2015 and indicators to track progress against 1990 levels. The United Nations Millennium Development Goals (MDGs) are 8 goals that UN member states have agreed to try to achieve by 2015.



Figure 1. Millennium Development Goals and Sustainable Development Goals. Source: UN, 2000 and UN, 2015

Speaking about sustainable development, we must understand: what exactly can and should develop sustainably? This is society, economic system, natural environment. In particular, sustainable development of the natural environment implies clean air, water, soil, functioning natural systems, i.e. preservation of the ability of nature to heal itself. From a social point of view, sustainable development involves the unification of all social, ethnic, age groups to participate in the management of the development of the territory; equitable distribution of work, income, social benefits, security and well-being.

Sustainable development of the economic system includes the use of efficient farming methods (in all industries and agriculture) aimed at improving the quality of resource use. These are resource-saving technologies, high quality goods and services. The development process of all three components is interrelated and interdependent, therefore it should be considered in unity. That is, it is advisable to consider the development process of the socio-ecological-economic system (SEES), consisting of three subsystems: ecological, social and economic.

Thus, the SD concept was formed as a result of the combination of three directions (Santos and Serpa, 2020):

1. Economic. From this perspective, the concept of "economic efficiency" is viewed from a completely different angle. As it became clear, long-term economic projects that take into account the laws of nature, as a result, turn out to be more effective than projects, the implementation of which does not take into account possible environmental consequences.
2. Environmental. The main goal of sustainable development in the field of ecology is the stability of physical and ecological systems. Ignoring the needs of the environment will lead to environmental degradation and endanger the existence of all mankind.
3. Social. It was the awareness of social problems that prompted the formation of this concept, aimed at preserving cultural and social stability, as well as reducing the number of destructive conflicts.

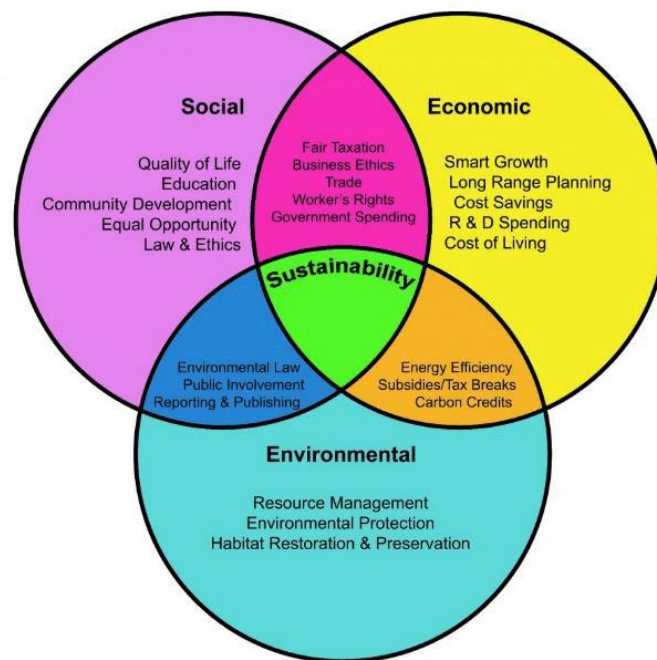


Figure 2. Relationships between Social, Environmental and Economic Sustainability. Source: Santos and Serpa, 2020

The stability of the three subsystems (ecological, economic and social) that make up the socio-ecological-economic system is not the same. The most stable is the ecological system, the least - the economic one. When we prioritize development on economic goals, we put the entire system in an unstable state. And only with the transition to environmental development priorities and the subordination of economic goals to social interests, we transfer the system to a state of sustainability, i.e. sustainable development.

2.1.2 Sustainable Development

The environmental sustainability is the ability of an ecological system to maintain its structure and functions in the process of exposure to internal and external factors. A synonym for this concept is environmental stability. The level of environmental sustainability of countries is quantified by the Environmental Sustainability Index (ESI). The index is based on the calculation of 76 parameters, including indicators of the state of ecosystems, environmental aspects of public health, environmental stress, institutional and social capacities and international activity of the state (Saisana, 2006).

Sustainable development, i.e. environmental sustainability is supposed to be achieved in the following ways:

- increasing the efficiency of the use of resources, through the introduction of environmentally friendly and advanced technologies, restructuring in the structure of the economy, environmental management, scientifically justified, secondary use and consumption of production waste;
- increasing the average life expectancy by improving its quality, environmental and social security, improving the health of people and introducing the “idea of a healthy society” with a healthy lifestyle;
- reducing anthropogenic pressure on nature by reducing emissions, clearing territories from "historical pollution", waste management, preventing environmental emergencies and improving environmental protection activities based on the introduction of an effective economic mechanism ("green investments" including) and ecosystem trans-regional the principle of implementing sustainable development programs;
- restoration and preservation of the natural environment, landscapes, ecosystems and biological diversity

At present, all the diversity of ideas about possible ways of further development of civilization can be conditionally subdivided into 3 groups: biocentrism, anthropocentrism and sustainable development (Gedzune, 2015).

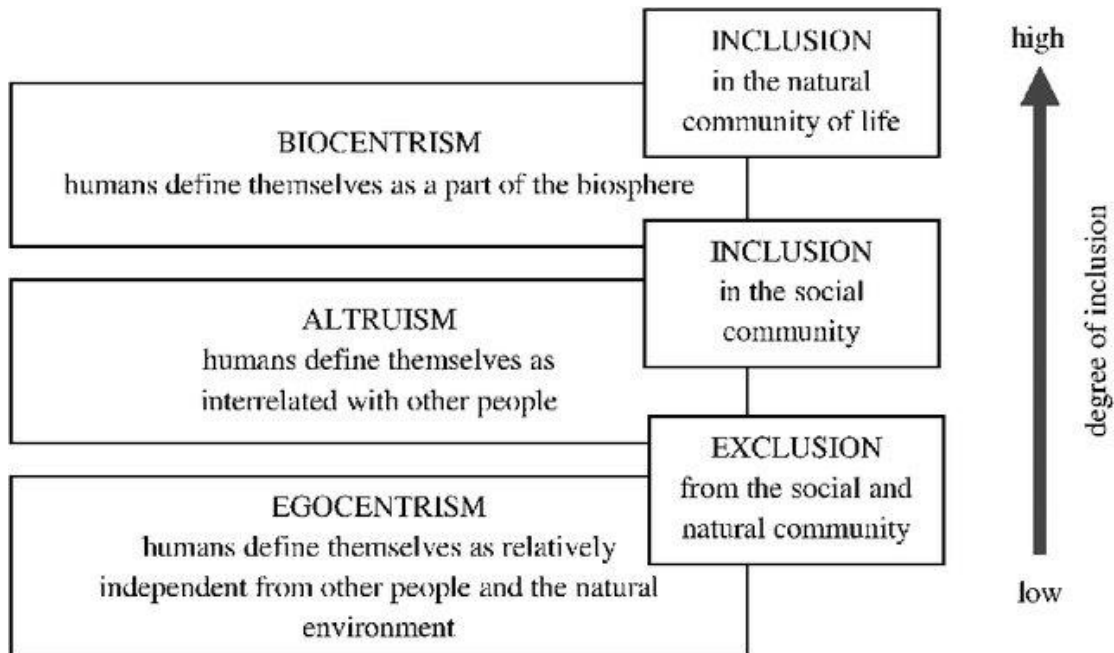


Figure 3. Egocentric, altruistic and biocentric positioning across the continuum of inclusion. Source: Gandzune, 2015

The main principle of biocentrism is the subordination of human development to natural processes by rejecting the benefits of civilization, i.e. the slogan "back to nature" is proclaimed.

The position of anthropocentrism is extremely opposite: the use of the biosphere as a source of resources for the growing needs of mankind, which is supposed to be achieved through technical progress (Verstraeten, 2015).

| ANTHROPOCENTRISM | BIOCENTRISM | ECOCENTRISM |
|--|---|---|
| Anthropocentrism is the view or belief that human beings are superior to all other organisms | Biocentrism places greater importance on living components of the environment | Ecocentrism is a perspective that places importance on the ecosystem as a whole |
| Focus on humans | Focus on all living things | Focus on ecosystem as a whole |
| Considers human beings the most important | Considers biotic factors important | Considers both biotic and abiotic factors as important |

Figure 4. Comparison of Anthropocentrism vs Biocentrism vs Ecocentrism. Source: Hasa, 2021

Sustainable development presupposes the harmonization of relations between mankind and the biosphere, the development of mankind in accordance with the laws of nature, which becomes possible under the condition of conscious restrictions on the consumption of resources based on the capabilities of the biosphere.

Thus, when disclosing the concept of sustainable development, 2 key aspects are distinguished:

- the needs of humanity, i.e. satisfaction of basic, most important, life-supporting needs;
- limiting needs based on the capabilities of the natural environment to satisfy them.

Technologies aimed at preserving the planet's ecological resources are of paramount importance for the sustainable development of the world economy:

- tightening of measures to prevent environmental pollution. Today, there are strict international and national standards that stipulate the content of harmful substances, for example, in the exhaust gases of cars, which forces car manufacturers to produce environmentally friendly cars. As a result, STCs, worried about the negative reactions of their consumers to environmental scandals, strive to follow the principles of sustainable development in all countries where they operate;
- creating cost-effective products that can be reused. This helps to reduce the growth in consumption of natural resources;
- creation of clean technologies. The problem here is that many industries use outdated technologies that do not meet the needs of sustainable development. For example, in the pulp and paper industry, many production processes are based on the use of chlorine and its compounds, which are one of the most dangerous pollutants, and only the use of biotechnology can change the situation.

By now, developed countries have been able to reduce the level of environmental pollution, or at least stabilize it. An example is Japan, which suffered in the 1960s and 1970s. From the excessive pollution of the atmosphere by numerous metallurgical plants, thermal power plants on coal, etc., but by now has managed to acquire the status of one of the most environmentally advanced countries in the world. However, this happened not only due to the use of the aforementioned technologies, but also because Japan and other developed countries have noticeably reoriented towards emerging economies as producers of products, the production of which greatly pollutes the environment (chemistry, metallurgy, etc.). Moreover, the process of curtailing "dirty" industries in developed countries was not so much deliberate as spontaneous, as the displacement of

local products by cheaper imported ones, although TNCs in developed countries contributed to this by transferring "dirty" industries to countries with lower costs. As a result, in many of these countries the problem of ecology and sustainable development has become aggravated.

Any kind of human activity uses biologically productive areas and / or fishing grounds. The Ecological Footprint (EF) indicator measures the consumption of food and materials by a population in terms of the area of biologically productive land and sea area required to produce these resources and absorb the resulting waste, and energy consumption in terms of the area required to absorb the corresponding CO₂ emissions.

The Ecological Footprint per person is the sum of six terms:

- the area of arable land for the cultivation of human-consumed cereals,
- the area of pastures for the production of livestock products,
- forest area for wood and paper production,
- sea area for fish and seafood production,
- area occupied by housing and infrastructure, territory,
- forest area for the absorption of CO₂ emissions from per capita energy consumption.

The Ecological Footprint is the sum of all these areas, no matter where on the planet they are located (Capaldi, N. et al., 2013).

The size of the "ecological footprint" for the countries of the world is calculated annually by the Global Footprint Network. Humanity consumes the services that nature provides it too intensively - faster than the natural potential for their production can recover. Already now, the cumulative footprint of mankind exceeds the capabilities of the biosphere by 30%. The footprint of the average consumer in the developed world is 4 times that of a consumer in low-income countries. In 2005, the global ecological footprint was 17.5 billion world hectares (mha), or 2.7 mha per person. At the same time, the total area of productive land and water surfaces of the planet, or biocapacity, amounted to 13.6 billion mha. The planet can only give 1.9 mg per person.

Eight countries - the USA, Brazil, Russia, China, India, Canada, Argentina and Australia own more than half of the entire biological potential of the Earth. Population and consumption patterns make three of these countries' ecological debtors, and their ecological footprint is larger than the biological potential of these countries - this is the United States and two fast-growing economies: China and India.

One of the scarcest resources on Earth (50% of countries already lack it) is water. A huge amount of water is sold in the form of goods and products. A feature of the blue economy concept is the emphasis on the systemic and sustainable development of economic sectors related to the use of the resources of the world's oceans and seas. Meanwhile, terminological and sectoral differentiation in the understanding of the "blue economy" remains, which makes it difficult to conduct international comparisons. The development of the blue economy concept reflects the recognition the exclusive role of the ocean and seas in the global economy. The World Wildlife Fund estimates the global value of the oceans at \$24 trillion. For example, the production of one cotton T-shirt requires 2,900 liters of water. On average, each person consumes and uses 1.2 million liters (about half of the Olympic pool) of water per year. At the same time, a resident of the United States uses about 2.5 million liters per year, and a resident of arid Yemen only 619 thousand liters. In general, in African countries, the per capita ecological footprint has decreased by 19% compared to 1961, although the population has tripled. Rich countries inherited 76% more over the same period. Greenhouse gas emissions alone in the wealthiest countries have grown 9 times.

Russia belongs to countries with an average income level, in such countries the number of inhabitants, as a rule, becomes smaller, and the footprint is also growing. For Russia, since 1961, it has increased by 21%. Today, Russia's footprint is 3.7 mha / person, which is almost three times less than that of the United States, but more than, for example, Ukraine, which uses 2.7 mha per person.

Ecological footprint is a measure of human impact on the environment, which allows us to calculate the size of the adjacent territory required for the production of the resources we consume and the storage of waste. With this unit of measurement, you can determine the ratio between your needs and the amount of ecological resources that we have in stock. This measure allows you to measure the pressure (impact) on the environment of any person, enterprise, organization, settlement, country and population of the entire planet. It reflects the consumption of environmental resources for the production of things we need, food, energy, etc.

An indicator is understood as an indicator (derived from primary data, which usually cannot be used to interpret changes); allowing you to judge the state or change of an economic, social or environmental variable.

Along with indicators, indices are developed and applied in practice. An index is an aggregated or weighted indicator based on several other indicators or data. The use of indices is acceptable where causal relationships are well understood.

2.2. The concept of Sustainability in Agri-food sector

Agriculture and food sectors are the main touching points between people and nature (FAO, 2018). Evolving this industry as an effective and sustainable systems contributes to achieving Sustainable Development Goals significantly (Defait, 2019).

The Agri-Food system is fundamental for people's lives. First of all, it provides the primary sources of nutrition and energy to fulfil basic human needs. Secondly, billions of people are employed in agricultural and food sectors. As a result, comparing with other sectors the Agri-Food industry uses natural resources in the widest extent (Laseter, 2021).

From the economic standpoint, the studied industry makes up 4% of global gross domestic product (GDP) and can reach approximately 25% of GDP in some developing countries (Gautam et al., 2022).

The global agricultural and food systems consists of international enterprises which produce around 11 million tons of food per year (FAO, 2021). In 2018 gross value of agricultural output reached \$ 3.5 trillion (FAO, 2021).

As regards employment, approximately 25% of population work the first stage of Agri-Food supply chain which is food production. This number rises for developing countries and can be equal up to 60% (World Bank Group, 2021). Therefore, taking into account also other segments of the industry such as food processing, storage, distribution and consumption, AgriFood sector are an integral part of many economies. European Union is not an exception. The incident of employees in the food and beverage sectors are the highest among all manufacturing industries in the EU countries (Townsend et al., 2017). In particular, there are 4.72 million people employed, a turnover of €1.2 trillion and value added of €236 billion (FoodDrinkEurope, 2019). For instance, the AgriFood industry comprises 25% of GDP in Italy.

Thus, effective and healthy AgriFood system is necessary to make the sustainable development goals achieved. Development of this sector can bring solid solutions to such issues as extreme poverty and hunger. In comparison with other sectors, agriculture enable to raise incomes of poor classes of population in 2-4 times more (World Bank Group, 2015).

However, at the moment, it is difficult to imagine how Agri-Food systems could develop if the population did not think about the next day. In the following few years, the agricultural industry around the world will undergo significant changes. Protecting the environment and combating the extinction of species will lead to new technologies, laws

and greater resilience in our work processes and human behavior. At the same time, the number of people in the world is growing by about 70-80 million people per year. Never before we have so many people lived on the planet at the same time. From the agriculture and food supply standpoint, it means considering that each person strives for an increase in consumption, with absolute food consumption due to population growth, relative consumption also grows.

The problem of sustainable food supply to the world will be a key challenge for future generations, which will subsequently highlight a huge range of challenges that need to be changed, developed or implemented.

The declaration of the MDGs in 2000 recognized that extreme poverty is unacceptable and that eradicating it is a collective responsibility (Fukuda-Parr, 2011). This was a normative shift in the way international development was viewed, away from a narrowly defined economic growth and toward a broader development agenda that encompasses poverty reduction, education, gender equality, and environmental sustainability (United Nations, 2015).

The governments of many countries focus their attention on the problems associated with the correct processing of food, lack of food, the correct development of agriculture without harming the environment, digitalization in agriculture and much more. All of these issues are tackled through unwavering global statistics that signal action. Also, this is started from the fundamental idea of sustainable agriculture which includes the 3 main aspects: environment, economy and society (Brodt, 2011). It is important for government to commit to broader support for public sector food and agricultural R&D that encouraged innovations that are not driven solely by profit. (Clapp, 2021).

At the moment, governments around the world have signed an agreement to achieve zero net emissions by 2050, thus farmers have to play an important role in achieving these goals (Darby and Gerretsen, 2019).

Indeed, agriculture can play a key role in tackling climate change, and there is a wide range of initiatives that farmers can take to create sustainable farming practices. However, the effective way to identify the possible agricultural sustainable solutions is firstly to systematize the current challenges in front of our environment and, consequently, AgriFood sector.

2.2.1. Economic Challenges

Agri-Good systems (Figure 5) consists of the wide range of agents and their interconnected activities not only in the initial processes of the supply chain such as production of food and non-food output but also in supporting downstream and upstream segments: distribution, logistics, marketing and etc. (FAO,2021).

Output of food system includes the products that intended for people consumption and done from crop and livestock, forestry, fisheries and aquaculture, as well as other sources such as synthetic biology. The latter are controversial in terms of benefits they bring. From one side, artificially produced food can reduce the environmental impact of the industry. On the other side, people employed in agricultural production of food can lose their jobs which is the negative economical impact. (Braun et al., 2021).

The connection of non-food supply chains with AgriFood systems lie in the provision of inputs that facilitate food production (fertilizers and farm equipment) and inputs for the production of non-food commodities.

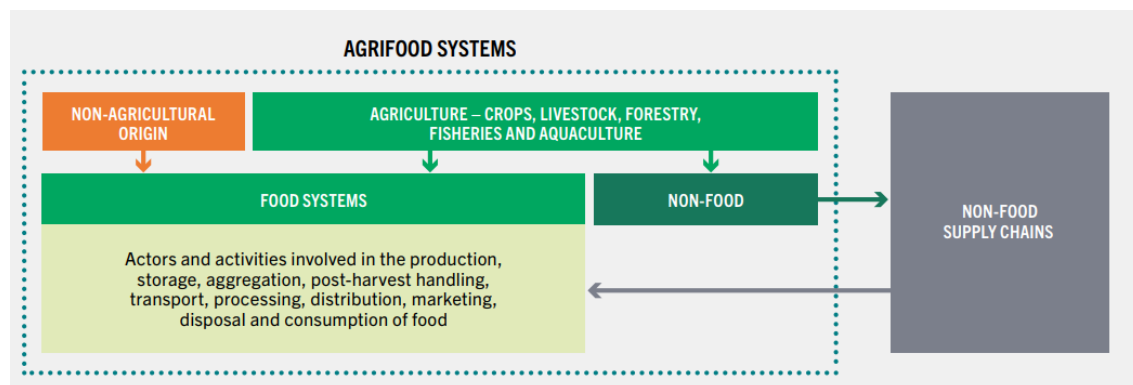


Figure 5. A conceptual framework for AgriFood Systems. Source: (FAO,2021)

In order to better understand how the AgriFood system is functioning it is crucial to identify key actors in its supply chain. Generally, its supply chain comprises a range of operational levels in a farm-to-table sequence: farming (cultivating land and growing crops), farming output processing and production, testing, packaging, warehousing, transportation, distribution, and marketing (Iakovou et al., 2012). Additionally, the above-mentioned activities require support from logistics, financial and technical entities for the continuous cycle. As a result, five types of flow arise that are presented in the Figure 2.2.2 (Jaffee et al., 2010; Matopoulos et al., 2007):

1. physical material and product flows;
2. financial flows;
3. information flows;
4. technology flows;

5. energy and natural resource flows.

Key actors can be divided into public institutions and private stakeholders (Tsolakis et al, 2013). The first class generally consists of national governments and related ministries, regulatory and administrative authorities, international organizations (for instance, the Food and Agriculture Organization). They are responsible for support enterprises in food chain and sustain a healthy environment in agricultural market (Bachev, 2012).

The second category includes the following units:

1. Food Producers. Farmers, breeders and fishers are engaged in this category. They are the main units in the agrifood supply chain since they provide key primary ingredients for food and drink by such operations as growing crops, raising livestock and fishery (Riccaboni et al., 2021). In 2016 farmland covered 47% of total land area in Europe, which took 10,3 million agricultural holdings (Eurostat, 2016).
2. Food Processors. These are entities engaged in processing and packaging of agricultural raw materials came from the above-mentioned actor. This category comprises artisan and industrial producers, processors of dairy or meat products and other processed foods (Riccaboni et al., 2021). Additionally, food services such as restaurants, bars, cafes also belong to this kind of participants in the value chain. According to the Farm to Fork Strategy by EU, food and beverage processors are intended to change the composition and types of products they manufacture for raising the availability and affordability of healthy, sustainable food (European Union, 2021).
In 2018 this stage of the supply chain counted 289 thousand F&B processing enterprises in the EU, which make up 14.3 % of all manufacturing enterprises. The turnover was € 1 093 billion with € 222 billion of added value (Eurostat, 2018).
3. Retailers, Distributers and Wholesalers. This class of actors includes the entities involved in distribution, storage and retailing of food stuffs: distributors, wholesalers, small and large retailers (Riccaboni et al., 2021). Within the EU's Farm to Fork Strategy, the European Commission encourage these actors to rethink the environmental impact they generate in packaging, the range of offered food products (European Union, 2021).
In 2018 2.7 million trading enterprises operated in the EU: 265 000 wholesalers and 888 000 retailers. The total turnover comprised € 2.48 trillion with € 424 billion of value added. They employed 16.4 million workers (Eurostat, 2018).
4. Input Providers. Input companies provide variable inputs, such as seed, fertilizer, fuel and labor, and quasi-fixed inputs, such as farm machinery, milling machines and coolers for perishables. Professional labor supply also relates to this category (FAO, 2021).

5. Service Providers. Service supply chains consists of companies that facilitate circulation of inputs, outputs and factors such as logistic and storage agents, facilitating the link between production and consumption. As an example, in Nigeria transportation enterprises enable delivery 75 % of the maize harvest from farmers to distributors. Similarly, almost all wholesalers rely on the same providers for storage (Reardon and Zilberman, 2021). Besides, there are entities within this group of actors that allows primary food supply chain to be more efficient, technologically developed and sustainable: R&D institutes, innovation centers, non-profit organizations (Jaffee et al.,2010).

Figure 6 (Tsolakis et al, 2013) presents the scheme of the AgriFood supply chains. It provides a clear picture of agricultural commodities’ movement from the upstream farm level to the midstream processors’ businesses and, finally, to downstream distributors. These three main operations, vital to any food system, are also supported by service companies (FAO,2021).

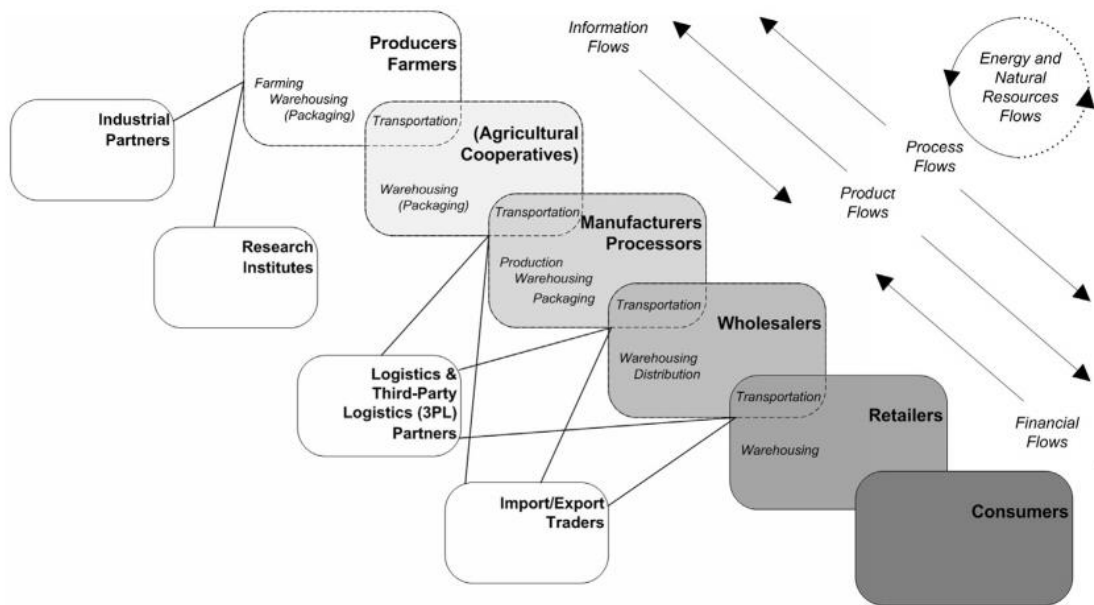


Figure 6. A conceptual system: Agrifood Supply Chain. Source: Tsolakis et al, 2013

The AgriFood supply chain have a number of unique characteristics that distinguish them from classical networks and increase the need for specialized management skills. According to Van der Vorst, (2000, 2006), AFSC has:

- the unique nature of the products, since in most cases they are products with a short life cycle;
- high product differentiation;

- seasonality of harvesting and manufacturing activities;
- variability in the quality and quantity of agricultural inputs and crop processing;
- special requirements for transportation, storage conditions, quality and processing of materials;
- national/international laws, rules and directives regarding food safety and public health, as well as environmental issues (e.g. carbon and water footprints) must be observed;
- the need for specialized attributes such as traceability and visibility;
- the need for high efficiency and cost-effectiveness of expensive technical equipment, despite the long production time;
- increased complexity of operations;
- the presence of significant capacity constraints.

Given the structure and features of the Agrifood Supply Chain, the following challenges it should address from the economical perspective to reach sustainability:

1. Provide resilience of the Agrifood Supply Chain

As stated before, the AgriFood supply chain engage multiple interconnected operations done by different actors inside and outside the system (Riccaboni et al., 2021). All of them are vulnerable to various risks and unexpected events. There is a strong dependence among not only the primary supply chain (farmers, processors and distributors) but also among supporting activities such as input, logistics and storage companies. Shocks and stresses outside the food system may also have a significant negative impact for actors performing primary activities (FAO,2021). Thus, considering the solid interconnection within the whole AgriFood supply chain, it is crucial to ensure the sustainable system for continuous operation (FAO,2021).

2. Create a fair competitive market environment

The agrifood sector is considered as highly concentrated and commodity market since in recent years mega-companies are arising through merges and acquisitions of small farms and enterprises (Clapp, 2021; Cagliano et al., 2016). There is a small number of multinational companies based in the European Union that compete in the global market. However, they sell a wide range of products. At the same time, the vast majority of enterprises (99%) and employees (58.2%) are related to small and medium enterprises (SMEs) (ECSIP Consortium, 2016; Fooddrink Europe, 2021).

It's dangerous for AgriFood sustainable development because this companies can pursue own commercial goals rather than the whole food system's purposes creating beneficial for them environment thanks to its power (Clapp, 2020).

A lot of suppliers, mostly farmers, are price-takers and do not have much bargaining power. Food processors and distributors have some room for differentiation, however they also experience the strong pressure for cost reduction, which can affect sustainability (Lawrence, 2013). As demand for sustainability increase, food itself can be viewed as one source of differentiation, and farmers can integrate innovative methods to elaborate branded products. For instance, illy was one of the first coffee producers that change the perception of its product from a typical coffee to a highly respected brand (Cagliano et al., 2021).

Also considering the weight of agricultural and farming activities in people's lives, it is crucial to mention such challenges as:

3. Eradicating extreme poverty and reducing inequality

In spite of global economic growth and a poverty decrease during the last 30 years, approximately 2.1 billion people live in poverty where 700 million in extreme poverty. The increasing inequality hinders the process of eradicating poverty. The majority of people who are poor and hungry earn for living by agricultural industry. Moreover, the high incidence of their expenses is food - the output of the food system. Therefore, the AgriFood sector is a main tool for poverty and hunger diminishing (FAO 2017).

4. Improving income earning opportunities in rural areas and addressing the root causes of migration

Young generation in countryside of developing countries often avoid working in farms that bring not enough income. In the search for more attractive job opportunities and higher level of live they move to other cities and even countries becoming migrants. As a result, older people and women stay in the farmlands to take care of it, however they struggle with such challenge as lack of resources to enhance their productivity (FAO 2017).

2.2.2. Environmental Challenges

Considering the environmental aspect of the topic, it was identified 5 main challenges that the AgriFood industry should solve:

5. Agricultural productivity enhancement to meet increasing demand

First of all, it is required to define how sustainably improve agricultural productivity to meet increasing demand (FAO 2017). Food consumption increases annually because of such structural changes as population growth, urbanization and personal income rise. The population is expected to reach 9.3 billion by 2050, with the majority of people living in cities (Alexandratos and Bruinsma, 2012). It is foreseen a significant increase in demand for agricultural products by 50 % between 2012 and 2050 (FAO 2017). Consequently, in order to sustain a world consumption production volume of agriculture will rise up and pressure of a natural resource base will be enhancing.

6. Ensuring a sustainable natural resource base

Additionally, ensuring a sustainable natural resource base is becoming an issue that should be addressed. Even though new technologies and techniques are implemented in the agricultural sector day by day natural resources base has already been experiencing difficulties to satisfy an overall demand for agricultural products (FAO 2017). The most damaged and representative aspects of the above-mentioned issue are land degradation, deforestation and water scarcities (FAO 2017). For instance, Food and Agriculture Organisation projected that the world area suitable for irrigation can rise at a relatively low rate of 0.1 % per year. Considering this percentage, it would be equal to 337 million ha by 2050, while in 2013 it reached around 325 million ha (Figure 7).

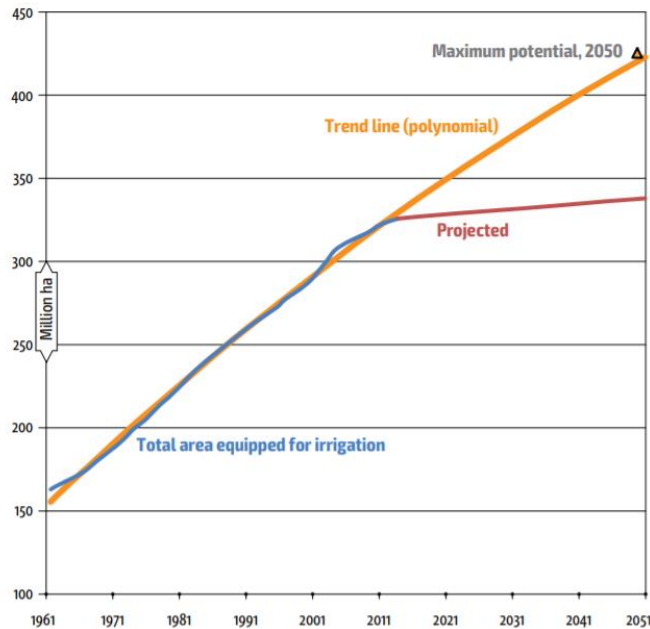


Figure 7. Trends and projections in total land equipped for irrigation to 2050, Source: FAO, 2016; Alexandratos and Bruinsma, 2012

7. Climate change and intensification of natural hazards

Moreover, agricultural production and its effect on land use has a negative environmental impact that manifested in emissions of greenhouse gases (GHGs) (FAO, 2017). In 2019 farming activities in the European countries generated 386 million tonnes of CO₂-equivalents of GHGs. Despite the fact that agricultural emissions reduced by 20.9 % from 1990 to 2019, in relative terms the agriculture’s incidence of all GHGs emissions rose by 0.4% and reached 10.3 % in 2019 (European Union, 2021). Therefore, climate change and intensification of natural hazards cannot be neglected to reach sustainability of agrifood sector.

In 2015, the leading countries recognized the necessity to face this issue. They organized, under the aegis of the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement on climate change, which acknowledges “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” (UNFCCC, 2015).

8. More productive, inclusive and flexible food system

Making food systems more productive, inclusive and flexible is other challenge in the development of Agricultural and Food systems. Agri-Food industry combines in itself the modern and conventional supply channels (FAO, 2017). Additionally, the system is

evolving and due to globalization process it relies on world's supply chains and large-scale distribution systems. For sure, it enable to address the rising demand for food and different (FAO, 2017). At the same time, more productive AgriFood supply chain generates new challenges (FAO, 2017):

- 8.1. A significant increase of food loss and waste. In the EU in 2018 farming, breeding and fishing as well as their output processing creates 57 million tons of waste. It makes up 2.7% of all waste generated in manufacturing activities (Eurostat, 2018);
- 8.2. Food security. A dangerous rise in the amount and nature of outbreaks of transboundary animal and plant pests and diseases (FAO, 2017);
- 8.3. The higher energy consumption and more serious environmental impact due to the long food chains.

The implications of these challenges for future food security and nutrition will need to be viewed from the perspective of food systems at large, including the impacts on traditional food chains and the producers and consumers who rely on them.

2.2.3. Social Challenges

The social aspect is presented by three challenges that are described detailed below.

9. Ending hunger and all forms of malnutrition

A key function of the agrifood sector is food provision for people. Facilitating the access of vulnerable classes of population to food and guaranteeing food security in cities, especially in developing countries will be the main approach to eliminating hunger during the next 15 years (FAO, 2017).

Besides, despite the fact that the rise in average income brings positive nutritional outcomes, the new challenge related to malnutrition will arise for the society. It includes undernourishment, micronutrient deficiency and overweight (FAO, 2017). Improvement in level of life will lead to changes in people's everyday meals that will be full of animal products. The risk lies on the fact that these products contain a lot of calories, fat, sugars and, at the same time, they are low nutrient. Considering also sedentary lifestyle in big cities, people will be more inclined to such diseases as obesity and overweight (FAO, 2017).

Thus, AgriFood system will take care of the change in dietary preferences of people as well as the demands of a growing number of poor and hungry (FAO 2017).

Spread of global supply chains and large-scale distribution systems affects not only environmental aspect of agrifood system but also challenges existence of farmers in the market (FAO 2017). It is still related to the challenge 8 mentioned in the previous Section 2.2.2 but from the different angle:

- 8.4.** The limited access and disconnection of smallholder farmers to market due to lack of infrastructure in rural areas;
- 8.5.** The limited access of smallholder farmers to new technologies (precision farming) due to lack of financial resources.

Formal, structured supply chains raise the efficiency of commodity flows – from factors of production to farmers and food to consumers. However, it influences food security negatively. As an example, distribution systems can be condensed in wealthier urban areas. Besides, it can be challenging for smallholder farmers to achieve the requirements of supermarkets such as uniformity, consistency, supply regularity, and high volume. Although there is spread of supermarkets, local food systems are play key role in poor countries since about 90% of food in countryside comes from domestic sources (FAO, 2017).

The decent attention should be paid also such issues as the link between farmers and markets, pricing policies and social protection to facilitate the access of customers to the healthy food. Therefore, the implications of these challenges for future food security and nutrition will need to be considered from the perspective of food systems, including impacts on traditional food chains and dependent producers and consumers (FAO 2017).

The summarized challenges that should face AgriFood sector are presented below in the table 1:

| <i>Sustainability Dimension</i> | <i>Challenges</i> |
|---------------------------------|---|
| Economical | <ol style="list-style-type: none"> 1. Provide resilience of the Agrifood Supply Chain; 2. Create a fair competitive market environment; 3. Eradicating extreme poverty and reducing inequality; 4. Improving income earning opportunities in rural areas and addressing the root causes of migration |
| Environmental | <ol style="list-style-type: none"> 5. Agricultural productivity enhancement to meet increasing demand; 6. Ensuring a sustainable natural resource base; 7. Climate change and intensification of natural hazards; 8. More productive, inclusive and flexible food system: <ol style="list-style-type: none"> 8.1. Food waste; 8.2. Food safety; 8.3. The higher energy intensity and heavier ecological footprint associated with the lengthening of food chain); |
| Social | <ol style="list-style-type: none"> 9. Ending hunger and all forms of malnutrition 8. More productive, inclusive and flexible food system: <ol style="list-style-type: none"> 8.1. The limited access and disconnection of smallholder farmers to market due to lack of infrastructure in rural areas; 8.2. The limited access of smallholder farmers to new technologies (precision farming) due to lack of financial resources. |

Table 1. Challenges in front of the AgriFood sector. Source: Own elaboration based on the literature mentioned before

2.2.4. Collaboration in Agrifood System

In the past, agricultural processing of new land and the use of new fish stocks have been the main ways to deal with food shortages. However, nowadays to address above mentioned challenges it is required more comprehensive and qualitative approaches.

In order to face above-mentioned problems, as well as many other sectors, the business and operational activities in AgriFood industry have shifted from the individualistic nature to the networks of collaborating companies (Kühne et al., 2015). It is necessary to combine specialized productions with traditional ones in order to achieve a competitive advantage in the global market and reduce the impact on the environment. The AgriFood system requires changes that develop communication and exchange of expertise between different players of the supply chain. The purpose of such partnerships should lie on the consolidation of the contractual strength, market power and the efficiency growth in order to sustain in the unstable and changing global business environment. Cooperating all together smallholder enterprises and big players in different stages of the Agri-Food system, they represent main forces to pursue the green and innovative policies articulated by governments and international organizations, to eliminate information gap (Barati et al., 2017; Contò et al., 2016).

In fact, stimulating social dialogue between various actors of the supply chain is becoming the first priority in dealing the challenges in front of industry (Carrillo et al. 2014). Embedded markets are elaborating stronger strategies for local development activities, creating new opportunities for rural families' livelihoods (Schneider et al., 2016). The experience of such countries as Spain, Czech Republic, Lithuania, Greece and Poland presented that collaboration of the agri-food small and medium enterprises (SMEs) enables to meet customers' needs in safe and healthy food (Bojar and Drelichowski, 2008).

Currently we live in the era of massive development and implementation of such new technologies as Artificial Intelligence, Blockchain, Internet of Things and etc. Thanks to them production process can reach maximum effectiveness, reduces waste significantly and achieve better resource allocation. However, taking into account complex situation in agricultural industry in modern world, it is challenging for a single farm especially related to SME to apply above mentioned scientific discoveries since its adaptation requires an enormous financial resources and infrastructure (Kühne et al., 2015). Based on the Indian Farmer Producer Organizations case, R. Krishnan demonstrates that different agents of food supply chain can achieve significantly better economic, environmental and social performances by collaborating with each other rather than operating alone (Krishnan et al., 2020).

The other significant reason to build strong network among farmers and other agents of food supply chain is the access to innovation (Kühne et al., 2015). Especially in this industry research and development processes can be enhanced and become more available for SME thanks to interaction of different enterprises (Avermaete et al., 2002; Weaver, 2008).

In general, there is a list of reasons how leading companies try expanding Supply Chain Collaboration (SCC), which include the global economic aim of lowering cost, increasing profit, developing operational flexibility (Bowersox et al., 2003; Mandal, 2017; Vereecke and Muylle, 2006), increase advantages over competitors (Mentzer et al., 2000), and being able to obtain additional resources (Park et al., 2004). Practice shows that better performance and more impressive results come from the cohesive work of stakeholders, and not from individual work (Simatupang and Sridharan, 2002; Sacchi et al., 2018). SCC is one of the types of such relationships, where the work is always very close and long-term. By sharing not only information and resources, but also by exposing common risks (Barratt and Oliveira, 2001; Bowersox et al., 2003), as well as by using variable coordination mechanisms (Agarwal and Subramani, 2013) to make joint decisions and resolve problems (Spekman et al., 1998), common goals are achieved in the SCC.

Besides, collaboration in agri-food industry is leading to sustainability. For instance, cooperation of suppliers and farmers can lead to more efficient use of resources and reduction of waste. Furthermore, circular supply chain turns waste of one company into an input for another and close collaboration between market actors contributes to this exchange (Ray and Mondal, 2017). Also due to information asymmetry products or services are allocated not properly that results in mismatch of demand and supply. Working jointly and sharing resources (physical, informational, technological and etc.) companies are able to meet market needs (Simatupang and Sridharan, 2002; Sacchi et al., 2018).

2.4. The definition of Platform

The collaboration within an industry can take different forms (Pop, 2017):

- alliances – an accordance between two or more independent enterprises to merge competences and resources for a short period of time to achieve defined strategic objectives;
- portfolios – an agreement created by the coordinating company with independent enterprises created by the coordinating company with the purpose of managing information flows through specific functions;
- networks – collaboration of companies to reach research and development objective regarding to business activity or the product itself;
- ecosystems a dynamic group of largely independent players who produce goods or services that collectively make up an interconnected solution. Such cooperation has certain rules and institutional agreements to sustain in the business environment.

However, the spread of new technologies and the integration of Internet in people's lives facilitation the development of a new business model grounded on collaboration: a platform-based economy. The European Union indicates collaborative economy primarily as collaborative Platforms that "create an open marketplace for the temporary usage of goods or services often provided by private individuals" (European Commission, 2016). In the European agenda for the collaborative economy of 2016 it is highlighted that this type of business model encourages economic growth and healthy competitive business environment (European Commission, 2016).

When a product is available to innovation process by external parties, it turns into a platform (Gawer and Cusumano, 2013). However, there is still limited understanding in the sector of what it is meant by a Platform in common sense. Currently this word is used to describe different business models. Based on the analysis of the corresponding literature, it was identified the following kinds of platforms depending on the extent of control between external parties and platform:

1. **Integrator Platform.** This kind of business model implies high level of control exerting by a platform. It means that a platform acts as a middlemen between external innovators and customers (Boudreau and Lakhani, 2009).

Example: Apple is a middleman through which transactions between software developers for iPhone and customers happen. The power of the company is expressed by monitoring and directly controlling operations with consumers, getting 30% of revenues. Besides, Apple can shape the

development path by choosing which apps are allowed to be present in the platform.

- 2. Product Platform.** The product or internal platforms serve as a technology foundation for external innovators that then directly sell the final product to consumers (Boudreau and Lakhani, 2009). Therefore, this kind of platforms have less control over other players. They can exert some power in terms of technical design of the key technology, but they enable direct communication of a product developers and customers.

Example: CoreTex is the membrane fabric created by W. L. Gore and Associates. It is widely used by more than 89 companies that based on the core technology developed a number of products such as medical implants, clothes and shoes (Boudreau and Lakhani, 2009).

- 3. Multi-sided Platform.** This business model is intended to facilitate the direct link between companies and customers eliminating third parties. It creates the infrastructure to easily transact among different business actors as long as they associate with a provider of platform (Parker et al., 2016).

Example: Airbnb is a two-sided, community-based online marketplace that helps connect travelers with local hosts. What started as a simple platform to offer "mattress and homemade breakfasts" has now revolutionized the way people travel. Airbnb's business model is unique, profitable, and has evolved to the point where it is now the most famous rental and rental brand in the world;

- 4. Industrywide Platform.** Industrywide platforms combine features of product and multi-sided platforms. On the one side, similarly the internal platform, a company provides the basis technology upon which external developers can create own product or services (Gawer and Cusumano, 2013). On the other side, the difference with the product platform and, at the same time, the common with multi-sided platform feature lies in the fact that the external innovators in this ecosystem are more flexible and the core technology is "open" to them. The level of the flexibility can depend on various factors like the access cost, governing type, access to information and etc. (Gawer and Cusumano, 2013).

Example: Windows and PlayStation3 are close to multi-sided platforms because they enable direct interactions between users and game or app developers. The industrywide platform owner does not fully control what third parties create with the core technology (Hagiu, 2014). At the same time, the electronic ink technology developed by E Ink also acts as an industrywide

platform. It is a key component in Amazon’s Kindle and other e-readers. E Ink functions merely as a component supplier to Amazon and others (Hagiu, 2014).

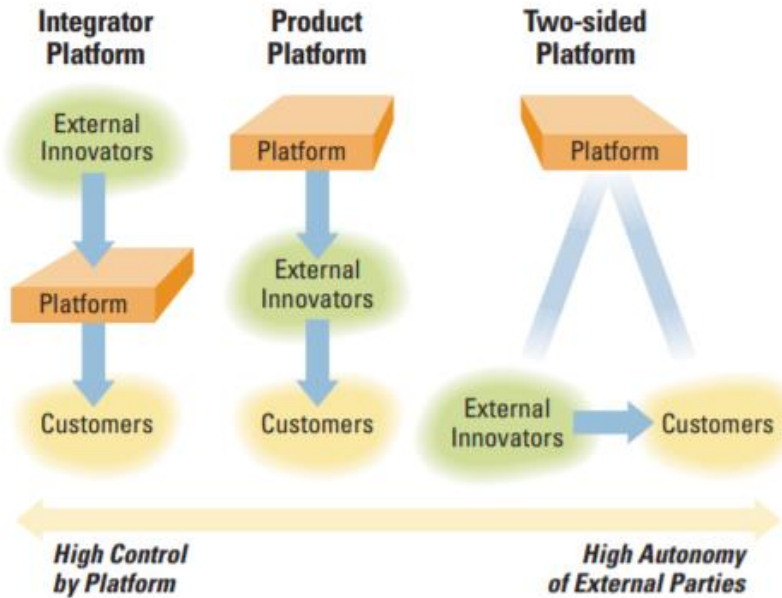


Figure 8. Platforms Classification. Source: Boudreau and Lakhani, 2009

Using the international literature, systematizing them and filtering out overlaps, we focused on multisided platforms which are also close to subject of discussions of the European Commission regarding collaborative economy.

2.5. Platform-based Business Model in AgriFood Sector

2.5.1. Emergence of Platforms in AgriFood Sector

In general, the way farmers function with other structures has undergone very significant changes over the past half century. If earlier farmers received services mainly from the state, now this system has become much more complicated. In the present period of time, this is a whole ecosystem that includes not only state entities, but also private and non-commercial ones (Shakhovskoy et al., 2020). It is also worth considering the impact of digital technologies on the expansion of this industry. The farming ecosystem is one of the difficulties in building relationships in the communication chain. Thus, new tools of digital systems have led to the development of new models to reach the most hard-to-reach farmers in rural areas.

In accordance with these innovations, the very process of providing delivery services to serve farmers began to change during the last 10-15 years. It can be definitely mentioned that this has become a more technological approach, especially from the private sector (Shakhovskoy et al., 2021).

Thus, two main trends can be distinguished in terms of shifts in service delivery (Shakhovskoy et al., 2021):

1. The focus has been on the topic of business sustainability, thus the **market approach to service delivery has changed**. Long-term indicators, which demonstrate investment attractiveness, show the effectiveness and reproducibility of models, became the leaders. Using this data, the cost-effectiveness of the intervention could be more clearly observed, as well as focusing more on the customer value proposition.
2. Introduction and increase in **the digital-enabled service delivery**. This has affected not only new entrants who started their business on the basis of digital technologies, but also existing suppliers who have modified the original business models to struggle modern market conditions.

On the one hand, it may seem that farmers do not directly contact the market or partially do not contact, since the prevailing part of their work focuses on the internal development of the business model, but this is not entirely true.

Let's consider the different side: thanks to the market-based approach, many enterprises, regardless of size, have been able to transcend the approach of either donor-funded projects or community extensions (Shakhovskoy et al., 2021). After the emergence of market-based approach, many organizations found that this area is an absolutely

promising investment area that will bring billions of dollars in profit. The main point is to correctly understand the needs of customers, their desires and find the most beneficial approach for both parties, taking into account the developing market. Other private organizations have taken up this strategy, as well as donors, investors and governments who have seen the promise and have begun to actively expand their support for market-based approaches to smallholder service delivery.

It should be noted that digital technologies have played a key role in the introduction of new business models (Shakhovskoy et al., 2021). This, more than ever, played into the hands of farmers, who often had difficult access due to the remote location, and, accordingly, the expensive price. Now we have a sustainable model that allows not only to speed up the communication process, but also to receive the best service, services, materials that adapt to their needs, and accordingly improve the ability to satisfy the conditions for business improvement, and at the same time the quality of their work. In turn, suppliers can increase the turnover of their units, developing a larger and more knowledgeable customer base, as well as maintaining profitability. It is important given that customer data is currently an important resource, as the more the provider understands the customer, the better the level of service delivery, which in turn leads to the optimization of monetization strategies.

The core of the development of digital technologies in agriculture and farming was the development of such a powerful digital device as a "Platform" (Shakhovskoy et al., 2021). It can be said that platform-based economy has taken the provision of services to a new level over the past ten years. Many entities, from donors to NGOs, have begun to invest their funds, provide grants for research and development and maintenance of business strategies. Thus, the platforms, the key goal of which is to connect different actors of the AgriFood supply chain, began to reach a new level, acquiring to some extent the status of an innovation through the involvement of such tools as blockchain, modern business strategies, etc.

However, there is a lack of information in the existing literature about the current status of platforms in the AgriFood sector. Particularly, it is vital to understand the statistical data of the platform-based economy presence in AgriFood market, geographical distribution, which types of platforms are used and how they are funded. Therefore, the first research question of the thesis is **“What are the characteristics (market share, geographical distribution, supply chain stages distribution, financial analysis) of platform-based sustainable startups market in the AgriFood industry?”**.

2.5.2. Classification of Platforms in Agrifood Sector

Without a common taxonomy and framework, learning around how Platforms can be used in agriculture has been limited.

Analyzing the existing literature regarding classification of AgriFood platforms, it was identified 3 main types within the industry.

1. E-Marketplace model.

This kind of platforms links various actors of AgriFood supply chain to facilitate direct transactions between them and information flow related to available markets and resources (Vlachopoulou et al., 2021).

Its main functions (Vlachopoulou et al., 2021):

- aggregate and organize fragmented users, making it easier for them to engage with each other;
- enforce minimum standards and support platform's users to exchange goods, services and information;
- actively matchmake between users to create interactions where there is more likely to be an exchange of value.

E-marketplaces require significant de-intermediation as agents and brokers no longer play a key role in the system and the value is expected to be captured and shared between farmers and the platform owner (Krishnan et al., 2020).

The "*forward exchange*" platforms are also related to this group. The difference from the pure e-marketplaces lies on the fact that forward exchange model has an auction approach with virtual bids (Krishnan et al., 2020). The market is fully transparent which means that food producers and sellers are aware of their customers and market prices. The forward exchange platforms provide the additional source of the direct connection with the consumers and access to the market. Through this channel farmers can sell to the food processors which are in the middle of the supply chain but also directly to retailers and wholesalers (Krishnan et al., 2020).

Within e-marketplace model there is also classification of platform based on supply chain stage where they operate. Linking food producers with the upstream stages of the supply chain, "*production and harvest services*" platforms enable farmers to easily lease agricultural equipment, hire necessary labor, get pre- and postharvest services such as cuttings, seedlings, drying, cleaning and grading of seeds (Krishnan et al., 2020). It also includes "*backward exchange model*" that related to connecting input (chemicals,

fertilizers, seeds) suppliers to smallholder agricultural enterprises (Krishnan et al., 2020). On such marketplace farmers can either find one company that provides necessary inputs with at the agreed price or get an offer from a group of suppliers with different services that farmers can select from. The platforms are mostly characterized by B2B relationships since it is the intermediate stage of food production (Krishnan et al., 2020).

Considering all platform types, e-marketplace platforms are the most attractive among the investors and, consequently, with most innovated over the last years (Shakhovskoy et al., 2021).

2. E-brokers model.

The main objective of e-broker platforms is to facilitate the matching among the various actors of the AgriFood supply chain and, thereby, enable the business exchanges for a commission or a fixed price. Such platforms can permit transactions between businesses (B2B), a business and a consumer (B2C) or consumers (C2C) (Vlachopoulou et al., 2021).

The key function they fulfill is provision physical, human, and digital infrastructure that involved parties can use in exchanging goods, services and information (Shakhovskoy et al., 2021).

Specifically, the following platforms fall in e-broker category (Vlachopoulou et al., 2021):

- *“Marketplace Exchange”* offers particular services to support the process of the exchange between the involved parties;
- *“Transaction Broker”* provides payment infrastructure in platforms to allow transaction actors to directly remunerate for the products or services (Shakhovskoy et al., 2021);
- *“Search Agent”* enables platform’s users the access to particular information regarding a product or service price or its availability.

3. Infomediaries (information intermediaries).

This category of platforms act as source of information that they get by themselves using different technologies and approaches. The information is collected and shared on request of various actors of AgriFood supply chain for their business activity (Vlachopoulou et al., 2021).

Their main function is to capture, aggregate and analyze interaction and customer profile data, and share these to help platform’s users make informed decisions (Shakhovskoy et al., 2021).

Information platforms are intended to cover information gap and challenges related to its access that farmers experience. The necessary data for agricultural activity refer to the weather, precise farming (diseases, pest information), yield, market prices, successful practices. All these information can facilitate to efficiency and productivity growth of a enterprise. In order to get these data it required to cooperate and create partnerships with the specialized organizations like weather establishment (Krishnan et al., 2020).

“Insight services” models sell the data they gather by placing it in a customer’s context. These platforms create the datasets and thanks to machine learning technics and AI generate valuable insight on behalf of different firms in the AgriFood industry (Canavari et al., 2010; Panetto et al., 2020; Rodrigues et al., 2021). In addition, through various digital tools *“virtual value-chain”* platforms in the AgriFood industry perceive “sharing of information as a value-creating opportunity” (Nabradi and Kovacs, 2020).

Aside from three mentioned classes, some authors distinguish also other platforms as Subscription-based and Finance models:

4. Subscription-based model.

This category of platforms is distinguished by the way it captures the value. It is a business model in which a customer pays a recurring amount to access a product. Generally, such platforms enable users to try the provided service or product by the certain free of charge period. Also, some companies offer multiple subscription’s plans which alter by different access to services (Warrillow, 2015).

5. The Finance platforms.

This model is intended to enable AgriFood companies to enter the market and grow by connecting them to potential investors (Nábrádi and Kovács, 2020). The finance platforms open up the access for farmers to capital and funding and facilitate the supply and demand alignment in the finance instruments market (IDH Farmfit, 2022). This category also involves platforms that link farmers with insurance companies that protect food producers from weather and crop yield uncertainties (Krishnan et al., 2020).

The summarized categories of platform models in the AgriFood sector are presented in the figure 9 below:

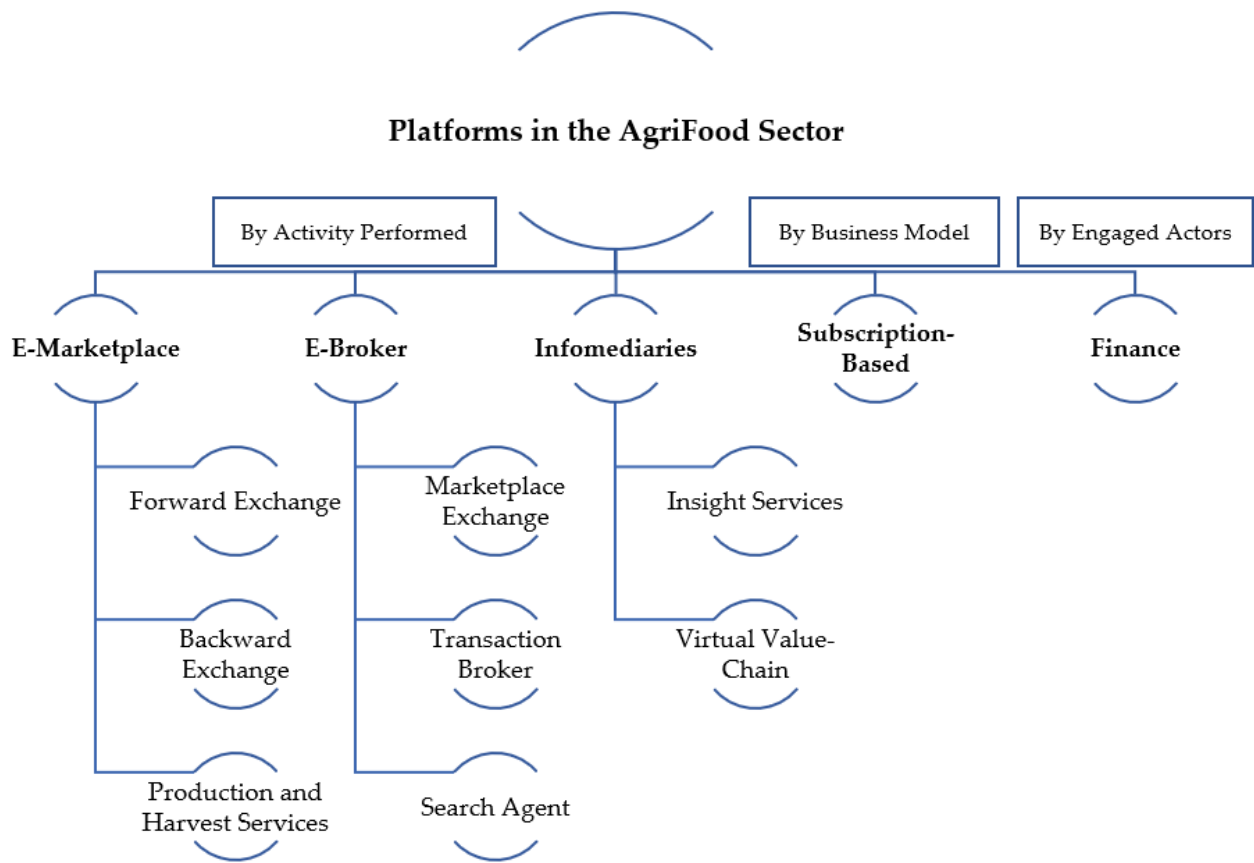


Figure 9. Classification of platforms in the AgriFood industry. Source: Own elaboration based on the literature mentioned above

Digital agriculture platforms, which support data sharing, analysis, interoperability, and public and private sector collaboration, as a new research domain, there is a lack of conceptual clarity around what constitutes a “digital agriculture platform”. In the section 2.4. we discussed existing classifications of platform-based business model in the agricultural sector. The limitation of the mentioned studies is that these taxonomies are based on the literature review only, not considering practical evidence. Besides, the authors mentioned in the section took into account only tangible attributes as a classification basis. To fill this gap, the second research question of the thesis is **“Which types of platform-based startups exist in the AgriFood sector?”**.

2.5.3. Sustainable benefits of platforms-based model

As highlighted in Section 2.2, the AgriFood market is forced to address a range of challenges that happen repeatedly. Resolving these challenges will require a systemic solution that creates more sustainable and inclusive market and reshapes the actors, relationships, norms, and incentives that drive market dynamics and outcomes (IDH Farmfit, 2022).

Platform-based model provides one possible way to reorganize agricultural system and raise the level of its sustainability –based on the global experience, they can be efficient intermediaries, aggregating disorganized markets and introducing market mediating mechanisms inside or among all stages of the AgriFood supply chain (Shakhovskoy et al., 2021).

There is a great number of the actors in AgriFood markets that tend to be highly dispersed. Particularly, it refers to farmers and agricultural SMEs. As a result, it is difficult for them to access the market and provide them any services. In low-income countries income of food producers drops by approximately 15% because of food loss. Besides, globally agricultural SMEs fail to receive about \$ 170 billion of funding (FAO, 2011). Despite the lack of a comprehensive global estimation of supply and demand for smallholder farmers' lending, the delta is assessed at \$ 100 billion per year only in sub-Saharan Africa (Joiner and Okeleke, 2019).

In addition, due to this "isolation" there is also information asymmetry from smallholder farmers' side since they either don't have tools to get the information or the data pass through various intermediary layers. It leads to lack of trust and connectivity among actors of the supply chain. Besides, the existence of multiple middlemen significantly increases transaction costs (Shakhovskoy et al., 2021).

Furthermore, the agrifood sector is considered as highly concentrated since in recent years mega-companies are arising through merges and acquisitions of small farms and enterprises. It's dangerous for sustainable development of the industry because this companies can pursue own commercial goals rather than the whole food system's ones shaping favorable for them environment thanks to its power (Clapp, 2020).

By digitally enabling direct connections between farmers, service providers, and other value chain actors, platform-based business model can help markets overcome some of these barriers.

First of all, from the economical standpoint, thanks to digitalization of transaction and activities AgriFood platforms create transparent and secure market for all actors in the

supply chain, especially farmers. It leads to fairer and lower due to avoiding involvement of intermediaries. This is often achieved by eliminating intermediaries in the value chain as well as improving the efficiency of the distribution system (Shakhovskoy et al., 2021). Consequently, platform-based economy provides the possibility for farmers to be less dependent on the food chain and avoid influence of big players. For instance, according to the Mozambiquan agricultural e-commerce company IzyShop statistics, farmers that use their platform as a distribution channel get higher than \$ 100 of income monthly. While other food producers in the country have about \$ 20 per month (Joiner and Okeleke, 2019).

Moreover, thanks to digitalization of all operations on a platform, AgriFood supply chain actors can store the history of their economic activity. At the same time, it enables to ensure the trustworthiness of farmers to financial and banking entities. As an example, the rise of Indonesian crowdfunding platforms facilitates the investment activity in the AgriFood sector. The startup Crowde serving as a platform that matching investors and farmers gathered 14 thousand smallholder entrepreneurs and 22 thousand people that provided about \$ 5 million in total (Joiner and Okeleke, 2019). In turn, this funding permits farmers to receive other products in finance market for investing it into business development. In addition, information transparency in the market can increase profitability of agricultural smallholder enterprises by capturing such new customer class as responsible shoppers. They are concerned to support local production and economy and choose goods from a particular origin. By business digitalization this information can be easily tracked. These factors make the farming business not only more profitable, but also captivating for young people to earn money (Joiner and Okeleke, 2019).

Secondly, considering environmental sustainability, platform-based economy significantly decreases post-harvest loss enhancing market productivity. As an example, the Colombian marketplace platform allows agricultural smallholder enterprises to reduce the food waste to 3%, while using traditional distribution channels farmers lose more than half of their produce (Joiner and Okeleke, 2019). Possibility to shorten time to market by the direct connection with customer enables to sell fresh and more nutritious products to a greater number of people. In this way the demand can be met and post-harvest food loss reduced to zero (Shakhovskoy et al., 2021).

Additionally, one of the function of platforms is eliminating information asymmetry among all actors in agrifood supply chain by collaborating with each other (Shakhovskoy et al., 2021). This allows to avoid mismatch of demand and supply and meet market needs (Simatupang and Sridharan, 2002; Sacchi et al., 2018).

Finally, social challenges in agricultural and food sectors can be tackled through implementing platform-based economy since it eliminates third parties and enable closer

communication of farmers and customers (Shakhovskoy et al., 2021). As well as crowdfunding and information sharing platforms open up the access for farmers to new technologies in terms of knowledge, competencies and financial resources in order to optimize the production activity.

Thus, platform-based economy is a promising model that can shake the AgriFood market up and make available various supporting services for all actors in the supply chain, especially for food producers. In the table 2 we summarized information mentioned above:

| <i>Sustainability Dimension</i> | <i>Challenges</i> | <i>Sustainable Benefits</i> |
|---------------------------------|--|--|
| Economical | <ul style="list-style-type: none"> • Provide resilience of the Agrifood Supply Chain; • Create a fair competitive market environment; • Eradicating extreme poverty and reducing inequality; • Improving income earning opportunities in rural areas and addressing the root causes of migration | <ul style="list-style-type: none"> • Provide greater transparency and visibility by eliminating middlemen • Facilitate less dependence in the food chain and avoidance of big players influence big players by eliminating middlemen • Make easier the access to financial instruments by creating financial history and crowdfunding platforms • Make farming more profitable and attractive business |
| Environmental | <ul style="list-style-type: none"> • Agricultural productivity enhancement to meet increasing demand; • Ensuring a sustainable natural resource base; • Climate change and intensification of natural hazards; • More productive, inclusive and flexible food system: <ul style="list-style-type: none"> ○ Food waste; ○ Food safety; ○ The higher energy intensity and heavier ecological footprint associated with the lengthening of food chain); | <ul style="list-style-type: none"> • Reduce waste and greenhouse emissions, facilitate efficient resource allocation by improving market productivity • Contribute to matching demand and supply by eliminating information asymmetry |

| | | |
|---------------|---|---|
| Social | <ul style="list-style-type: none"> • Ending hunger and all forms of malnutrition • More productive, inclusive and flexible food system: <ul style="list-style-type: none"> ○ The limited access and disconnection of smallholder farmers to market due to lack of infrastructure in rural areas; ○ The limited access of smallholder farmers to new technologies (precision farming) due to lack of financial resources. | <ul style="list-style-type: none"> • Provide the infrastructure to easier access to the market and new technologies for farmers by eliminating middlemen, easier access to financial instruments and information sharing among actors of agrifood supply chain |
|---------------|---|---|

Table 2. Sustainable benefits of platforms in agrifood industry. Source: Own elaboration based on the literature mentioned above

Using mainly theoretical approach, different authors highlighted that collaborative business model, particularly platforms, leads to market efficiency and information sharing which allows to address economical, environmental and social challenges. What is missing in the state of art is the more systematic based on practical method view on how platforms effect sustainability especially taking as a basis UN goals of sustainable development. That is why the third research goal of the thesis is to study **“How do Platforms create sustainability in the AgriFood sector?”**.

2.5.4. Challenges of Agrifood Platforms

As described above agricultural markets have certain structural characteristics that represent significant potential for platforms to add value. However, despite this opportunity, platform-based model in the AgriFood sector lagged behind compared with other industries by decades due to the several challenges (Shakhovskoy et al., 2021).

Up to the present time, this gap could be prompted by inappropriate digital infrastructure and lack of connectivity in rural areas. As stated before, platforms are digital by definition, that is why, the presence of digital technologies is crucial to permit them fulfil their functions of direct communication within the AgriFood sector eliminating middlemen. In fact, a great number of farmers, especially in low-income countries, experience the challenge related to lack of sufficient mobile connectivity which constrain significantly shifting to platform-based model (Shakhovskoy et al., 2021). Considering the AgriFood value chain as a whole, the appropriate infrastructure links small and big data (Coble et al., 2018). Moreover, the access to the digital connectivity in cities can be seen as a competitive advantage over farmers in rural areas. Practical research in Australia proved that technology availability disrupts the way women approach the farming activity which was resulted in time saving (Hay and Pearce, 2014).

Even when the access to digital technology is sufficient, there are more reasons why farmers struggle with implementing the technology within their farm. Another cause is the lack of supporting institutions that help farmers in their use and adoption of technology (Khanna et al., 2018) and, consequently, switching to platform-based economy. As an example, the help from third parties is required to farmers from African countries. They need not only financially resources but also direct connection with research organizations to raise the awareness and implement new tools in their enterprises for improving the productivity and food security (Richards et al., 2009).

Another potential cause of not making use of digitalization is the lack of appropriate incentives. The successful integration of market digitalization demands sharing the common incentives among all actors of the supply chain in order to collaborate (Cecchini and Scott 2003). In addition, the level of adoption is vulnerable to behavioral factors of market players that may be resolved through the right incentive system (Khanna et al., 2018).

Finally, platform-based model prospers in the standardized environment with consistent geographic areas and time (IDH Farmfit, 2022). This is not the case of farming system. Due to the fact that a particular crop can be raised in specific natural conditions, their value chain activities highly depend on the climate, soil, nature – factors that is impossible to manage. (IDH Farmfit, 2022). As a result, agricultural platforms are limited in the

opportunity to scale to another regions or countries because it needs customization. That is why, smallholder farmers are very localized networks. Additionally, the farming business are vulnerable to crop seasonality and market volatility (Shakhovskoy et al., 2021).

2.5.5 Enablers of Agrifood Platforms

In order to overcome the challenges mentioned in Section 2.5.4 it requires to create the healthy and sustainable business environment setting appropriate enablers.

Considering digital nature of the platforms, they are more likely to thrive in businesses that don't intend to use physical assets for transactions (Shakhovskoy et al., 2021). The bright examples are social networks such as Instagram or Twitter and sharing platforms like Airbnb (IDH Farmfit, 2022). Although, there are platforms that require serious physical infrastructure. For instance, e-commerce platforms Amazon or Alibaba possess warehouses, packing and shipping competences in order to perform their business operations. However, they require partnerships with service providers for transportation and delivery activities (Shakhovskoy et al., 2021).

Undoubtedly, the technological, communication, and institutional revolutions of the past decades have enabled SMEs to virtually integrate horizontally and vertically with other firms to create virtual organizations for substantially enhanced capacity for innovation (Weaver, 2008). However, there is yet no state regulation of platform-based economy that will provide risk protection and investment security in a particular country. The key topics that should be covered by the future legislation are a deep knowledge of the phenomenon and explicit distinction of the involved concepts (Nábrádi1 and Zovács, 2020).

The other driver of successful functioning of platforms is a supportive ecosystem. The Indian agricultural market is considered as an example of the prosperous platform-based economy. There are about 250 accelerators and 1500 investors that provide funds and services for 55 000 startups to develop (MANAGE-Center for Agricultural Extension Innovations, 2020). Moreover, some of accelerators and investors work particularly work in AgriFood sector supporting farmers and other actors in that supply chain. There are ICRISAT, CIIE, and NAARM organizations. In addition, on a regular base qualified reports with the assessment of AgriFood industry state are issued to provide a better understanding of the environment and to facilitate decision making process. Last but not least, the level of digital adoption rises in India. Mobil connectivity and Internet access are available not only in cities but also it is spreading in rural areas. In this way implementation of platform-based economy among smallholder enterprises accelerates (Anupam and Saravana, 2019; Pahwa et al., 2020).

Additionally, Simatupang and Sridharan, (2002) highlighted the following drivers for sustainable collaborative supply chain:

- **Appropriate Performance Measurement System**

In order to achieve effective collaboration within the supply chain the involved actors have to define the performance measurement system. It becomes a foundation to better understand the system itself, impacts on motivations of system members and gives a picture of results of business collaboration. Setting performance goals facilitates the continuous improvement of the whole supply that lead to business success for all participants.

- **Integrated Policies**

All actors of the supply chain should agree on the integrated policies for overall productivity because each company pursues its own objectives and follow targeted strategy. They have to decide within the system how to change it and find a balance between individual and collective value. Depending on planning horizons, updating the policies should follow different procedures. As concerns strategic level which is long-run and require involvement of top management and resource guidance, members should solve occurring challenges and disagreement all together to achieve common competitive advantage. The serious changes in one policy withing the system should lead to corresponding changes in others. As regards tactical level, the relative guidelines and procedures have to be developed to manage arising conflicts and decision-making process.

- **Information Sharing**

As stated before, there are different flows of information within the AgriFood supply chain: resources availability, contract and processes status, prices tracking, industry-specific data as weather forecast and pest and diseases distributions. Implementation of new technologies enables to collect and share the data in real time. As an example, developing a single source of information in web format can facilitate collaborating and connecting all operations and resources throughout the system from input stage to a final customer.

- **Incentive Alignment**

Any collaboration requires a certain level of commitment among all actors of the system. As mentioned before, in order to better off from merging the efforts and resources they cannot neglect the common value. However, it is challenging for a single company to step aside from its own corporate objectives for the sake of cooperation. Entities within the supply chain should be motivated to pursue collaborating goals and incentive alignment enables to agree on advantages and challenges that arise within the collaborative business activities.

In order to summarize the current issues platform-based economy in AgriFood industry experience and their probable solutions, the table 3 is presented below:

| <i>Challenges</i> | <i>Enablers</i> |
|---|---|
| Low Digital Connectivity in Rural Areas | Digital Penetration |
| Lack of Support from Third Parties | Supportive Ecosystem |
| Lack of appropriate incentives | Incentive Alignment |
| AgriFood Supply Chain, especially food production stage, Creates Hyper-Localized Networks | Appropriate Performance Measures |
| | Integrated Policies |
| | Information Sharing |
| | Explicit State Regulation of Platform-Based Economy |

Table 3. Challenges and enablers of platform-based economy implementation in AgriFood industry. Source: Own elaboration based on the literature mentioned above

Thus, based on the literature dedicated to this topic, it can be concluded that it is not fully explored. Most articles are related more to digitalization process rather than particularly platform-based economy. Moreover, the conclusions are built on case-by-case studies and not generalized. That is why the fourth research question of the thesis is **““What are the enablers and barriers in the implementation of Platform-based startups in the AgriFood sector?”**.

3. Research Questions

This section is aimed to present the gaps in academic literature defined during the literature review and research questions arising from it.

In the literature review it was conducted the broad analysis of the platform-based economy in the AgriFood sector and its classification, challenges and enablers. The objective of this research is to reveal empirical evidence on which clusters of sustainable AgriFood clusters exist and what is the environment they operate in; however, some literature gaps were outlined in the Sections 2 and described below.

First of all, what is missing in the state of the art is the current situation of platform-based economy in the Agri-Food industry. It was not possible to find sufficient number of literature sources that describe the whole picture of the penetration level of platforms in the market. Several authors reported a statistical data related to the market share and income generated, however, it concerns the certain platforms type such as e-commerce or marketplace. This information should be updated and complemented by wider range of characteristics describing platform-based economy in the AgriFood sector. To fill this gap, the first research question of the thesis is **“What are the characteristics (market share, geographical distribution, supply chain stages distribution, financial analysis) of platform-based sustainable startups market in the AgriFood industry?”** (Hereafter RQ1).

Secondly, a common taxonomy of platform-based model in the AgriFood system enables to learn in depth how platforms can be used in the industry. Section 2.4 provides the summary of existing in research papers classifications of this business model. While some studies consider a single attribute as a basis for clustering such as performing activity, the comprehensive cross-functional research affecting different aspects was not found. Besides, a part of academic articles apply classification not sector-specific based only on theoretical analysis. Therefore, it was decided to develop AgriFood specific taxonomy of sustainable platform-based startups by practical evidence. Consequently, the second research question is **“Which types of platform-based startups exist in the AgriFood sector?”** (Hereafter RQ2).

Thirdly, the section 2.5.3 gives an overview of AgriFood platforms' contribution into the sustainability from the different perspectives: economical, environmental and social. Most of researched papers relying on theoretical approach. In order to deep dive into this topic and gain a better understanding it is required to conduct systematic practical-oriented analysis using the common sustainability framework such as 2030 Agenda of sustainable development by UN. Thus, the third research question is **“How do platforms create sustainability in the AgriFood sector?”** (Hereafter RQ3).

Finally, the integral part of the platform-based economy research is the environment where platforms have to grow. The sections 2.5.4 and 2.5.5 present the barriers and enablers of the platform's development in the AgriFood industry. The majority of observed literature are focused on the digitalization process or collaboration model in a whole rather than particularly to platform-based economy. Despite the digital nature of platforms, it constrains the deep learning of what factors are stopping or facilitating their thrive. In addition, mostly the existing research used case-by-case studies lacking the comprehensive view on the topic. As a result, the fourth research question of the thesis is **"What are the enablers and barriers in the implementation of Platform-based startups in the AgriFood sector?"** (Hereafter RQ4).

4. Methodology

This section is dedicated to revealing the ways of analysis and details of the methodology that helps to provide answers in the course of uncovering four research questions, namely the identification of platform-based startups with a focus on sustainability in the agri-food sector (Figure 10).

First, a sample of agricultural and food startups was created using the online database Crunchbase (Sections 4.1.1 and 4.1.2). Then, the sustainability framework was developed to identify and assess the startups' sustainability impact was identified and assessed based on the developed framework (Section 4.1.3). Such database was subsequently enriched with information about the platform's characteristics, retrieved through secondary sources and corporate websites (Section 4.1.4). Thus, the final database of AgriFood sustainable platforms was developed by implementing AgriFood, Sustainability and Platform Frameworks. A clear specification of analyzed startups facilitate **external validity** of the current research. Then, the clustering analysis was performed by using a k-medoids algorithm and sustainability orientation of each cluster was defined (Section 4.2). Finally, the semi-structured interviews were carried out and analyzed to validate the results of the clustering analysis and identify challenges and enablers of platform-based model in the AgriFood industry (Section 4.3). Thus, the semi-structured interviews sharpened the **construct validity** of the current research. Besides, the interviews were based on the pre-defined open-ended question to prevent research bias to the analysis' results which highlight the **reliability** of the thesis.

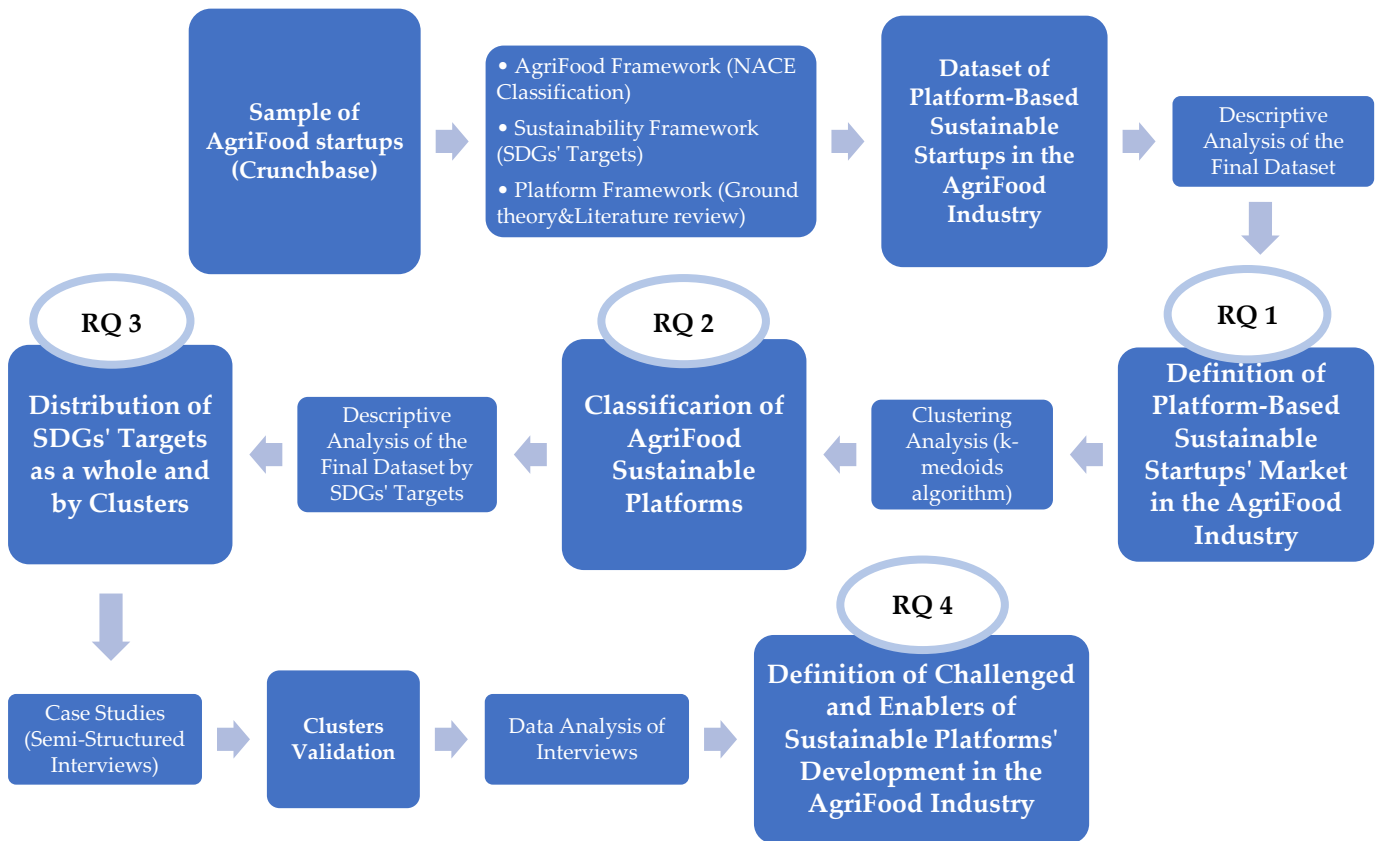


Figure 10. Graphical Representation of Research Procedure for Addressing the Research Questions. Source: Own elaboration

4.1. The Construction of Multi-sided Agri-Food Platforms Database

Considering the gaps identified in the literature, it was concluded that the best way to continue the research of the Agrifood sector is an empirical analysis.

Therefore, the examination was built on the creation of the database with a sufficient number of Agrifood startups. The main source of data was the online business intelligence tool www.crunchbase.com. Crunchbase is a platform for finding business information about private and public companies. The online repository includes information on investments and funding, founding members and executives, mergers and acquisitions, industry news and trends. Crunchbase presents data about over 675000 companies (Data retrieved, 02/03/2022). Additionally, Crunchbase as a source for database constructing was chosen due to the fact that it contains information about innovative technological startups which is the subject of our research. Thus, the online

intelligence tool is not only a comprehensive massive of diverse data but also a suitable to the thesis.

Nevertheless, given the diversity of presented in the source companies, the results of an analysis can degrade in terms of precision. The diversity is showed by existence of different industries, size, funding and age on the platform. Therefore, the data retrieved from Crunchbase has to be selected and sorted attentively to avoid inappropriate cases. For these reasons, the further analysis was performed including classification by the stage of the supply chain they belong to, the sustainability goals they pursue and, finally, the relation to platform-based economy. As a result, we receive database of platform-based sustainable startups in Agrifood industry.

The first four paragraph present of this section are focused on the frameworks an methodology used for the classification above-mentioned startups and creating the final database for the empirical analysis.

4.1.1. Startup Extraction Method

In order to build a comprehensive and relevant database of Agri-Food sustainable platform-based startups the different kinds of information were retrieved from the online digital source Crunchbase for each of them:

- General information: Company name, Founded Date, Headquarters location (city, region, state), Email contact, Phone Number, Website, Status, Number of Employees, Number of Founders;
- Financial information: Number of funding rounds, Number of lead investors, Last funding date, Last funding amount, Last funding type, Last equity funding amount, Total equity funding amount, Total funding amount;
- Other data assigned by Crunchbase: Company name URL, Category groups, Categories, Description.

As mentioned before, Crunchbase is business intelligence tool that include information about multiple companies of different age, industries and size. Consequently, it was required to benefit from research filters integrated in the web-site to narrow the search and focus on only relevant for the thesis cases. It was chosen the following filters:

1. Foundation date: *between* 31/12/201 and 31/12/201

According to Puri and Zarrutskie, (2012), new ventures are the ones that founded within maximum 5 years. That is why, this filter was set to avoid outdated information and have a database corresponding to the research conducted.

2. Status *include* any Operating, IPO, Acquired

This filter allows to consider only startups that still operating because the thesis is focused on carrying out the analysis of still valid cases.

After defining above mentioned preliminary filters it was decided to apply two different approaches for extracting startups from Crunchbase:

1. Extraction by category groups;
2. Extraction by key words.

The first approach is based on the possibility of the online intelligence tool to specify category group a company belongs to in the advanced search. A category group is a set of categories (defined as output a startup produce or activity it performs) that represent the industry or economic area a startup operates. Among 46 categories groups available

the most suitable for the research were “Agriculture and Farming” and “Food and Beverage”. As a result, there are two first extractions presented in the table 4 below:

| <i>Extraction</i> | <i>Filters</i> |
|-------------------------------|--|
| 1 st extraction | <i>Foundation date: between 31/12/2011 and 31/12/2016</i> <i>Status, include any: Operating, IPO Acquires</i> <i>Category group include any: Agriculture and Farming</i> |
| 2 nd extraction | <i>Foundation date: between 31/12/2011 and 31/12/2016</i> <i>Status, include any: Operating, IPO Acquires</i> <i>Category group include any: Food and Beverage</i> |

Table 4. Extraction by category groups “Agriculture and Farming” and “Food and Beverage”. Source: Crunchbase

Eliminating the duplicates the approach based on category groups provided 8307 startups.

The second approach was performed to include also the startups that are related to Agri-Food industry, however, due to different reasons, are not assigned to any of “Agriculture and Farming” and “Food and Beverage” groups. It can be achieved by analyzing descriptions of companies through key words. In fact, there is a brief description for each startup present in the information platform. The additional step that should have been done was to define the correct key words list by which the extraction would be possible.

The list of key words was generated using substantives of the statistical classification of economic activities defined by European Union. It was chosen the codes that relates to Agri-Food supply chain. In the next section 4.1.2. this classification and Agri-Food activities will be studied in details. In order to consider a sufficient number of cases in the analysis the words were used in both forms: singular and plural.

Since the key words are defined the additional filter can be set. Online searching tool Crunchbase enable to choose the startups that in their “Description” “include any” “Key Word_1”. This filter should be used together with above mentioned foundation date and status constraints but excluding the companies falling in “Agriculture and Farming” and “Food and Beverage” category groups to avoid duplicates. In the table 5 below the examples of the extraction are showed:

| <i>Extraction</i> | <i>Filters</i> |
|-------------------|----------------|
|-------------------|----------------|

| | |
|-------------------------------|---|
| 1 st extraction | <i>Foundation date: <u>between</u> 31/12/2011 and 31/12/2016</i> <i>Status, <u>include any</u>: Operating, IPO Acquires</i> <i>Category groups <u>does not include</u>: Agriculture and farming</i> <i>Category groups <u>does not include</u>: Food and Beverage</i> <i>Description <u>include any</u>: Key word_1</i> |
| 2 nd extraction | <i>Foundation date: <u>between</u> 31/12/2011 and 31/12/2016</i> <i>Status, <u>include any</u>: Operating, IPO Acquires</i> <i>Category groups <u>does not include</u>: Agriculture and farming</i> <i>Category groups <u>does not include</u>: Food and Beverage</i> <i>Description <u>include any</u>: Key word_2</i> |
| 3 rd extraction | <i>Foundation date: <u>between</u> 31/12/2011 and 31/12/2016</i> <i>Status, <u>include any</u>: Operating, IPO Acquires</i> <i>Category groups <u>does not include</u>: Agriculture and farming</i> <i>Category groups <u>does not include</u>: Food and Beverage</i> <i>Description <u>include any</u>: Key word_3</i> |
| ... | ... |

Table 5. Extraction by key words. Source: Crunchbase

After deleting all possible duplicates arisen due to having in description more than one key words, the extraction by key words resulted in having 12358 startups.

However, the second approach gives a large number of companies and not necessarily all of them can be suitable for the further analysis. That is why some corrections of the second approach should be done to have more robust data. Particularly, the startups have to be checked on the matter of belonging to Agri-Food industry which will be described in the next Section 4.1.2.

4.1.2. The Agri-Food Industry Framework

In the Section 4.1.1. it was described startups extracting from online intelligence tool Crunchbase using two approaches: by category groups and by key words. The first method provides precise results in terms of relation to Agri-Food supply chain because it was set a filter of category group “Agriculture and Farming” and “Food and Beverage”. However, the second approach resulted in quite higher number of companies that not necessarily operate in the studied industry.

In order to exclude inappropriate cases, the direct analysis of description, a web-site and other information sources with open access of each startup was performed to identify if it corresponds to at least one of economic activities defined by European Union and related to Agri-Food supply chain.

For specification economic activities it was decided to integrate NACE codes (“Nomenclature statistique des activités économiques dans la Communauté européenne”). It is the statistical classification of economic activities in the European community. NACE classification gives a detailed insights for each activity. It consists of 20 Sections (from A to U, in alphabetical order), 64 Divisions (two digits), 177 groups (three digits code) and 235 classes (4 digits code).

Besides, each NACE code is subsequently assigned to one of Agri-Food supply chain stages. Even if company operate in different areas and performs different activities it is explained only by one code. In order to make a choice among various operations it is decided to follow the principle of going with the activity “which contributes most to the total value added of that unit” (Eurostat, 2008). It is also aligned with NACE’s guideline.

The following Section 4.1.2.1 presents the framework of distribution of economic activities defined by NACE classification to Agri-Food supply chain stages to allow further analysis.

4.1.2.1. The division of NACE codes by Supply Chain Stages

As before indicated Agri-Food system consists of the entire range of actors and their interlinked value-adding activities. Previously, in the Section 2.2.2 the supply chain was divided by private and public actors of it according to N. K. Tsolakis. However, for the following analysis it is decided to classify the Agri-Food system by primary and secondary activities (Porter, 1985).

The primary activities are related to actors who contribute to the processing natural resource in order to get a final agricultural product. While secondary activities enable this

transformation happens by arranging infrastructure for the Agri-Food industry, supports business processes and etc.

The units involved in the former of the activity's groups are input companies, farmers, breeders and fishers, food processors, retailers and food service. Each actor is linked to the previous stage of the supply chain by getting the output from it as input for own operations. For primary activities NACE code's allocation is based on which product a company has as an output.

As concerns support activities, they consist of the following units: wholesalers, technology suppliers, service providers and support activities (which include both packaging and transportation activities). They allow representatives of primary activities to exchange their outputs an input in order to have sustainable supply chain. NACE codes are assigned to the companies by the description and the main contribution to the system.

As stated in Section 2.2.1, all actors and stages of Agri-Food supply chain are interconnected within primary group of activities and also with secondary group of activity. It is hard to imagine the production process without the proper environment and infrastructure. As well as the support activities have no need if the primary operations do not exist.

The following sections present each stage and activity included in it.

4.1.2.1.1. Primary activities: Input Suppliers

The ultimate goal of activities at this stage of the supply chain is to provide farmers, livestock keepers and fishermen with resources suitable for growing crops, raising animals and fishing. Indeed, the main operations that make up this stage are the production and sale animal feed, chemical and natural products to improve the quality of the soil and prepare it for agricultural activities. In addition, entities acting as input providers may offer services for the maintenance and dissemination of genetic property in seeds and plants.

A characteristic of input suppliers is that their activities require large investments in research and development, especially in the fields of natural science and biotechnology (KPMG, 2013). These studies can be carried out either by themselves or by individual public or private research companies (Caiazza, 2016). However, in any case the research activity was classified as a service provider stage because it is complementary operation to its core business.

The following codes from NACE classification were chosen for input companies' stage:

| <i>Code</i> | <i>Title</i> | <i>Description</i> |
|--------------|--|---|
| 01.30 | Plant Propagation | This category comprises all activities for the production of substance suitable for direct propagation of plants. Particularly, it includes cuttings, seedlings. In addition, the activities presented in this class also relate to the production of grafting material into which the stem is planted for future harvest. |
| 01.64 | Seed processing for propagation | The activities classified in this section are all those actions performed in the post-harvest phase which have as goal the treatment (drying, cleaning, and grading) of seeds in order to perform a selection of these for building a seed stock. In the selection phase the seeds are sorted between damaged, immature and undersized ones or those which can be stored and sold safely. This class also includes operations that concern the treatment and propagation of genetically modified seeds. |
| 10.91 | Manufacture of prepared feeds for farm animals | This class concerns the production of farm animal feed including the one produced through slaughterhouses wastes. Other type of animal feeds might be missing in this class such as fishmeal for animal feed and by-products which can also, but not only, be used as animal feeds. Fishmeal for animal feed are identified within the class 10.20 "Processing and preserving of fish, crustaceans and molluscs" which is instead allocated in the "food processors" stage of the supply chain. |
| 20.15 | Manufacture of fertilisers and nitrogen compounds | This class refers to the manufacturing of fertilisers of different chemical compositions. Both straight and complex fertilisers are included here, made up of nitrogen, phosphorus or potassium. For what nitrogen compounds are concerned, this class refers to those products containing "nitric and sulphonitric acids, ammonia, ammonium chloride, ammonium carbonate, nitrites and nitrates of potassium" (Eurostat,2008). |
| 20.20 | Manufacture of pesticides and other agrochemical products | This category refers to the production of solutions for control of pests, insects, fungi, herbs, acars, mollusc, biocides. |

| | | |
|-------|--|---|
| 46.12 | Agents involved in the sale of fuels, ores, metals and industrial chemicals | Such economic activity is proper of the agri-food supply chain since it includes the agents who sell agrochemical products and fertilizers. |
|-------|--|---|

Table 6. Activities related to the input suppliers stage. Source: Eurostat, 2008

4.1.2.1.2. Primary activities: Farmers, Breeders and Fishers

The second stage of the Agri-Food system consists of those entities that use as an input the goods provided by the input suppliers. The final product of farmers, breeder and fishers can be sold in the primary market or have to be processed on the further stages of the supply chain.

Below NACE codes related to these actors are presented:

| <i>Actor</i> | <i>Code</i> | <i>Title</i> | <i>Description</i> |
|----------------|-------------|---|---|
| Farmers | 01.1 | Growth of non-perennial crops | This group includes all the activities needed in order to grow products of those plants which are replanted every two growing seasons. The classes selected among those who belong to 01.1 group are those whose output are products grown for edible purposes |
| | 01.2 | Growing of perennial crops | These activities concern the cultivation of crops from plants that last more than two seasons. This happens for two possible reasons: some plants grow and produce continuously or they produce just during their season but will grow crops for at least two growing seasons |
| | 01.61 | Support activities for crop production | This activity aims at categorizing all those services made in order to appropriately grow crops (preparation and maintenance of agricultural soil; treatment of plants growth through pest control, spraying, timing and etc.; harvesting the final product) |
| | 01.63 | Post harvest activities | This activity concerns the preparation of crops for the primary markets. The main actions needed in this phase of the agricultural cycle can be: sorting, |

| | | | |
|-----------------|-------|--|---|
| | | | cleaning, drying (for certain types of leaves), trimming, milling etc. |
| | 02.30 | Gathering of wild growing non-wood products | This class includes the collection of edible products coming from wild areas such as mushrooms, berries, nuts, acorns, truffles, mosses, and horse chestnuts |
| Breeders | 01.4 | Animal production | This group gathers all those activities which through the raising and breeding of animal generate products which can be, with or without appropriate processing, considered as food |
| | 01.62 | Support activities for animal production | This class represents all those activities needed for the well being, breeding, propagation and realisation of the output of farm animals |
| | 01.70 | Hunting trapping and related service activities | This class identifies hunting and trapping of animals also, but not only, for food purposes |
| Fishers | 03.11 | Marine fishing | The activities here included are those which aim at capturing wild marine fish and other aquatic organisms |
| | 03.12 | Freshwater fishing | The activities here included are those which aim at capturing freshwater fish and other aquatic organisms |
| | 03.21 | Marine aquaculture | This class includes all those activities that have as output the production of marine organisms which are achieved through aquaculture techniques. |
| | 03.22 | Freshwater farming | This class has similar output as class 03.21 with a different process. Peculiar to this class, are activities of frogs farms |

Table 7. Activities related to the farmer, breeders and fishers stage. Source: Eurostat, 2008

4.1.2.1.3. Primary activities: Food Processors

The third step in the primary supply chain consists of food companies. They take products from farmers, breeders and fishermen as an input and subject it the initial processing to turn them into food. However, the output of food processors can also

require further processing such as, for instance, cooking by actors of the next stages of supply chain.

The NACE codes falling into this stage of the Agri-Food supply chain are the following:

| <i>Code</i> | <i>Title</i> | <i>Description</i> |
|--------------|--|--|
| 10 | Manufacture of food products | This activity includes the operations needed in order to process food into edible products or intermediate products by own account or by third parties (i.e. slaughterhouse activities). These classes address all those agents that are involved in the process of transformation of the goods and can, but not necessarily will, participate to the wholesale or retail sale process |
| 11 | Manufacture of beverages | The definition of this class is straightforward as the activities here concerned are all those that are needed in order to produce beverages from bottled water to soft drinks and alcoholics to sell to retailers and food services |
| 20.59 | Manufacture of other chemical products n.e.c. | Due to the not precise definition of this class it contains numerous activities which only partly refer to the agrifood industry. This class was considered in the supply chain definition since it includes the production of chemically modified gelatins and oils and fats which are food ingredients |

Table 8. Activities related to the food processors stage. Source: Eurostat, 2008

4.1.2.1.4. Primary activities: Retailers

Retailers are supply chain actors that sell goods to the final consumer, primarily for individual use (Eurostat, 2008). As regards the Agri-Food industry, retailers vary in size and are scattered across the geographic area. Thus, they have the opportunity to cover the needs of the market quickly and can adjust business accordingly.

Retailers perform the following activities:

| <i>Code</i> | <i>Title</i> | <i>Description</i> |
|-------------|--|--|
| 47.2 | Retail sale of food, beverages and tobacco in | The aim of this group of activities is to describe the sales that happen within stores that do not sell anything else other than food and beverage items to the final consumer |

| | | |
|-------|---|--|
| | specialized stores | (B2C). Moreover, within this group it is included the retail sale of tobacco products (47.26). However, due to the fact that tobacco products are do not nourish human beings these are not considered as part of the supply chain |
| 47.76 | Retail sale of flowers, plants, seeds, fertilisers, pet animals and pet food in specialised stores | This activity defines the sale of gardening products for the growth of crops. These inputs such as plants, seeds and fertilizers can be bought by small farmers in retail stores |
| 47.81 | Retail sale via stalls and markets of food beverages and tobacco products | This activity is similar to the ones performed in the 47.2 However, the Eurostat (2008) classification, discriminates the sales made according to the physical shop in which it is performed |
| 47.91 | Retail sale via mail order houses or via Internet: | This class takes into consideration the sales made through phone, internet or mail of any kind of products. Given that this class the includes the sales of any item it is reasonable to assume that food products sales via internet are included in this class |
| 47.99 | Other retail sale not in stores, stalls and markets | While this class takes into consideration both door-to-door sale which is rarely applicable to the industry identified, it also mentions sales through vending machines. This latter mean of distribution is a widespread practice for food products and therefore is included in this stage |

Table 9. Activities related to the retailers stage. Source: Eurostat, 2008

4.1.2.1.5. Primary activities: Food Service

The food service agents prepare and sale meals that are ready for consumption. Companies falling into this stage of Agri-Food supply chain can have different businesses comprising the HoReCA (Hotel Restaurant and Catering) definition.

| <i>Code</i> | <i>Title</i> | <i>Description</i> |
|-------------|--------------|--------------------|
|-------------|--------------|--------------------|

| | | |
|-------|---|--|
| 55.1 | Hotels and similar accommodations | The main activity here considered is the provision of accommodation services performed by hotels, hostels, motels, resorts etc. While this broad definition might seem not to refer precisely to the agri-food industry, it is also true that within the activity here described there are included the provision of food and beverage service |
| 56.10 | Restaurants and mobile food service activities | Restaurants, cafeterias, fast foods, take out places, ice cream truck vendors, mobile food carts, food preparation in stalls |
| 56.21 | Event catering activities | Catering for a specific event |
| 56.29 | Other food service activities | Catering for a specific period of time |
| 56.30 | Beverage serving activities | Bars, taverns, lounges, coffee shops, fruit juice shops, mobile beverage vendors |

Table 10. Activities related to the food service stage. Source: Eurostat, 2008

4.1.2.1.6. Secondary activities: Wholesalers

“Wholesale is the resale (sale without transformation) of new and used goods to retailers, business-to-business trade, such as to industrial, commercial, institutional or professional users, or resale to other wholesalers, or involves acting as an agent or broker in buying merchandise for, or selling merchandise to, such persons or companies.” (Eurostat, 2008)

According to the definition, it can be inferred that wholesalers play important role in the industry because they arrange the connection between the trade of various participants in the B2B supply chain, facilitating the optimization of trade in goods throughout the supply chain. In fact, wholesalers have possibility to take possession of suppliers' inventory. As a result, they can decrease the uncertainty and financial burden of downstream actors associated with inventory. Besides, through their network, they allow suppliers to sell products to a wider range of customers. (Eurocommerce, 2014).

It is worth to mention that wholesalers also contribute in food traceability, consequently, food safety and quality which are crucial aspects in the Agri-Food sector (Eurocommerce, 2014).

The following codes from NACE classification were chosen for input companies' stage:

| <i>Code</i> | <i>Title</i> | <i>Description</i> |
|--------------|--|--|
| 46.11 | Agents involved in the sale of agricultural raw materials, live animals, textile raw material and semi-finished goods | These activities consider the involvement of 81 all those actors that sell agricultural raw materials, live animal and semi-finished goods for the agri-food. The wholesalers here identified are those that do not act in own account |
| 46.19 | Agents involved in the sale of a variety of goods: | This class is extremely general on the goods sold by such agents. Indeed, it must be considered as integrating part of the agri-food industry only in the moment in which the wholesalers sell along with other goods also food products. Moreover, the activity refers to wholesalers that do not act in own name |
| 46.21 | Wholesale of grain unmanufactured tobacco, seeds and animal feed | This class includes all those activities performed by agents that act as an interface between suppliers and customers of grains, seeds, animal feeds, agricultural products and oleaginous fruits |
| 46.23 | Wholesale of live animals | The activity here represented aims at addressing the sale of live animals from breeders to food processors which as previously defined take care of both slaughterhouses' activities and processing of raw meat products |
| 46.3 | Wholesale of food, beverage and tobacco | This group of classes concerns the sale of manufactured goods from farmers (for what fruit and vegetables are concerned) or the food processors to the B2B customer |

Table 11. Activities related to wholesalers stage. Source: Eurostat, 2008

4.1.2.1.7. Secondary activities: Technology suppliers

The companies involved in this Agri-Food supply chain stage manufacture and sale the equipment, specifically machinery, for enterprises that produce food which is primary stage. Technology suppliers perform such activities as:

- 28.30 Manufacture of agricultural and forestry machinery;
- 28.93 Manufacture of machinery for food beverages and tobacco processing;
- 46.61 Wholesale of agricultural machinery, equipment and supplies;
- 77.31 Renting and leasing of agricultural machinery and equipment.

4.1.2.1.8. Secondary activities: Support activities

The entities performing support activities cover such important responsibility in Agri-Food supply chain as transportation and packaging. They provide logistics services for all actors who take part and support exchanging goods in the industry. The ancillary activities are essential to ensure a continuous flow of inputs and outputs between the various participants in the primary supply chain. Besides, taking into account the industry feature of good's perishability, this stage of supply chain should have a well-organized and efficient system.

Among NACE codes support activities are presented by:

- 49.2 Freight rail transport;
- 49.41 Freight transport by road;
- 53.2 Other postal and courier activities;
- 51.21 Freight air transport;
- 50.40 Inland freight water transport;
- 50.2 Sea and costal freight water transport;
- 52.1 Warehousing;
- 52.24 Cargo handling;
- 52.29 Other transportation support activities;
- Service activities incidental to transportation: land (52.21); water (52.22); air (52.23);
- 17.21 Manufacture of corrugated paper and paperboard and of containers of paper and paperboard;
- 22.22 Manufacture of plastic packaging goods;
- 23.13 Manufacture of hollow glass;
- 25.91 Manufacture of steel drums and similar containers;
- 25.92 Manufacture of light metal packaging.

4.1.2.1.9. Secondary activities: Service providers

This stage of Agri-Food supply chain provides services to various actors involved in primary activities of the industry. The functions they fulfil related to agriculture and food systems indirectly and can be developed internally in companies of primary stages.

There is a classification of service providers by 4 groups and NACE codes assigned to each of them in the table below:

| <i>Group</i> | <i>Code</i> | <i>Title</i> | <i>Description</i> |
|---|--------------|--|--|
| 1. Communication to customer | 73.11 | Advertising agencies | These classes incentivize a customer to consume provided goods and services |
| | 73.20 | Market research and public opinion polling | |
| | 63.12 | Web portals | Agents performing these economic activities enable primary actors to get online through web-sites and applications |
| | 62.01 | Computer programming activities | |
| | 79.90 | Other reservation service and related activities | This activity allows to reserve restaurants and hotels with dining services |
| | 58.19 | Other publishing activities | Information and communication is paramount for food safety and traceability in Agri-Food industry. For this reason, the service providers also perform labeling activities of food products. |
| 2. Management of demand and supply | 66.11 | Administration of financial markets | This class provides the daily settlement of the food prices. It is an important activity since the price of food is extremely volatile due to the presence of commodities markets (KPMG,2013). |
| | 63.11 | Data processing hosting and related activities | The entities performing this activity are the interface between the producer and the consumer through marketplaces |
| 3. Innovation of inputs and | 72.11 | Research and experimental development on natural sciences | These classes are involved in the development of new solutions for the agri-food firms through R&D activities in the field of natural |

| | | | |
|--|--------------|---|--|
| | 72.19 | Other research and experimental development on biotechnology | science, biotechnology and agrochemical practices and consulting |
| 4. Enhancement of food production processes | 74.90 | Other professional, scientific and technical activities | These activities refers to agronomy consulting and management of natural resources due to weather conditions and veterinary services |
| | 75.00 | Veterinary activities | |
| | 62.01 | Computer programming activities | These classes develop software solutions to manage the operations of the actors of the agri-food industry e.g. software for monitoring crops |
| | 63.11 | Data processing hosting and related activities | |

Table 12. Activities related to the service providers stage. Source: Eurostat, 2008

4.1.3. The Sustainability Framework

The next aspect that had to be considered during the creation and analysis of the database is the sustainability in Agri-Food industry. In order to define a common framework of sustainability it was decided to use as reference the Sustainable Development Goals proposed by the United Nations in the “2030 Agenda of sustainable development”.

The main purpose of the document is to provide an ambitious plan to promote peace and prosperity, protect the planet and eradicate poverty by 2030. The Sustainable Development Goals are universally recognized as paramount for the future of our world. They appeal to all elements of the community, including local and national governments, businesses, industry and individuals. To achieve better performance, it is necessary to achieve consensus, effective interaction and innovation. Considering it, 17 sustainable goals were established and total 169 targets were defined for each of them to create a clearer guideline for all actors.

The SDGs as a framework were chosen because it is a comprehensive agenda considering a broad variety of global issues that concern 5 areas: people, planet, prosperity, peace and partnership (United Nations, 2015). It can be applicable for assessing not only primary stages of Agri-Food supply chain but also entities performing secondary activities. Moreover, the FAO confirms appropriateness of SDG framework since the organization evaluate its actions in the field of poverty and hunger reduction, agricultural productivity enhancement, development of inclusive food systems and resilience to crises based on the 2030 Agenda of Sustainable Development.

Obviously, “2030 Agenda of Sustainable Development” is focused on all aspects of life and not all of topics are applicable to Agri-Food industry. Based on the Agri-Food supply chain definition formulated in Section 2.2, the appropriate goals and targets were chosen by attentive studying each of them. The selection process was resulted in 18 targets belonging to 8 sustainable goals.

Having the framework of sustainability defined, the next step is to develop the methodology of how allocate each target to the Agri-Food startups.

The chosen approach consists in automated assignment the targets of sustainable goals to companies considering their detailed descriptions in Crunchbase profile (Neely, 2008). In order to automate and accelerate the process it was required to create a codebook of keywords and phrases that can be present in business characterization. Terms and phrases were defined by taking into account the substantives of targets. Below the table 4.1.3.1 with keywords is presented:

| <i>SDG</i> | <i>Target</i> | <i>Description</i> | <i>Keywords</i> |
|--------------------|---------------|---|---|
| Zero Hunger | 2.1 | “By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round” | XXXHung, XXXNutri, Nourish Shortage of food, Food short, Food gap, Food insecure, xxxHealth, Safe drink, Safe food, Foodbank, Food-bank, Food bank, Food kitchen, Food access, Community kitchen, Food, Donat, Redistribut, Re-distribut, Broke, Disadvantaged, Underprivileged, Charit, Relief, Poor, Famine, Edible food, Low-income, Low income, broker |
| | 2.2 | “By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons” | Nutrition, Children, Kid, Girl, Child, Bab, Breast milk, Breast feed, Human milk, Pregnant, Lactat |
| | 2.3 | “By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment” | Middle-size farm, Middle-size food, Middle-size prod, Middle-sized farm, Middle-sized food, , Middle-sized prod, Local food, Locally gr, Locally sourc, Local agr, Local produc, Local communit, Local farm, Vegetable garden, Orchard, urban farm, Underdevelop, marginal farm, smallholder, Small wine, Pastoral, Shephard, Indigenous, Woman, farm, Women farm, Farmers market, farmer market, farm, agricult grower, producer, winer, subscription, sales channel, trading, platform, sales platform, commerce, poor , poverty farm, short, value chain, supply chain |
| | 2.4 | “By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality” | Climate change, Climate dat, Extreme weather, Drought, Flood, Disaster , Disease, Pest , Crop protect, Weath, Ph value, Land qual, Soil qual, Change, Environ, chemical, hazardous, Toxi, phytosanitary, Fumiga, pesticide, herbicide, fungicide, methyl, phosphine, sulfur, pollutant, contamina, fertiliz, Potass, nitrogen, phosphor, synthetic, fert |
| | 2.5 | “By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and | Seed bank, seedbank, plant bank, plantbank, Vari, Vary, Divers, Seed, XXXPlant, Cattle, Livestock, Poult, Animal, Species , Specy, Crop |

| | | | |
|---------------------------------|-----|--|--|
| | | international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed” | |
| Clean Water and Sanitation | 6.3 | “By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally” | XXXQuality, Waste, Treat, Recycl, Reus, Polluti, Toxic, Chemic, solvent, debris, plastic, garbage, trash, Hazard, inorganic, non bio, non-bio, pest , fertiliz, Purif, XXXClean, phosphor, nitrogen, pathog, Contamina, Eutrophicat, Salini, silt, Leach, Acid, Aquifer, Ocean, Sea, Lake, River, waste water, wastewater, waste-water, runoff water, run-off water, ground water, groundwater, ground-water, ambient water, water body, body of water, surface water, surface-water, surface runoff, surface run-off, sewage, overland water, drain, bildge, effluent, effluvium, xxxWater, Purifier, water treatment, water quality, water filter |
| | 6.4 | “By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity” | withdr, Precision, xxxEfficien, Optimi, recycl, Reus, Re-us, Circ, Scarc, Water, Irrigat, watering tim, drought tolerant, crop rotat, rotate crop, rotating crops, Aeroponic, Hydroponic, Indoor gr, Indoor farm, Vertical farm, Water use, Water-use, water consum, de-water, dewater, Water-stress, Water stress |
| Decent Work and Economic Growth | 8.5 | “By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value” | social enter, social goal, social aim, social objective, social idea, social philos, social business, social compan, socially-respons, socially respons, social-responsab, fair trade, equal oppor, empower farm, empower wom, empower discap, empower handic, empowering farm, empowering wom, empowering discap, empowering handi, local job, new job, more job, local employ, job creat, fair salar, fair price, fair pay, fair income, fair wage, decent job, decent income, decent wage, decent salary, decent pay, improved income, improve income, improving income, improving the incom, increased income, increase income, increasing income, increasing the incom, additional income, additional source of income, extra income, income cond, forced labour, forced labor, child labour, child labor, social responsab, access to market, market access, disabal, LGBT, GLBT, transgender, bisexual, gay, lesbian, handicap, loan, lend, credit, |

| | | | |
|--|------|---|---|
| | | | finan, invest, afford, farm, rural, emerg, agricult, ethic, behavior, behaviour, income, wage, labour, pay, salary |
| | 8.8 | “Protect labor rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment” | Rights, Secure, Health, Safe, Labour, Labor, Job, Work, Job conditions, Work conditions, Working conditions |
| | 8.9 | “By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products” | Green, Social, Cultur, Sustainable, Local, Tour, journey, excursion, holiday, trip, Travel, Local, Food, Sourc, Connect, Econom, Culture, Product, agrituris, agritour, agri-tour, agri-turis |
| Industry, Innovation and Infrastructure | 9.4 | “By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities” | agrobot, agro-bot, agro bot, robot, cold-chain, coldchain, cold chain, xxinfrastructure, storage facil, storage equip, XXDigital infra |
| Responsible Consumption and Production | 12.2 | “By 2030, achieve the sustainable management and efficient use of natural resources” | Material, Fertiliz, Chemic, Resource, Consum, Reduc, Footprint, Efficien, Substitut, Precision, Manag, Optimiz, precision farm, precision viti, precision bio, precision crop, precision agri, Crop yield, Crop output, Harvest yield, yield, Increas, Seed improv, seed enhance, genetic, GMO, seed, Greenhouse, Horticulture, Hydroponic, Aquaponic, Aeroponic, Vertical farm, Indoor agri, Indoor farm, Plant-based, plant based, Vegan, meat-free, meat free, lab-grown meat, lab grown meat, animal-free meat, animal free meat, cultured-meat, cultured meat, cultivated meat, cultivated-meat, cell based, cell-based, cell-cultur, cell cultur, vegetable protein, vegetable-protein, vegan-protein, vegan protein, animal based, animal-based, animal-protein, animal protein, soy protein, soy-protein, plant-protein, plant protein, alternative-protein, alternative protein, meat, animal, substitut |
| | 12.3 | “By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses” | Redistribut, Re-distribut, abundant, XXXreshap, XXXeimag, repurpose, XXXStorag, Shelf-life, Shelf life, Best-before, Best before, |

| | | | |
|-------------------------|------|--|---|
| | | | Long-lasting, Upcycl, Up-cycl, Recycl, Re-cycl, Thrown, Symbio, wast, Circular, food |
| | 12.4 | “By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment” | pest , crop prot, environ, eco, bio, coat, food container, foodware, Packag, dispos, recycl, single-use, single use, reus, re-us, reduce, degrada, compost, green, sustain, environ, bio |
| | 12.8 | “By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature” | certifi, trace, XXXtrack, blockchain, transpar, xxxlabel, farm-to-fork, farm to fork, consumer behav, healthy food, healthy lifestyle, diabet, obesit, consumer aware |
| Life below Water | 14.4 | “By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics” | seafood, sea food, fish, ocean harvest, trace, track, certifi, supply chain, XXocean, XXsea, XXacqua, XXcoast, fishing net, XXmarine, preser, conserv, sustain, Ocean preser, overfish, over fish, fish stock, ocean health, aquaculture, aqua cultur, aquafarm, aqua farm, maricultur, mari cultur, marinefarm, marine farm, fishing farm, fish farm |
| Life on Land | 15.1 | “By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements” | Organic, XXXNatural, Cover crop, Crop rotation, Biodiver, CO2, Carbon, greenhouse gas, Nox, Nitrate, Oxide, Methane, Holistic manag, Holistic farm, regenerative, land use, endanger, deforest, de-forest, wildfire, conser, protect, degrad, restor, soil, land, protected area, marine environ, forest, wetland, ocean, sea , river, lake, environ, ecosystem, mountain |

Table 13. SDG's and Targets for Agri-Food sustainability assessment. Source: UN, 2015

Using the codebook generated by theoretical approach the coding process was prosecuted through SEARCH function in the spreadsheet program Microsoft Excel. Thus, the start-ups in question were defined as sustainability-oriented if the characteristics of their operations or results are represented by at least one guiding principle of the considered reference structure.

Thus, the studied companies were considered as sustainability-oriented if the description of their business are represented by at least one target of SDG. The coding process was resulted in 1582 sustainable startups.

4.1.4. The Platforms Characteristics

The last step of the database creation is to identify the platform-based startups among Agri-Food sustainable entities and to reflect their main characteristics.

As stated in the Section 2.4 the subject of the current research is multisided platforms that allowing the interconnection of two or more agents of the supply chain (Parker et al., 2016). The description and other open sources such as web-sites, social medias of startups were studied in order to check their belonging to platform-based economy. Besides, companies that don't operate at the present moment were excluded from the database. They have either nonfunctioning web-site or outdated information. The manual process enabled to reduce the number of relevant entities to 188 startups.

Having the final configuration of companies, it is necessary to define the appropriate attributes that can explain a business model of the platforms. A business model is a compact, simplified view of a business designed to describe and analyze the operation of an entire system of integrated business processes. In other words, it presents how a company create, capture and deliver its value (Osterwalder et al., 2010). Therefore, studying the literature and existing classifications of Agri-Food startups mentioned in the Section 2.5.2, it was decided to choose attributes that represent these three aspects.

Firstly, in order to create a value a product should be reviewed through customer's lens side (Osterwalder et al., 2010). It helps to formulate persuasive value proposition which is the core of the business model. That is why, the attributes that explain this side of a startup are:

1. **Key value proposition.** It is a clear and simple statement of the benefits that consumers will receive when purchasing a product or service. Using the grounded theory approach which consist in building hypothesis based on data collection and analysis, this attribute takes the following values (Strauss and Corbin, 1997):
 - Price/Cost/Efficiency - Improvement of productivity, reduction of costs, efficient use of resources;
 - Security/Transparency - Assurance of traceability and fair business environment;
 - Sustainability – Despite the fact that all startups studied in the current research are sustainable-oriented, the main point of this kind of value proposition is to engage platforms in achieving sustainable targets defined by UN;
 - Social value – Creation of community, support of relationship between various actors.

2. ***Sides of a platform.*** This attribute present which entities are enabled to collaborate through a platform. For the sake of simplicity and correspondence, it was decided to use the stages of Agri-Food supply chain mentioned in Section 4.1.2.:
 - Farmers. Breeders and Fishers
 - Food Processing Industry;
 - Food Service;
 - Input Companies;
 - Retailers;
 - Wholesalers;
 - Technology Suppliers;
 - Service Providers;
 - Final Customer.
3. ***Network effect.*** This attribute explains the connection between the utility of the value and the number of users (Klemperer, 2018):
 - Direct effect - an increase in the consumption of a product increases its value;
 - Indirect effect - the presence of one group of users increases the value of the product for another group of users.

The second element of the business model is value delivery (Osterwalder et al., 2010). It is important to understand which activity a company perform, what recourses and capabilities it possesses. The following attributes explain value delivery:

4. ***Use of new technologies.*** Since a platform has a digital nature, it is interesting to investigate what type of new technologies it uses to provide a product or service. It was chosen the most popular tools among the companies in the constructed database:
 - Blockchain;
 - Artificial Intelligence;
 - Satellite Technologies;
 - Other;
 - No.
5. ***Data-Driven.*** Besides, in some cases, platforms use generated data to provide their services in the best way. This attribute takes value:
 - Yes;
 - No.
6. ***Platform type.*** This characteristic describes which core function a particular platform performs. Based on the grounded theory method, the following types were identified:

- Management Platform – based on the data gathered by special equipment (sensors) provide farmers or other platform’s users insights how to improve productivity and efficiency of their business;
- Matching Platform – allow platform’s users to find an appropriate partners among themselves to fulfill their needs;
- Social Media – enable communication, sharing thoughts and ideas like-minded people;
- Marketplace – connect a buyer and a seller eliminating middlemen
- Ecosystem – bring together various actors of a supply chain for the effective collaboration;
- Auction Platform - allow platform’s users to trade commodities according to specified in advance conditions.

The last but not least part of the business model is the monetization of value, what financial flows exists (Osterwalder et al., 2010). The chosen attribute related to this area is:

7. ***Key revenue stream.*** The characteristic presents the way a user pays for a product or service:
- Free – service is free of charge;
 - Subscription - regular payment of a recurring amount for access to the product or service;
 - Commission – the percentage for a transaction;
 - Sales – fixed price for a product or service.

However, it was decided to eliminate this attribute because of difficulties related to identifying the correct payment ways for a startup. The vast majority of the companies in the database doesn’t have such information in the open sources. As a result, the coding process were performed considering 6 first attributes.

4.2. The Clustering Analysis of Multi-sided Agri-Food Platforms Database

In order to define homogenous classes of Agri-Food sustainable platform-based startups k-medoids clustering analysis was performed.

The k-medoids algorithms are unsupervised learning algorithm. It is a partitioning method that attempts to minimize the distance between points labelled as being in a cluster and a point labelled as the centre of that cluster. Unlike the k-means algorithm, k-medoids selects the input data points as centres (medoids), and thereby allows for better interpretability of cluster centres. Because k-medoids minimize the sum of pairwise differences instead of the sum of squared Euclidean distances, they are more robust to noise and outliers than k-means. Moreover, there is no restrictions related the number of variables dependant on the dataset size unlike other partitioning clustering methods (C. Vercellis, 2009).

The attributes selected fir the clustering algorithm are platforms characteristics presented in the Section 4.1.4. For the purpose of the analysis, all the variables were transformed into categorical values which means that if the corresponding column has value “1” the startups possess a characteristic, otherwise it takes value “0”. The coding process were conducted manually based on the open information of the startups.

Silhouette analysis can be used to examine the distance between the resulting clusters. A silhouette plot shows how close each point in one cluster is to points in neighboring clusters, and thus provides a visual estimate of parameters such as the number of clusters. This measure has a range [-1,1].

The clustering algorithm were carried out using the python programming language and Jupiter web-based computing platform. In order to identify the optimal number of clusters, the silhouette analysis was used. A silhouette coefficient shows how close each point in one cluster is to points in neighboring clusters, and thus provides a visual estimate of parameters such as the number of clusters. This measure has a range [-1,1]. Silhouette width near +1 indicates that the sample is far from neighboring clusters. A value of 0 means that the sample is at or very close to the decision boundary between two neighboring clusters, and negative values indicate that that these samples might have been assigned to the wrong cluster (Vercellis, 2009).

In the figure 11 below the results of the silhouette analysis for the researched database are presented:

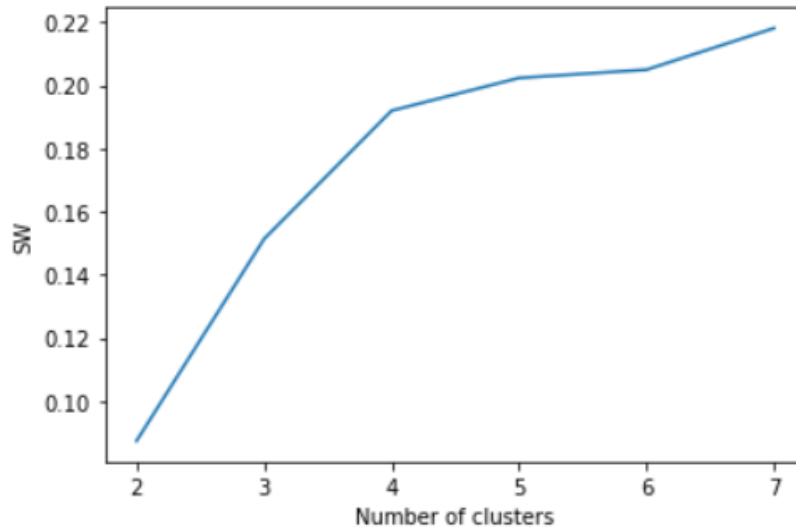


Figure 11. Silhouette score by numbers of clusters. Source: Own elaboration in Jupiter platform

Based on the silhouette analysis' results, it was decided to clusterize the dataset into 6 clusters since it is the most rational choice in terms of silhouette width and simplicity. Thus, the final clustering algorithm has the following format:

```
kMedoids = KMedoids(n_clusters = 6, init='k-medoids++', random_state = 0)
```

All 188 Agri-Food sustainable platform-base startups have been divided into six groups which are following different patterns and are analysed individually in the next paragraphs.

4.3. Identification of Platform-based Sustainable Startups in the AgriFood Industry by Case Studies

In order to further investigate platform-based business model in the AgriFood industry, it was decided to implement case studies method. The selected approach enables to gain a comprehensive and detailed understanding of the phenomenon, taking into account the context and impacting factors (Prosman et al., 2016). Thus, the conducted study allows to check the results of the clustering analysis (RQ2) and to respond the RQ4 **“What are the enablers and barriers in the implementation of Platform-based startups in the AgriFood sector?”**.

4.2.1. Data Collection by Semi-Structures Interviews

The startups involved in the investigation were chosen from them the constructed database based on the frameworks described in Sections 4.1.2, 4.1.3, 4.1.4. It means that the engaged companies were sustainable-oriented platforms operating in the AgriFood sector. As a result, based on the theoretical replication the 6 entities were selected each of which describes the one of the clusters identified by the clustering analysis. It was checked the corporate web-sites and other open sources to choose the most representative companies by the cluster defining characteristics. Besides, the geographical diversity was respected to consider the different context of the company’s business operations in the research. However, one cluster was not covered since none of the startups among this group we tried to reach out respond. At the same time, other cluster was represented by two companies. The table 4.2.1 demonstrates the brief information about the parties involved in the study and its context:

| <i>Case</i> | <i>Company Name</i> | <i>Brief Description</i> | <i>Cluster</i> | <i>Country</i> | <i>Company Size</i> | <i>Geographical Scope</i> |
|-------------|---------------------|---|----------------|----------------|---------------------|---------------------------|
| 1 | Hungry | “Hungry is a food-tech catering company that connect customers to chefs, delivering fresh food from these chefs to the customers” | Food Delivery | USA | Medium | National |
| 2 | Gofoodie | “Find the best dishes recommended by people you trust, wherever you are” | Social Network | Spain | Small | Global |

| | | | | | | |
|---|---------------|---|-------------------|-----------|-------|----------|
| 3 | Replate | “Replate provides tech and logistics to match surplus food from businesses with communities in need to reduce food waste and end hunger” | Service Providers | USA | Small | Global |
| 4 | AgUnity | “AgUnity is an award-winning tech company connecting organizations working to address UN SDGs with smallholder farmers in emerging markets” | Ecosystem | Indonesia | Small | National |
| 5 | Grow Computer | “The Operating System for Indoor Agriculture and Controlled Environments” | Farmers Network | USA | Small | National |
| 6 | EcoTrace | “Ectrace brings transparency and security to the supply chain market in the agribusiness segment” | Ecosystem | Brazil | Small | Global |

Table 14. Background of the cases. Source: Own elaboration

For the purpose of data collection, the 6 semi-structured interviews with representatives of the selected companies were conducted. Before the interviews, each participant received a file describing the purpose of an interview and topics being highlighted during it. Taking into account the countries diversity, all interviews were carried out via video communication platforms such as Zoom or Microsoft Teams. The conversation took place within February 2022 and lasted approximately 30 minutes in average. For data comparison the interviews followed the defined in advance structure, however, they were also supplemented by clarifying questions in some cases (Appendix 1). In order to get detailed information the interview structure consisted of open questions derived from the studied literature and the results of clustering analysis. The topics covered were:

- Overview information
- Value proposition of a startup
- Customer types targeted by a startups
- Challenges experienced by a startup
- Enablers facilitating the growth of a startup

- Results of Clustering Analysis

All interviews were recorded and, subsequently, transcribed (Appendix 2).

4.2.2. Data Analysis by the Long's Framework

In order to structure the data received from the semi-structured interview it was applied two level of coding process. The first-order coding process lied in retrieving from the open-ended answers semantically similar codes. It was resulted in ... barriers and ... enablers.

The second-order coding process was related to the barriers only and based on the framework of new technology adoption developed by Long et al. (Long et al., 2016). It suggests dividing the barriers into two groups depending on who is responsible for technology adoption: demand-side and supply side barriers. In the current research dedicated to platform-based economy in the AgriFood industry demand-side barriers consist of the challenges that platform users face while supply-side barriers are related to the challenges from the platform provider's point of view.

Additionally, the framework was adjusted to the needs of the thesis and supplemented by three more categories that were not mentioned:

1. Institutional barriers that are connected to activities from the government side;
2. Non-institutional external barriers that are connected to activities from the non-governmental stakeholders' side. Also it includes barriers that cannot be controlled by any stakeholders such as natural disasters;
3. Both-side barriers that are connected to the transactions between demand and supply sides.

The proposed framework is summarized in the figure 12 below

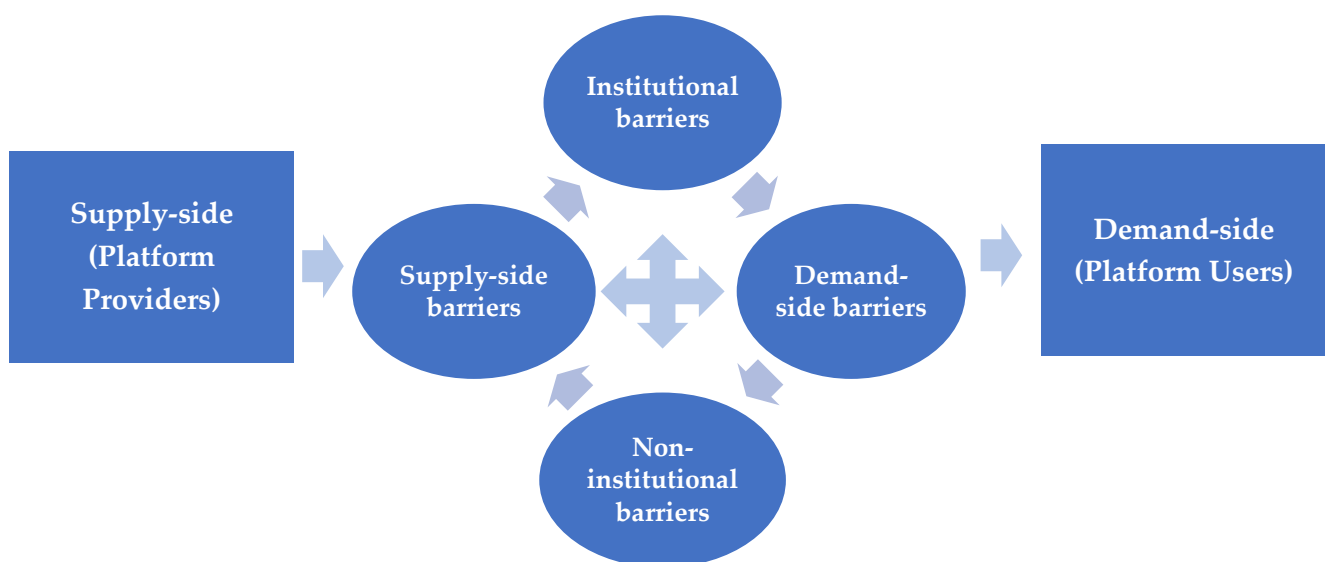


Figure 12. Barriers Framework. Source: Own elaboration based on Long et al., 2016

Finally, the identified enablers were corresponded to each barrier to present the possible ways of addressing the challenges.

5. Results

This section is focused on the results gained implementing the methodology described in section 4. Firstly, the results of the descriptive analysis was provided to present the platform-based economy characteristics in the AgriFood industry in section 5.1. Secondly, the clustering analysis of the platforms-based sustainable startups was discussed in section 5.2. Later, section 5.3 identified the sustainability impact of platform-based startups in the AgriFood sector. Finally, barriers and enabler of the platform-based economy in the studied sector were reported.

5.1. The Preliminary Assessment of Multi-sided Agri-Food Platforms Database (RQ1)

In order to identify the platform-based sustainable startups' market in the AgriFood industry descriptive analysis by several factors were performed.

5.1.1. Distribution of startups per supply chain stage

The extraction of the database from online intelligence tool Crunchbase resulted in 20665 startups where 7119 (34,4%) companies are related to the Agri-Food industry. Among them only 1807 (25%) startups belong to sustainable-oriented group.

The most common stage among the companies with these 2 characteristics is Service Provider (744 items). The next actors of Agri-Food supply chain are represented by Food Processors comprising 353 startups and Technology Suppliers including 205 startups. The figure 12 shows the complete distribution by supply chain stages in percentage:

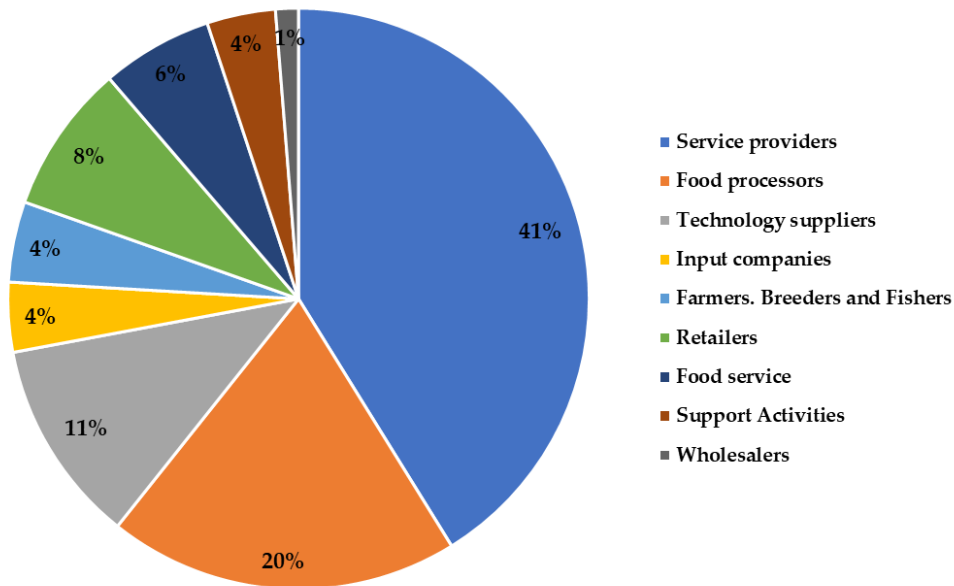


Figure 13. Agri-Food Sustainable Startups Distribution by Supply Chain Stages. Source: Own e elaboration based on the developed database

Platform-based startups make up 10% (188 items) of the Agri-Food sustainable companies' database. Given the digital nature of the platform-based economy, the vast majority of these enterprises (147 items) represents Service Providers stage. The detailed distribution are showed in the Figure 13 below:

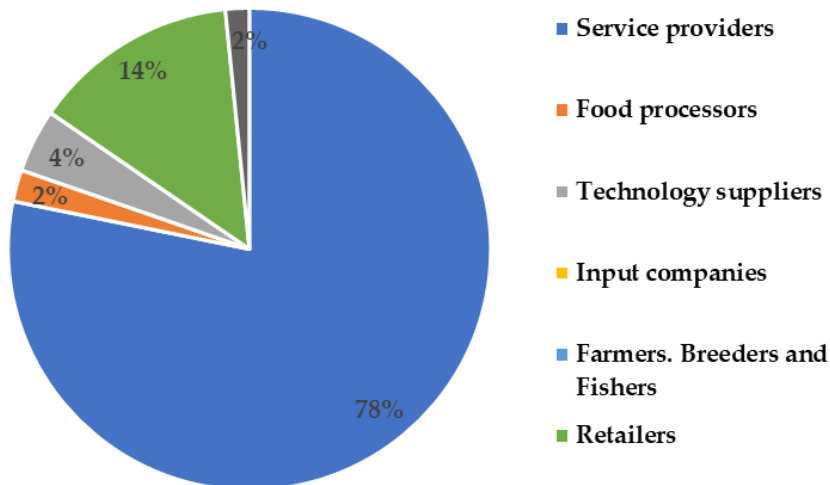


Figure 14. Agri-Food Sustainable Platform-Based Startups Distribution by Supply Chain Stages. Source: Own elaboration based on the developed database

5.1.2. Distribution of startups per geographical area

The figure 14 below demonstrates the distribution of Agri-Food sustainable startups by country. There are geographical areas with more than 10 companies. The highest number of the studied enterprises are based in the United States (30%) followed with a big lag by India (8%) and the United Kingdom (6%). Italy takes the 15th place in the world registered 22 startups within 5 years.

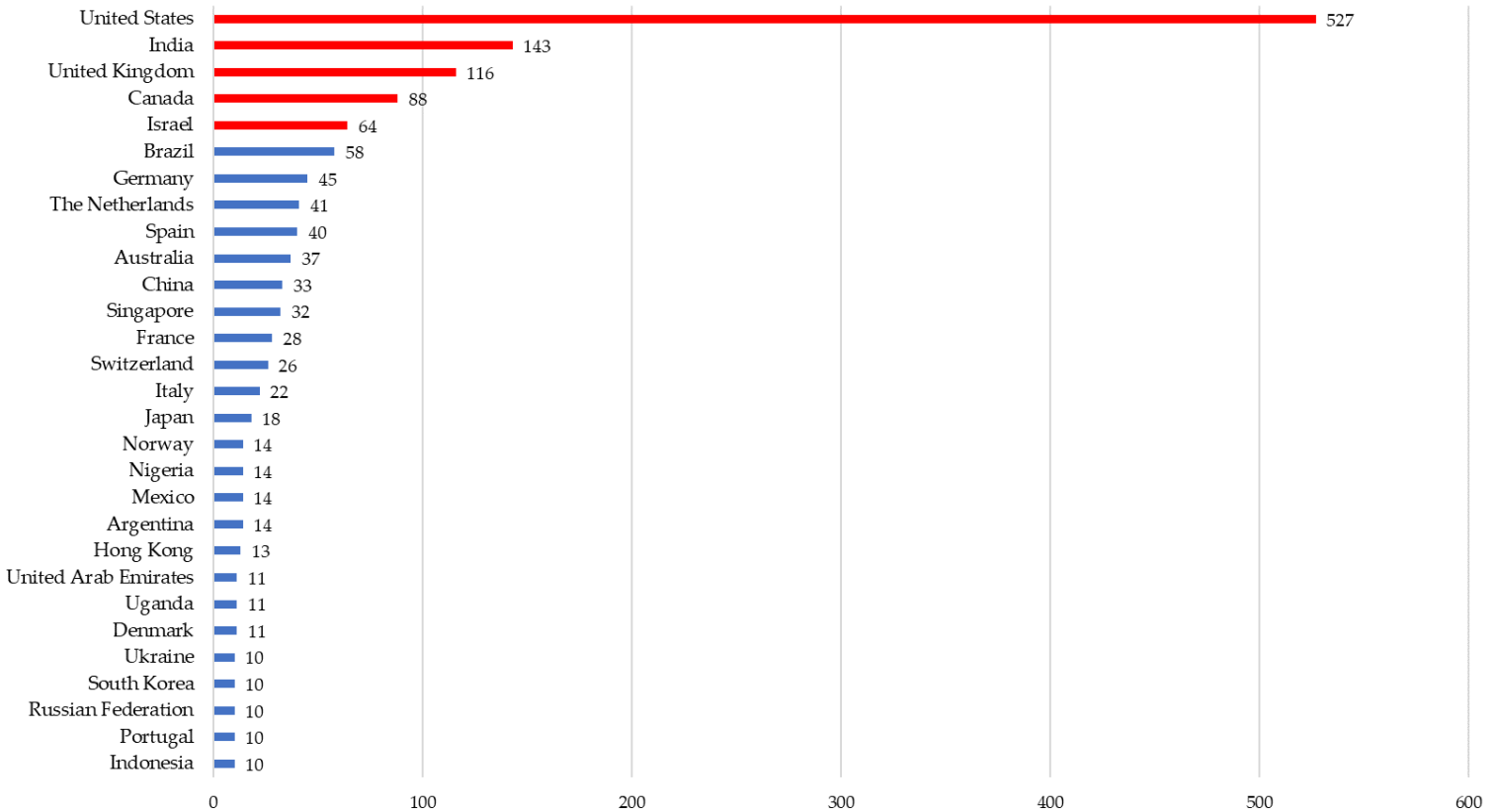


Figure 15. Agri-Food Sustainable Startups Distribution by Countries. Source: Own elaboration based on the developed database

As regards to platform-based startups, the ranking list slightly changed bringing Brazil and Spain to the top 5 countries with the highest number of platforms. The United States still takes the first position with 43 platform-based companies as well as Italy keeps the 15th place developing 22 platforms. The Figure 15 presents the more detailed picture of platforms' distribution by geographical area:

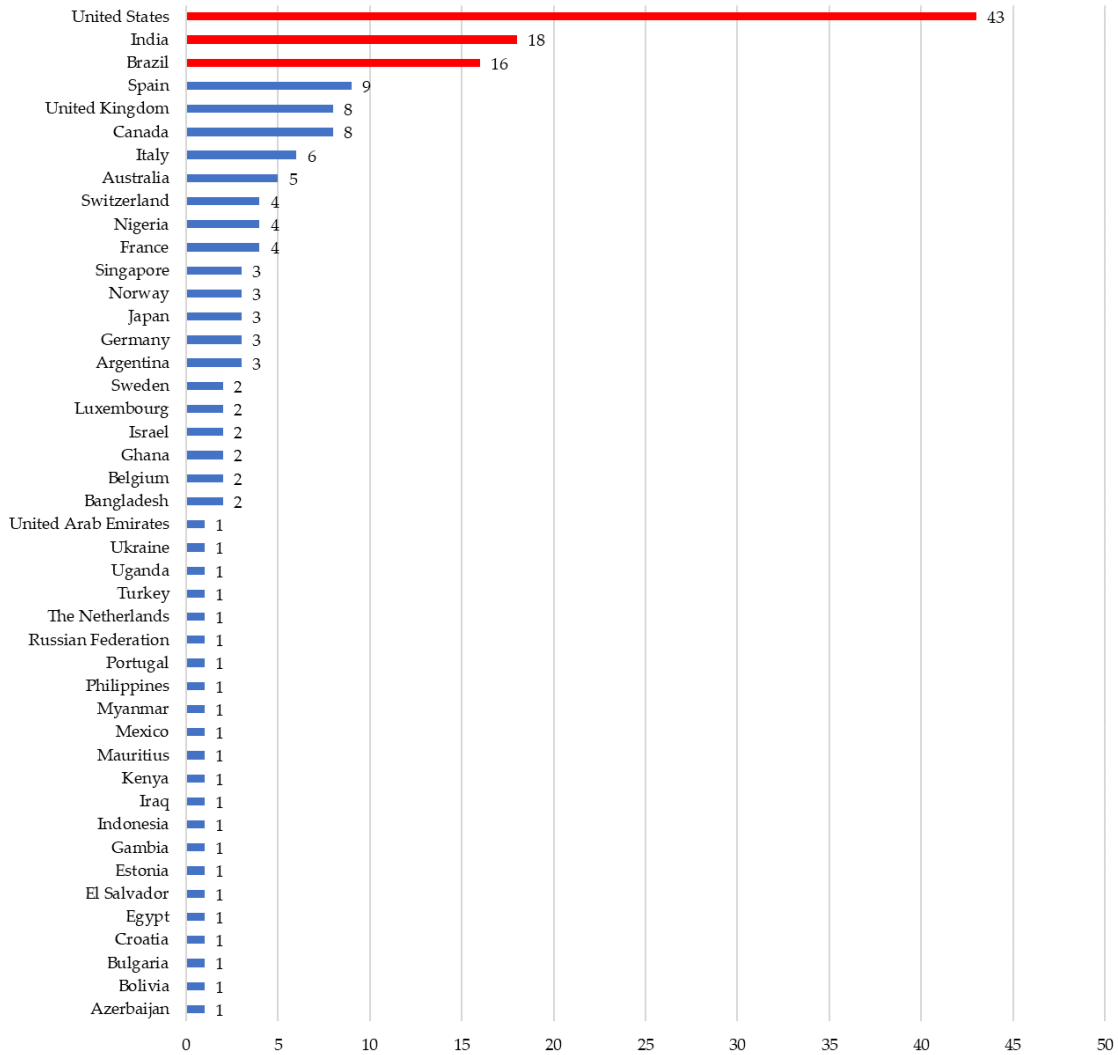


Figure 16. Agri-Food Sustainable Platform-Based Startups Distribution by Countries. Source: Own elaboration based on the developed database

The results in absolute values can skew the perception of domestic platform ecosystem of countries, taking into account the differences in their sizes and levels of economic development. In order to present more reliable data, it was implemented the additional performance calculated as division of the startups' number to the country population (in millions). Data related to the number of citizens is taken from World Bank at the time of the request for the study in February 2022.

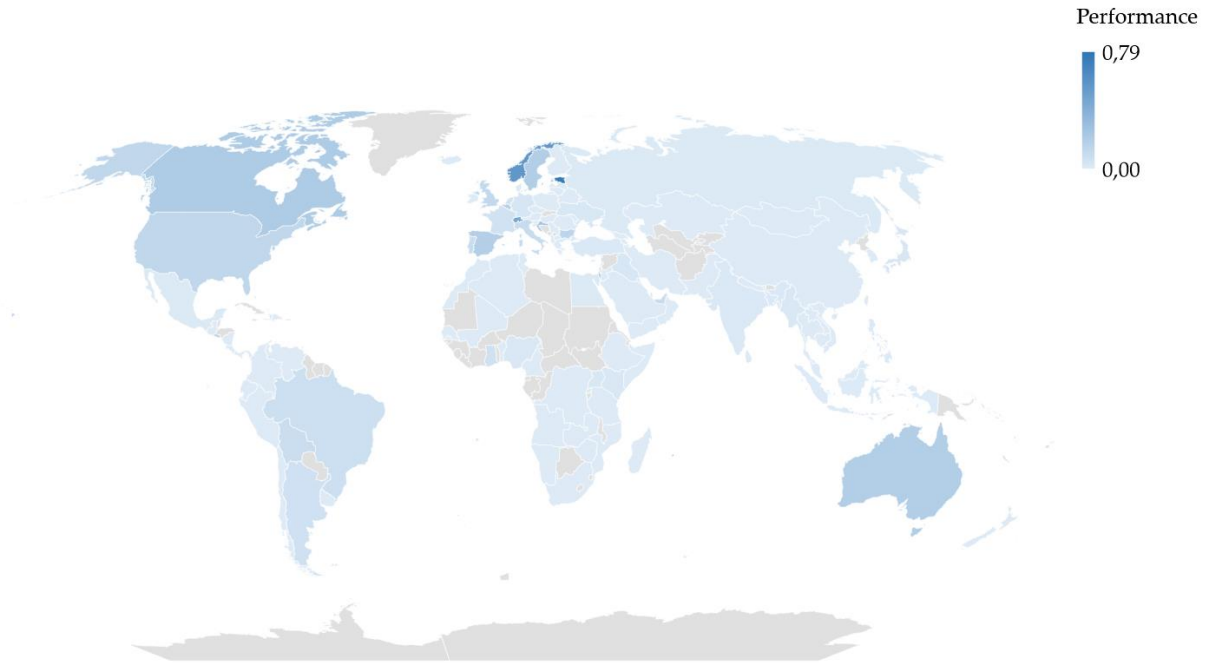


Figure 17. Number of Agri-Food Sustainable Platform-Based Startups by Countries per Million of Citizens. Source: Own elaboration based on the developed database

As seen in the figure 16, the outstanding results performs Estonia with 0,75 registered Agri-Food sustainable platforms per million of citizens. The noticeable values comparing with the rest of countries have also such countries as Norway, Singapore and Switzerland.

5.1.3. Financial Analysis

The financial analysis was performed to understand if platform-based sustainable Agri-Food startups are able to raise financial capital. Firstly, it was decided to compare the frequency of platforms and not platforms to be funded by third parties. The tables 4.2.1.3.1 and 4.2.1.3.2 presents that in average enterprises that don't use platform-based model receive funding more often than the rest. However, there is only the slight difference of 42% versus 41%. Besides, it is noticeable that the last two years of the considered period the situation is completely opposite. The percentage of funded platforms are higher in 2019 and 2020 because platform-based economy gains popularity in business environment. Thus, it can be concluded that platform-based companies in Agri-Food industry gather more interest among shareholders then the rest of the database.

Despite the rising attention to Agri-Food platforms, the average funding amount is twice more for not platform-based startups. It means that shareholders are not ready to invest

in Agri-Food sustainable companies with platform-based model as much financials as in other enterprises in the industry.

| <i>Not Platform-Based Startups</i> | | | |
|------------------------------------|------------------|----------------------|-----------------------------------|
| <i>Year</i> | <i>Funded, %</i> | <i>Not Funded, %</i> | <i>Average funding amount, \$</i> |
| 2016 | 44% | 56% | 6066799 |
| 2017 | 43% | 57% | 12563183 |
| 2018 | 41% | 60% | 3444699 |
| 2019 | 26% | 74% | 2120279 |
| 2020 | 14% | 86% | 140333,3 |
| Total | 42% | 58% | 8010893 |

Table 15. Percentage of funded and not funded not platform-based sustainable Agri-Food startups per year. Source: Own elaboration based on the developed database

| <i>Platform-Based Startups</i> | | | |
|--------------------------------|------------------|----------------------|-----------------------------------|
| <i>Year</i> | <i>Funded, %</i> | <i>Not Funded, %</i> | <i>Average funding amount, \$</i> |
| 2016 | 49% | 51% | 6271980 |
| 2017 | 34% | 66% | 3210084 |
| 2018 | 39% | 61% | 1259825 |
| 2019 | 29% | 71% | 1280000 |
| 2020 | 33% | 67% | 65000 |
| Total | 41% | 59% | 4350484 |

Table 16. Percentage of funded and not funded platform-based sustainable Agri-Food startups per year. Source: Own elaboration based on the developed database

5.2. The Clustering Analysis Results (RQ2)

The clustering analysis enabled to classify the AgriFood sustainable platforms into 6 clusters presented below.

5.2.1. Cluster 1 – “Food Delivery”

The platform-based companies that belong to this cluster are the ones who are facilitating the connection of Food Service actors (sale of ready for consumption meals) in Agri-Food SC and customers. Cluster 1 consist of 43 Agri-Food sustainable platforms.

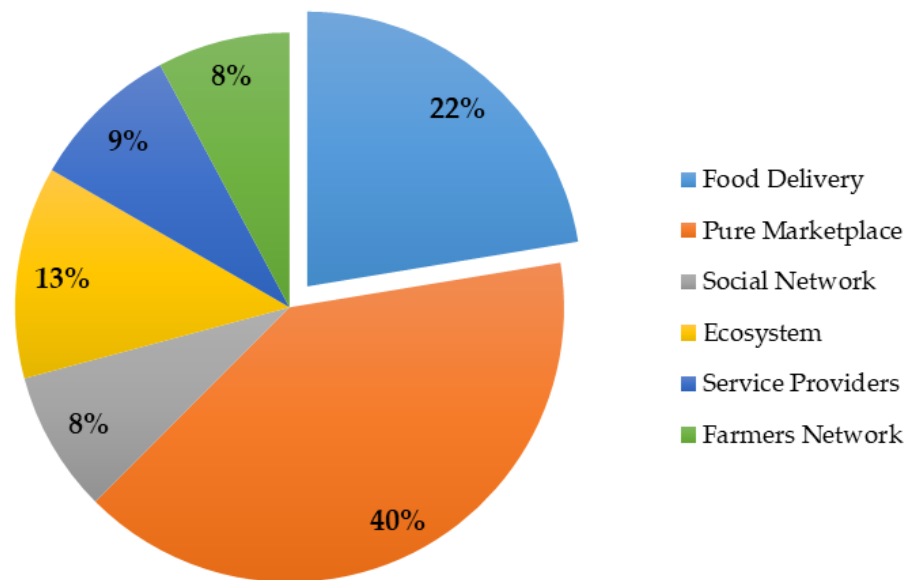


Figure 18. Platforms Distribution by Clusters: “Food Delivery” Cluster. Source: Own elaboration based on the developed database

Startups falling into this cluster mostly are providing an electronic ordering system that helps automate the operational activities of restaurants and mobile food services. It eases the process of finding a client for these businesses from the one side and enables the customer to get food from the desirable place fast from the other side of a platform. That is why, the main benefit and competitive advantage they provide delivering their product is price/cost/ efficiency. Indeed, Food Delivery Platforms economizes time for a customer in terms of delivering and waiting time because in the meantime he/she can be occupied by more relevant businesses. For food services it means an additional point of sales and marketing promotion.

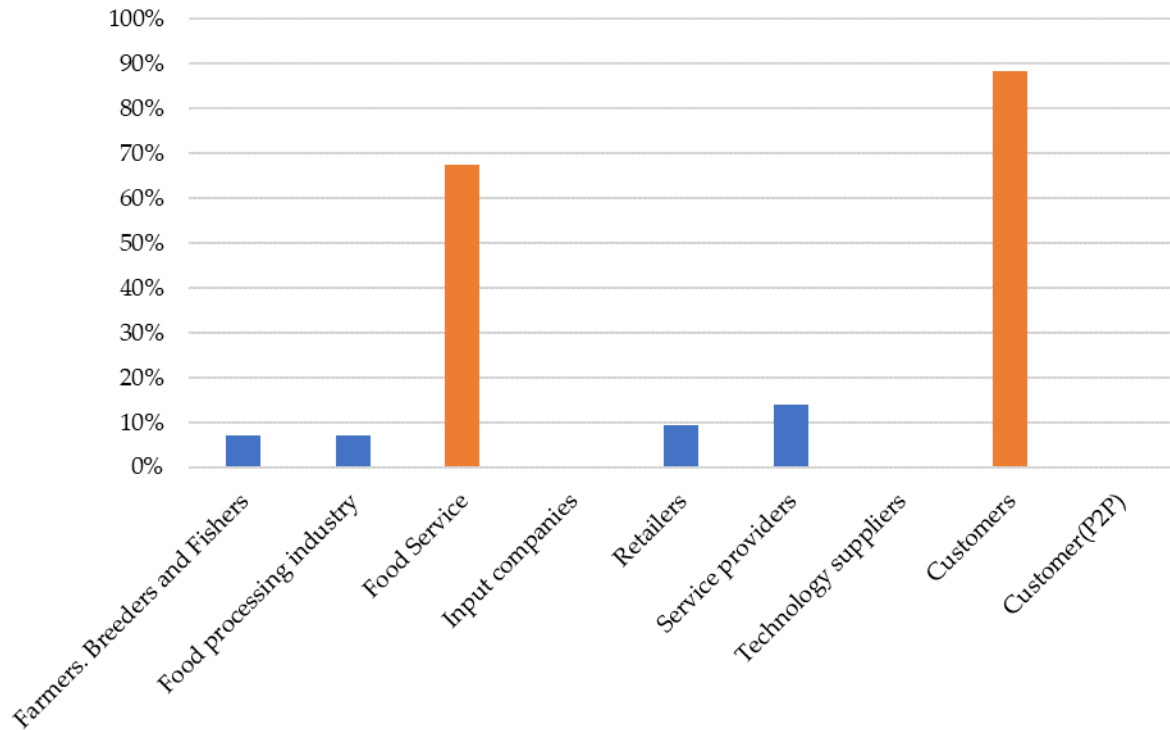


Figure 19. Supply Chain Actors Distribution by Clusters: “Food Delivery” Cluster. Source: Own elaboration based on the developed database

Additionally, the part of platforms included in Cluster 1 allows local businesses to make profit. They enable to interact home chefs, people who are passionate about cooking and clients who look for homemade or local food. For instance, Foodpeon is an online food delivering platform that gives an opportunity to users to eat healthy food from their neighbors. Their slogan is: “let your neighbor cook for you”. Moreover, the goal of the startup is to empower women to be independent by selling their dishes.

It is worth to mention that generally startups included in Cluster 1 don’t use new technologies to provide their services (0% in attribute “Use of new technologies”). Besides, the utility of the platform for food service representatives rises with the increase of customer’s number and vice versa. It means that all Cluster 1 platforms have indirect network effect.

5.2.2. Cluster 2 – “Pure Marketplace”

“Pure Marketplaces” is focused on building a platform for communication representatives of farming business such farmers, breeders or fishers and final customers. Cluster 2 is the most populated among all 6 clusters in the AgriFood industry and it counts 77 AgriFood sustainable platforms.

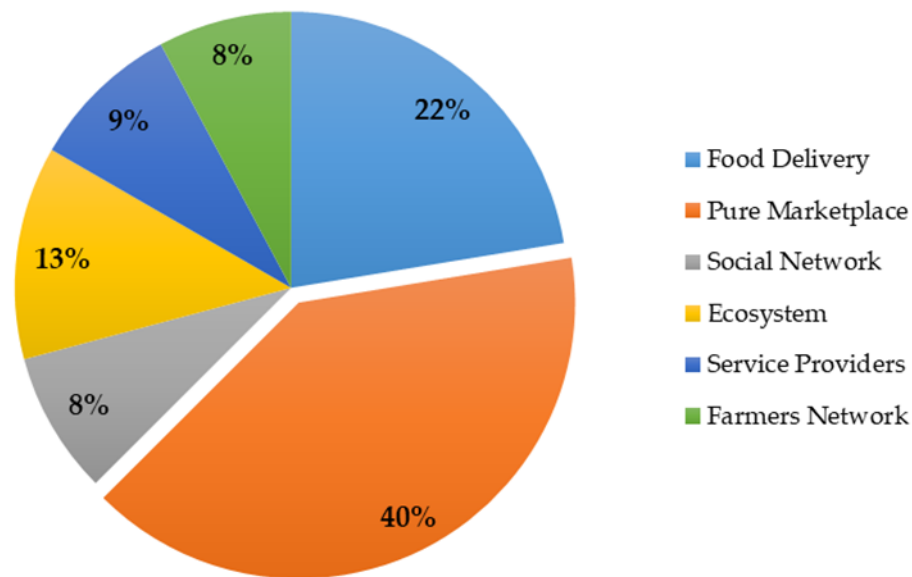


Figure 20. Platforms Distribution by Clusters: “Pure Marketplace” Cluster. Source: Own elaboration based on the developed database

Platforms included in Cluster 2 enable easy exchange of products between smallholder agricultural enterprises and general consumers. They create infrastructure that consists of diverse farming goods catalogue, payment and communication tools and other fulfillment services. These startups allow farmers to be linked to the market in spite of their geographical position. Moreover, platforms of Cluster 2 eliminate middlemen in such exchanges of goods and farmers have a direct connection with a customer. Consequently, transactional costs decrease. From the customer side, they use such platforms to have healthy and fresh products for their real price even living in big cities far from agricultural areas. Therefore, their main key value proposition is price/cost/efficiency.

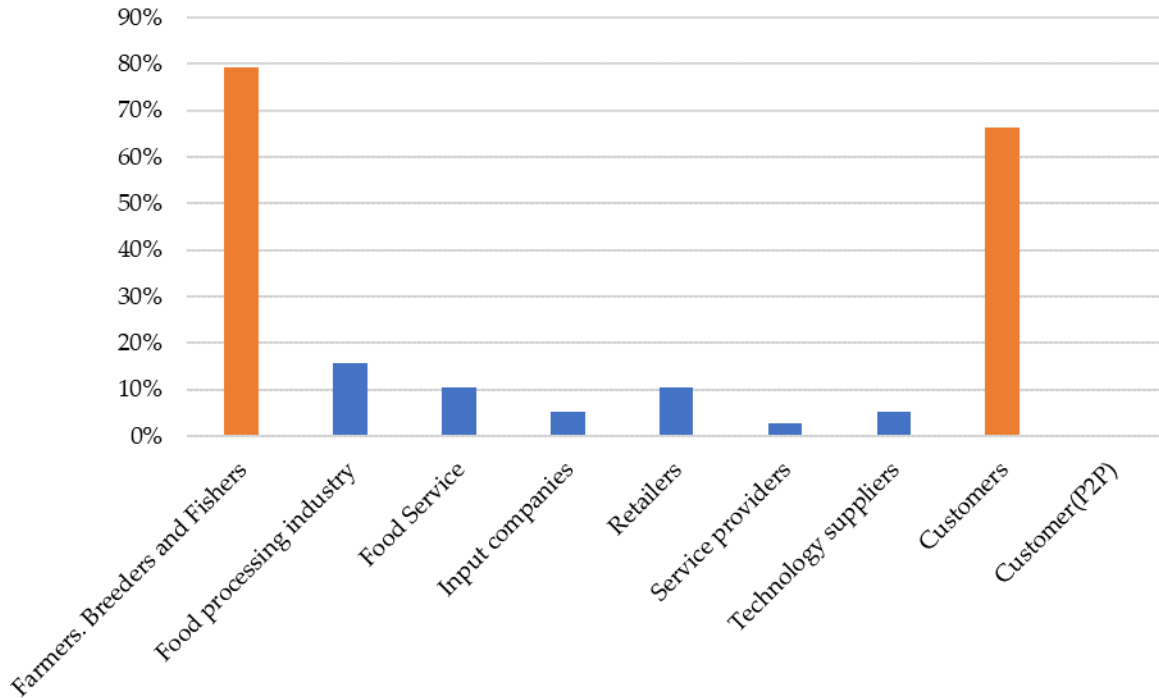


Figure 21. Supply Chain Actors Distribution by Clusters: “Pure Marketplace” Cluster. Source: Own elaboration based on the developed database

However, there are also Agri-Food sustainable platforms that link farmers with downstream actors of the supply chain like technology suppliers and input companies in Cluster 2. These startups provide a place where smallholder agricultural enterprises can find necessary equipment, seeds, fertilizers at fair prices from all over the world. For instance, WebGados is a Brazilian platform enabling transactions among breeders and sellers of dairy cattle, agricultural machinery, rural properties using only computer or a smartphone.

5.2.3. Cluster 3 - "Social Network"

Cluster 3 comprises entities that is focused on creating and supporting community of people that are interested in food, gastronomy, healthy nutrition. It is the smallest group of Agri-Food sustainable platforms that consists of 16 startups (8,33%).

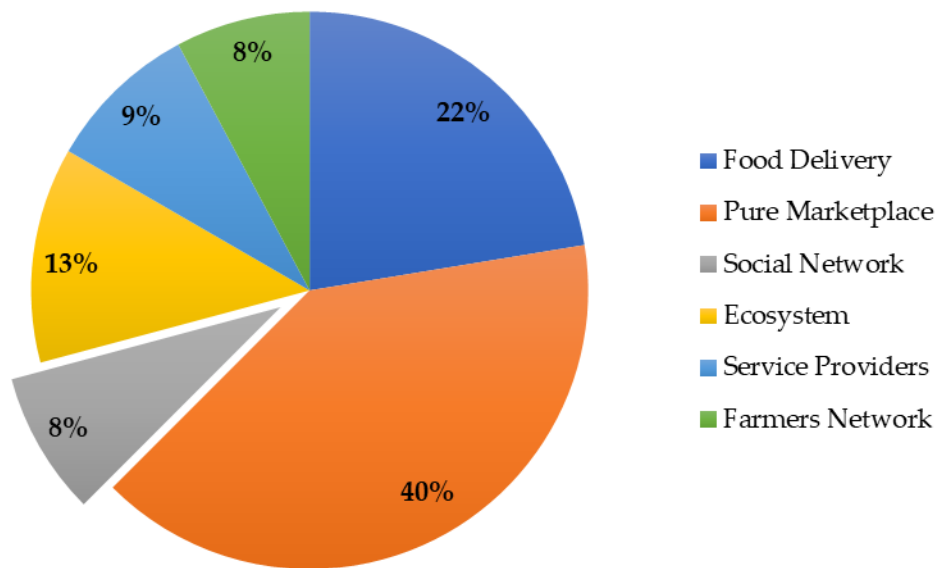


Figure 22. Platforms Distribution by Clusters: "Social Network" Cluster. Source: Own elaboration based on the developed database

Platform-based enterprises belonging to Cluster 3 raise the customers' awareness of Agri-Food industry, mostly the Food Service stage, and the improvement of their emotional satisfaction. It supports the community of foodies to share insights, recommendations, reviews of visited places, best diets, etc. As a result, the key value proposition that these platforms convey is social value.

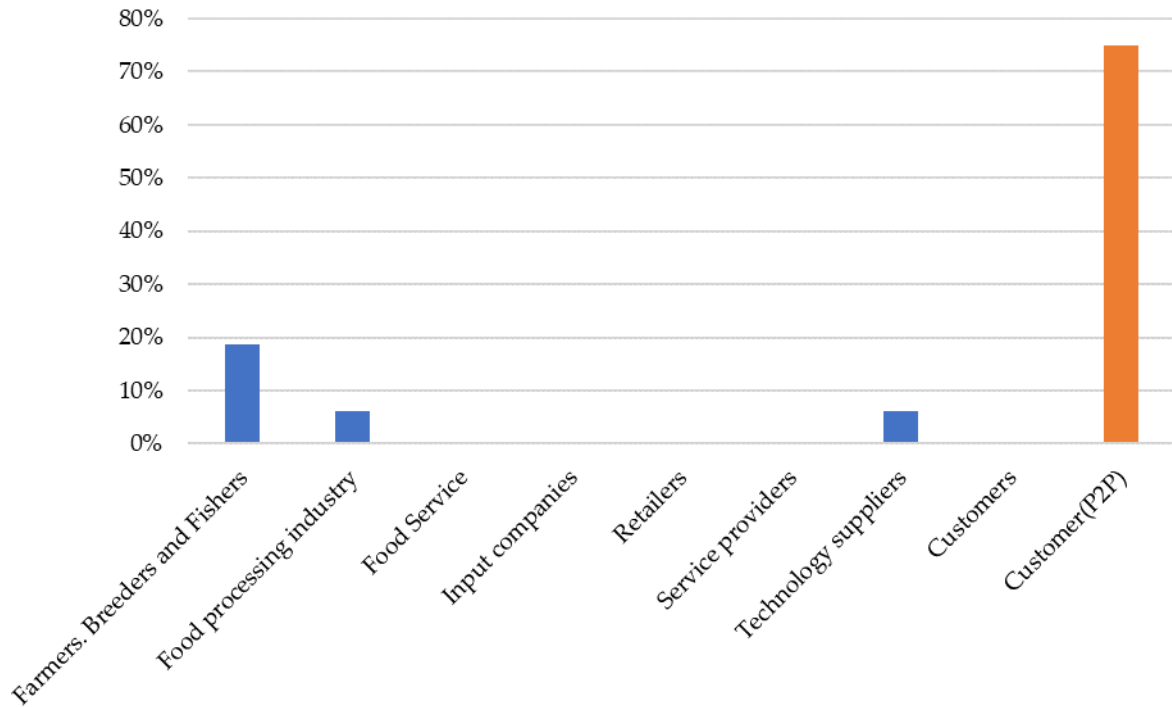


Figure 23. Supply Chain Actors Distribution by Clusters: “Social Network” Cluster. Source: Own elaboration based on the developed database

As well as the general social media companies falling into Cluster 3 facilitates the direct peer-to-peer connection for experience exchange between people from all over the world. Therefore, 88% of the platform has a direct network effect.

EatLocal clearly represents the Cluster 3. The main idea is to share recommendations of restaurants and bars with your friends and also to find real local places. The app allows to exchange experience with your community and receive food advice from people you trust.

5.2.4. Cluster 4 - "Ecosystem"

Cluster 4 comprises platform-based startups that bring together multiple actors of Agri-Food supply chain for the effective collaboration. There are 24 enterprises in "Ecosystem" class which make up 13% among all units in the studied database.

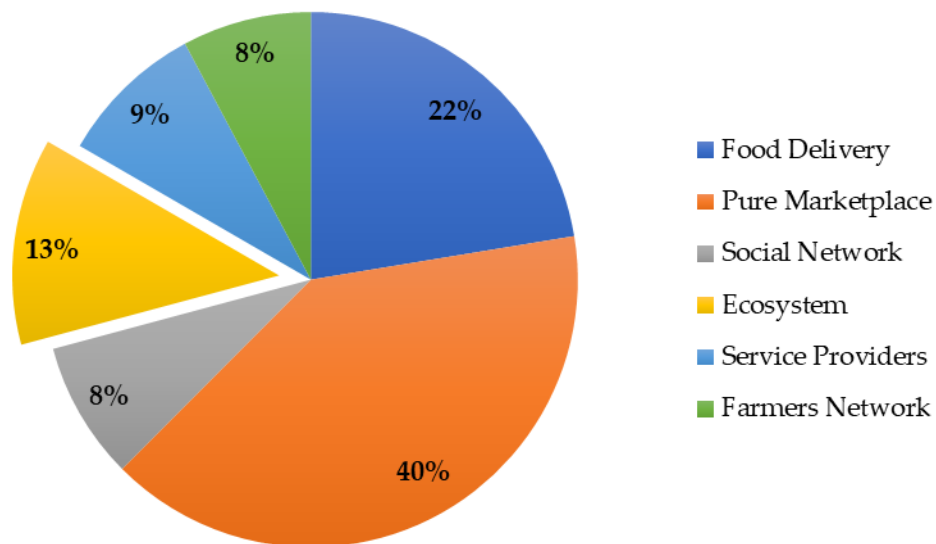


Figure 24. Platforms Distribution by Clusters: "Ecosystem" Cluster. Source: Own elaboration based on the developed database

Companies falling into this category provides platforms where various agents of the industry can arrange partnerships, create the network of useful connections, exchange competencies in order to increase common value. It is crucial to have a transparent and trustworthy environment to convince different business agents be involved in ecosystem. For this purposes, 75 percentage of "Ecosystem" platforms implement new technologies, particularly, half of them use Blockchain which is a ledger of decentralized data that can be exchanged securely. Besides, 17% of companies included in Cluster 4 apply Artificial Intelligence. Thus, enterprises of "Ecosystem" Cluster is focused on delivering its user such value proposition as security/transparency.

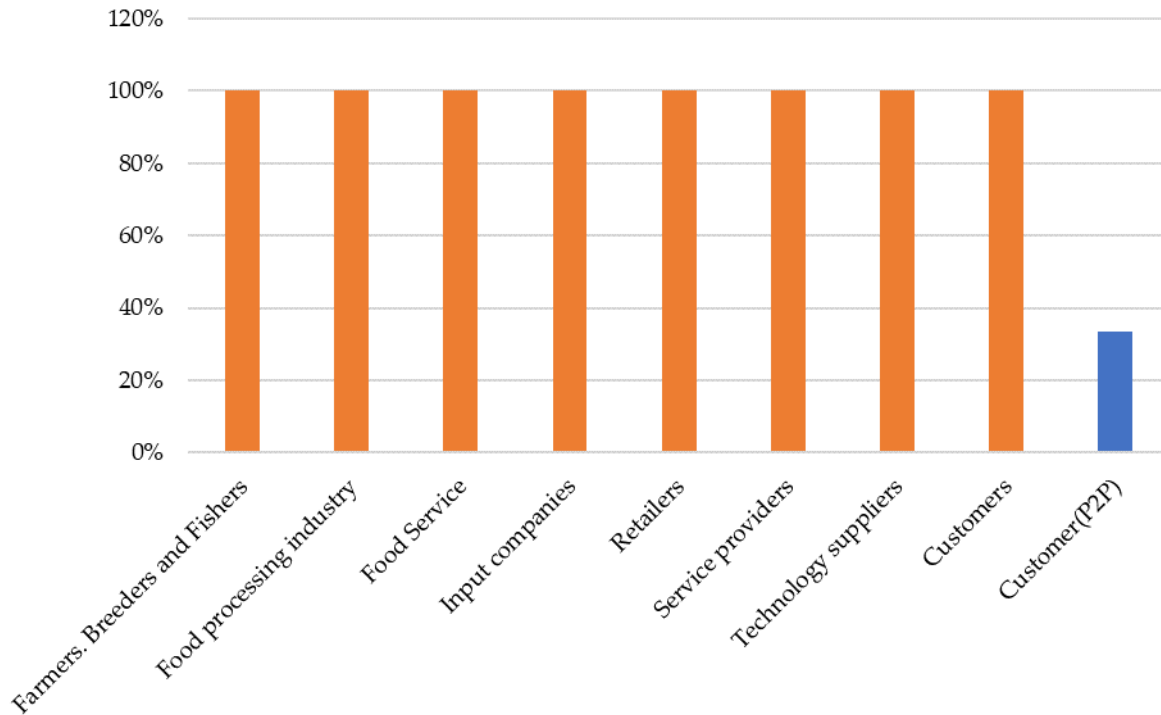


Figure 25. Supply Chain Actors Distribution by Clusters: "Ecosystem" Cluster. Source: Own elaboration based on the developed database

Given globalization and the cross-border movement of food, the tracking and following the steps of a product throughout the supply chain is a big challenge. In such a fragmented industry as agriculture, where multiple actors operate in the chain of a single product, with multiple registration systems (in some cases paper and pencil), guaranteeing transparency and avoiding opacity in some areas is crucial. NuraSign is exactly the platform supported by blockchain technology that allows the creation of a unique, secure and immutable digital record of each product to offer traceability from origin to table.

5.2.5. Cluster 5 - “Service Providers”

The platform-based startups belonged to Cluster 5 enable companies operating in other industries to support core activities of Agri-Food supply chain actors. This category consists of only 17 startups from the database which make up 9%.

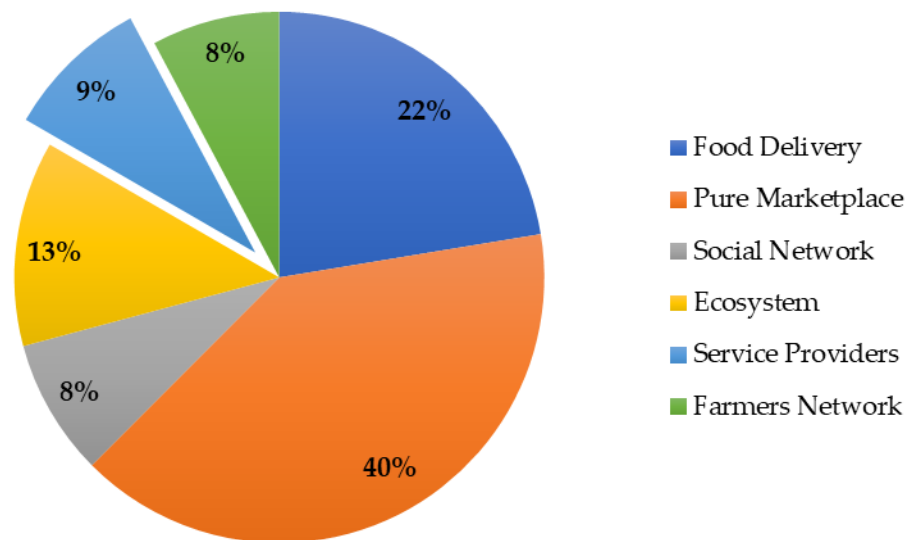


Figure 26. Platforms Distribution by Clusters: “Service Providers” Cluster. Source: Own elaboration based on the developed database

The principal focus of enterprises of Cluster 5 lies in connecting the right counterparties in the right time and place. Literally all units of the database falling in “Service Providers” class fulfil Matching function. They facilitate partnership between farmers, breeders and fishers and service providers. By the service providers it is meant companies that are related to Agri-Food industry indirectly such as crowdfunding entities, waste management organizations, insurance companies and etc. These platforms play a key role in providing the access to the market and support the core operations.

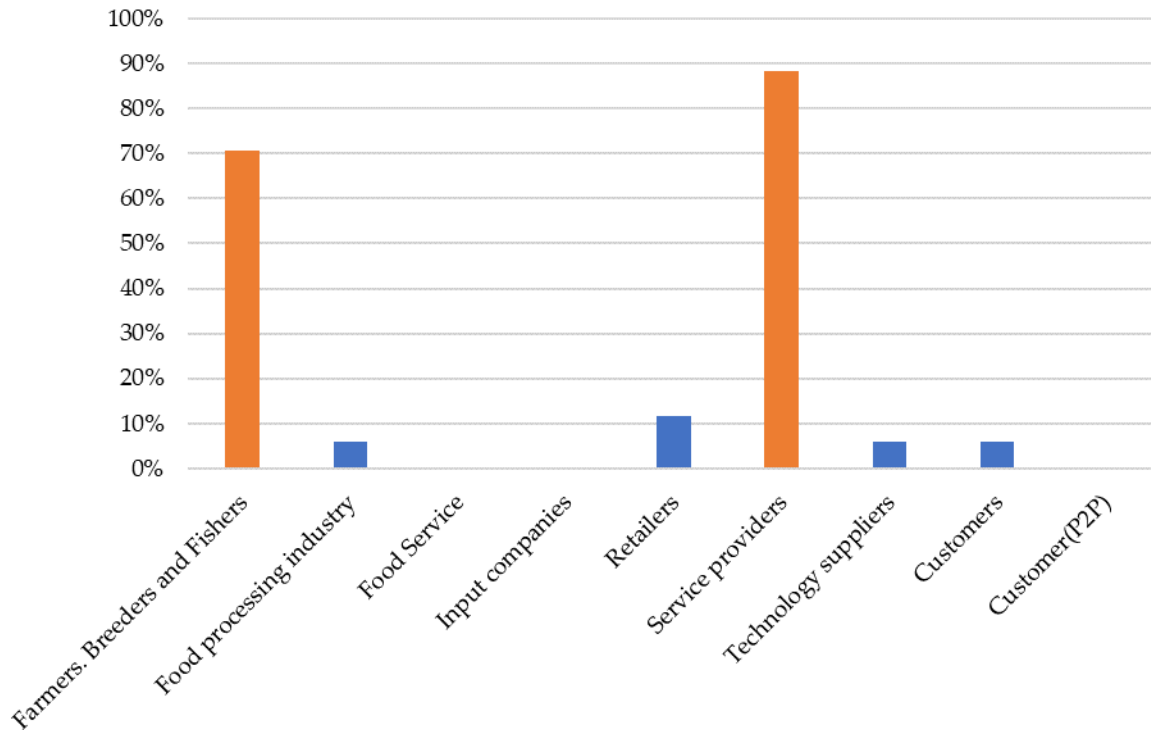


Figure 27. Supply Chain Actors Distribution by Clusters: "Service Providers" Cluster. Source: Own elaboration based on the developed database

As an example, the platform-based startup Siembro provides agricultural companies a financing solution to boost their business. Thanks to agreements with banks and financial institutions, the Spanish platform offers enterprises with core business related to Agri-Food industry a wide range of tools to get capital for entering to the market or their further development.

5.2.6. Cluster 6 - “Farmers Network”

Cluster 6 consist of Agri-Food sustainable startups that facilitate the explicit and direct link between smallholder farmers. They have the lowest share among all clusters and their number is just 15. However, they fulfil the crucial function in Agri-Food system – building and support farmer’s community.

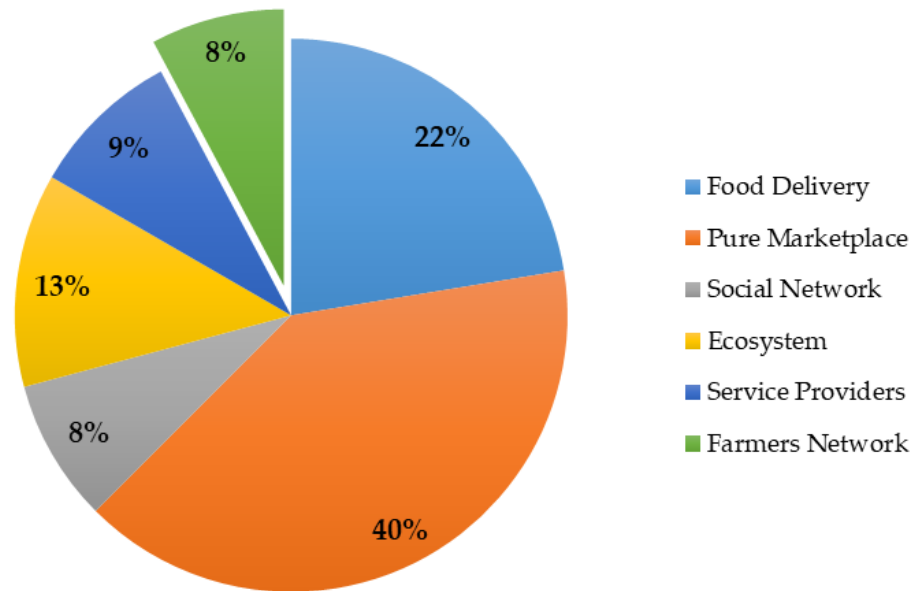


Figure 28. Platforms Distribution by Clusters: “Farmers Network” Cluster. Source: Own elaboration based on the developed database

The core business of startups falling into “Farmers Network” cluster is to operate as a management platform. Management platforms provide multiple services to smallholder agricultural enterprises such as market and industry insights on how to increase productivity of farming activity, to reduce the waste through inventory management, promote themselves and gain competitive advantage. In order to make it happened these companies widely use new technologies to gather necessary data and analyze it. 87% of “Farmer Network” platforms are based on such tools as Artificial Intelligence (53,3%), Blockchain (13,3%) and Satellite Technologies (20%).

However, Cluster 6 startups are considered as multi-sided platforms which is the subject of the current research due to the fact that one additional feature of the management platform is communication among farmers. They have an opportunity to share the successful practices and useful information with other members of the community. For instance, Argentine company BoosterAgro provides farmers a platform that allows to monitor their crops through satellite images of the green index, view alerts for insects, weeds and diseases reported by the network of field monitors, view the rainfall in

different areas on a map, access weather reports and economic exclusives on medium-term trend. But most importantly, the generated information is available for all platform’s users and can be used for optimization of own farming activities.

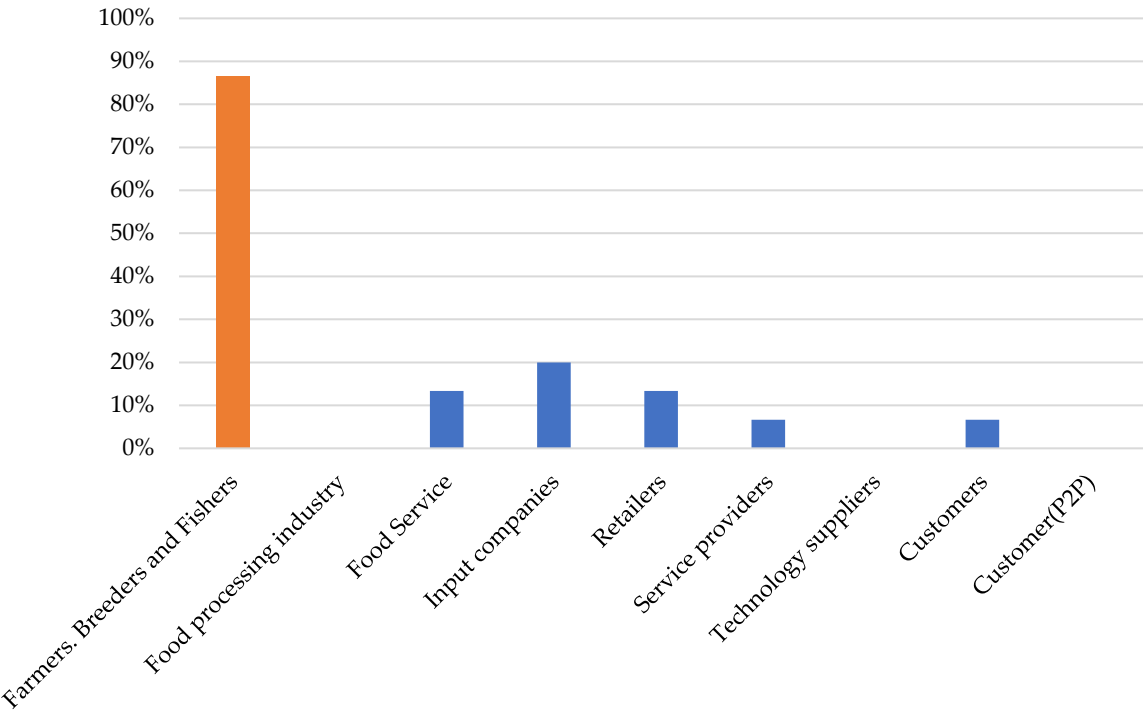


Figure 29. Supply Chain Actors Distribution by Clusters: “Farmers Network” Cluster. Source: Own elaboration based on the developed database

5.2.7. The Clustering Analysis Results Validation

In order to confirm the results of the clustering analysis semi-structured interviews were conducted. During the interviews the final classification was presented and each cluster was described in depth. Later a participant was asked the question “What do you think which cluster suits you more?”. Due to the lack of dedicated time the representative of the “Food Delivery” cluster missed the part related to the clustering analysis. In addition, as stated in the Section 4.2., cluster “Pure Marketplace” wasn’t covered because none of the reached out companies responded. Nonetheless, all responded companies chose the cluster that corresponds to the results of the clustering analysis. Besides, based on the answers of the “Food Delivery” platform’s representative can be concluded that the cluster was identified correctly since they are aligned with the defining characteristics of the cluster.

5.3. The Sustainability Analysis of Multi-Sided Agri-Food Platforms (RQ3)

Once the classification of platform-based startups in Agri-Food industry based on their business model was identified, it is crucial to investigate how each of the defined clusters contributes to the sustainable development. In order to assess the sustainability impact, it was used the framework explained in Section 4.1.3 where SDG's targets related to the observed industry were chosen and assigned accordingly to all enterprises in the constructed database.

Before describing each cluster from this standpoint, it is worth to make clear the overall picture of sustainability orientation in platform-based model of Agricultural and Food sectors. Remarkably, the most covered target (34% of startups) is 8.9 "by 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products". The reason may reside in the fact that the second largest cluster is "Food Delivery" which contribute to tourism enhancement by providing easier access to Food Service agents. Besides, 32% platforms fulfill the target 12.8 that highlights the importance of sustainability development awareness and information sharing. Indeed, thanks to digital nature of this kind of business model, the access to knowledge and its spreading become more available for all Agri-Food supply chain actors. Finally, platform-based enterprises bring efficiency to any operations in different areas facilitating the connection among different actors by the definition. It fosters achieving the target 2.3 (26% of companies) linked to doubling the agricultural productivity. However, platform-based startups in Agri-Food industry are contributing to achievement of not all targets defined for the sector. There are 2.2, 2.5, 6.3, 6.4, 9.4 and 12.4 targets in that list. The Figure 4.2.3.1 presents which percentage of platforms cover each target.

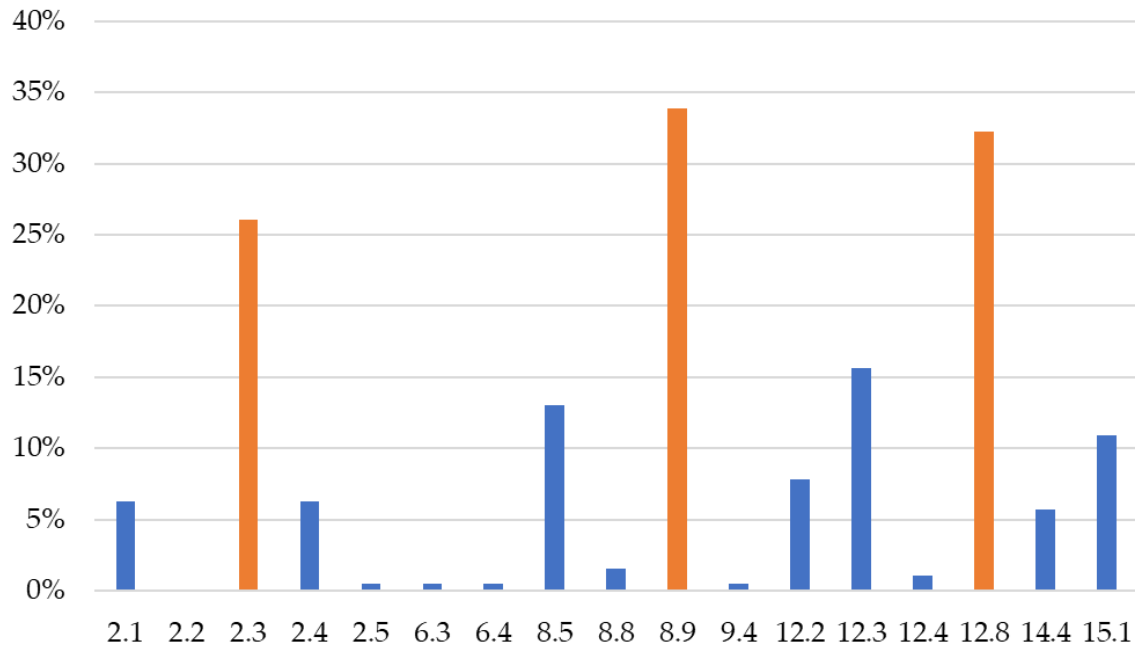


Figure 30. Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

As regards each cluster separately, half of “Food Delivery” platforms pursue the 8th SDG related to decent work and economic growth. Particularly, as stated before, they fulfill target 8.9. Food Services such as restaurants and bars are integral part of the hospitality industry. Providing easier access to these entities allows the development of touristic sector. Moreover, among representative of the cluster there are startups (26%) that as an additional service help restaurant business to sell surplus meals to customers at discounts. Thus, such platforms try to reach the halving of food waste and reduction of food loss (12.3).

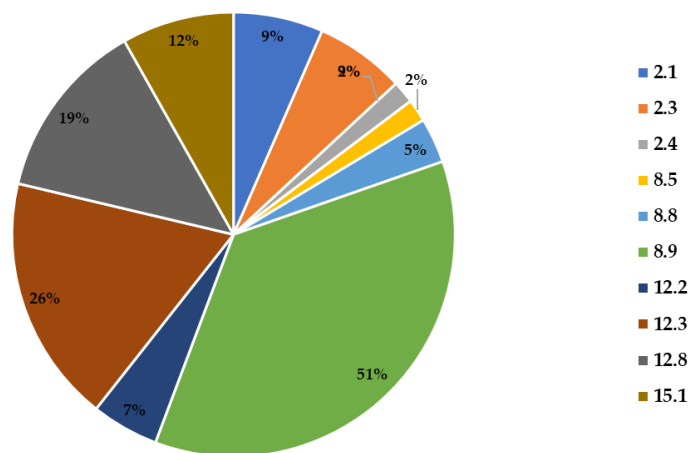


Figure 31. “Food Delivery” Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

The primary goal of “Pure Marketplace” platforms is providing efficiency to farming business entities by letting them directly trade with a final customer. By eliminating middlemen, it enables farmers not only to enter the market but also boost their income. That is why, in the first place the cluster helps to achieve target 2.3 linked to small-scale producers’ productivity and the profit they make. Also “Pure Marketplaces” are focused on distribution of farmers’ fresh produce facilitating the healthy nutrition and lifestyle of customers (12.8).

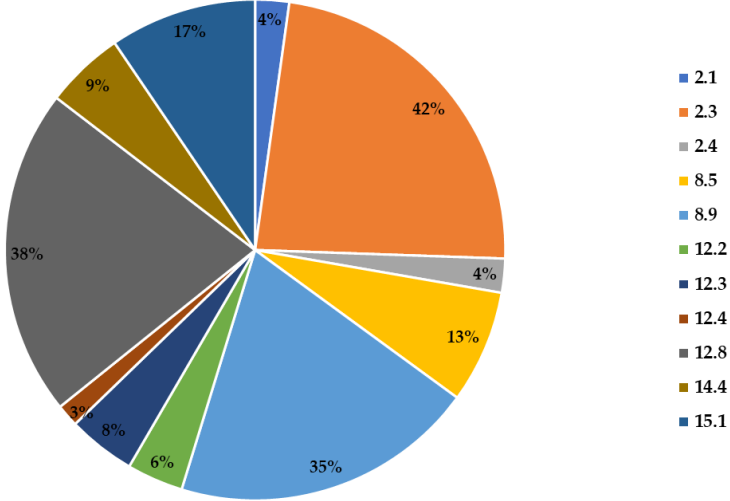


Figure 32. “Pure Marketplace” Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

The next cluster “Social Network” supports the community of gastronomy interested people to share their experience, reviews and advises with each other mostly regarding to the restaurant sector. The additional feature of these platforms is possibility to reveal local places. Therefore, the vast majority of “Social Network” startups (69%) pursues target 8.9.

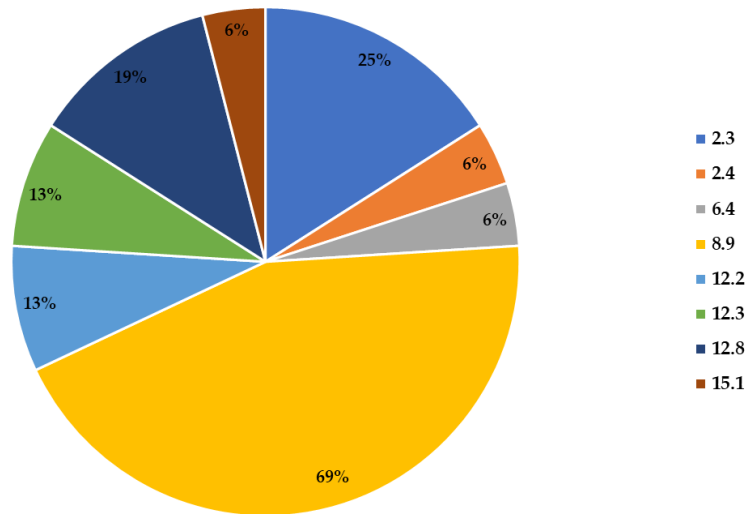


Figure 33. "Social Network" Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

Thanks to wide implementation of new technologies, in particular, Blockchain, "Ecosystem" startups create secure and transparent platform for collaboration and information sharing among all actors of Agri-Food supply chain. It allows companies falling into this cluster to take part in reaching the target 12.8. that struggling to raising people awareness in sustainable development.

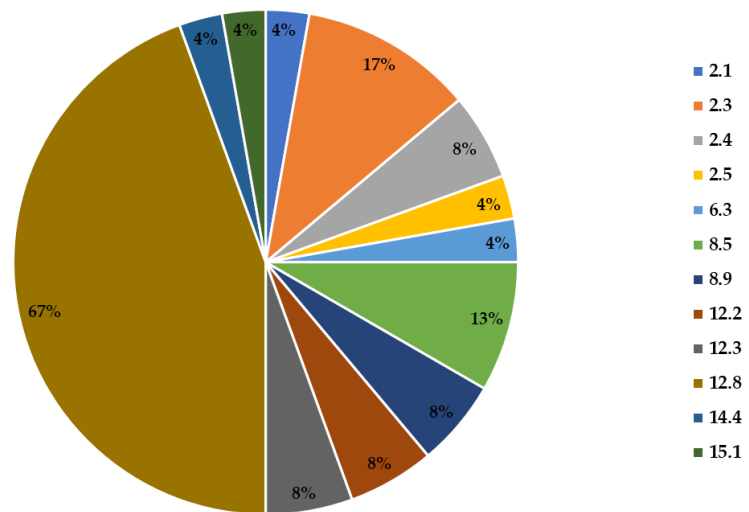


Figure 34. "Ecosystem" Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

More than half of the companies that belong to the “Service Providers” cluster brings benefits in achieving target 8.5 which aims to provide decent work to all people with equal reimbursement. The platforms are focused on supporting farmers to set up the business and sustain it by connecting them with crowdfunding companies, waste management organizations and etc. Thus, regardless the gender, age or place of living, people have possibility to not only arrange their source of income but also generate employment in their farms.

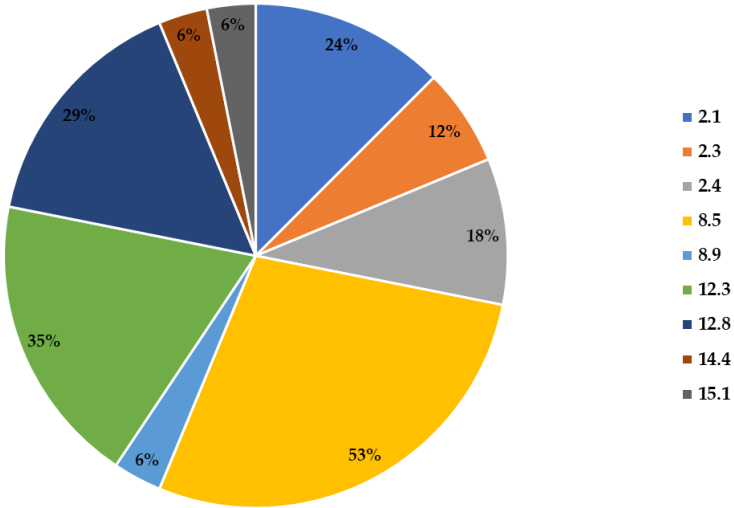


Figure 35. “Service Providers” Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

Finally, “Farmers Network” entities are intended to raise production and cost efficiency. As stated in Section 5.2.6, they are based on management platforms that gathers the data of the farm through sensors and provides insights about crop management and treatment, fertilizers and diseases awareness. However, the key point that these data are shared among all the platform’s users. Therefore, companies from the final cluster enhance the agricultural productivity, facilitate efficient use of resources and waste management. It directly corresponds to the targets 2.3, 12.2, 12.3 that are most covered in the cluster “Farmer Network”.

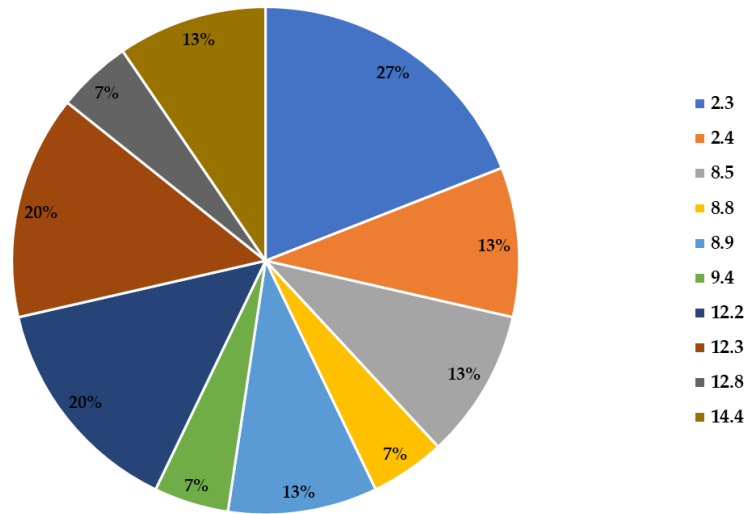


Figure 36. "Farmers Network" Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

5.4. Identification of barriers and enablers in platform-based economy of the AgriFood industry (RQ4)

The analysis of semi-structured interviews enabled to identify and structure barriers of platform-based economy in the AgriFood industry and to propose possible solutions to address the challenges by revealing the enablers.

5.4.1. Identification of barriers in platform-based economy of the AgriFood industry

The first-order coding process allowed to highlight 9 barriers presented in the table 16 below:

| <i>Barriers</i> | <i>Respondents</i> |
|---|--|
| Affordability | Case 1, Case 3 |
| Creation of professional team | Case 1, Case 2, Case 3, Case 6 |
| Difficulties of digital technology adoption | Case 1, Case 2, Case 3, Case 4, Case 5 |
| Legal constrains | Case 1, Case 2, Case 4, Case 6 |
| External factors (COVID-19) | Case 2, Case 3, Case 5 |
| Trialability | Case 2, Case 5 |
| Lack of financing | Case 2, Case 3, Case 6 |
| Lack of government support | Case 2, Case 6 |
| Lack of digital connectivity | Case 4 |

Table 17. Barriers identified by semi-structured interviews. Source: Own elaboration based on the semi-structured interviews

The second-order coding was resulted in division of above-mentioned barriers into five groups based on the actors responsible for platform's model adoption.

5.4.1. Demand-side barriers

Demand-side barriers are related to those actors of AgriFood supply chain that use platforms to fulfill their needs. It includes:

- **Difficulties of digital technology adoption**

Five out of six startups' representatives highlighted that they experience a challenge related to the acceptance of new technologies by other actors of the AgriFood supply chain – platforms' users. Firstly, it is connected to low level of digital literacy of customers:

“I mean a lot of our customers are not tech-savvy. And, so, we have to make technologies much simpler that they will use it” – Case 1

“When you are created a new function, new everything, you need to test it all the time with reapply” because “...this is smart things, that you don’t think so about them, before you are really working with a client” – Case 2

Secondly, the behavioral factors also hamper the development of the platform-based model:

“I would say that we have had harder time to get a non-profit to sign up and use it properly to schedule when they want to receive food and what kind of food they want to receive. With donors... I think that there is a little bit of laziness” – Case 3

“We see that the most poverty happens in the last mile. And a lot of times it’s not because they cannot, it just because they don’t have needs to really manage themselves better”; “It is also about convincing them that it is the way to do so many different things by having a smartphone it will be another level. They probably used to have like a Candy Phone that they can call but why do they have to have a smartphone” – Case 4

5.4.2. Supply-side barriers

Supply-side barriers are related to those actors of AgriFood supply chain that provide platforms. It includes:

- **Creation of professional team**

Many respondents experienced an issue of finding the effective-functioning team because of the intense competition in labor market of engineers which are key people in a startup, high dependence on the software engineer and necessity to create a healthy environment in a company:

“I think that the biggest challenge that is were in the Bay area is that there is a high competition for labor here. Particularly for engineers” – Case 3

“He [developer] quick left. And we couldn’t access the code. So, it was 8 months of work wasted. And I had to quickly hire new developers and you know to get new team members to rebuilt everything from the beginning” – Case 1

“The correct people and best team has to be people that are... With all professional skills and also people when you can work with them 24 hours per day” because “as a startup you have a lot of bad moments. And if you are not in a good environment everything is going to fall down” – Case

2

- **Trialability**

One of the startups' representatives mentioned that the implementation of new technologies requires trials in the market. However, these experiments are not always affordable for startups:

"We are like trying the solution and then if it's working then we are investing then in technology"; "Something was really automatic but at the end needed to have a lot more investments for that" – Case 2

Moreover, he highlighted that testing on the market enables to avoid creating a useless product:

"...to create a product which is really useful or someone really need it. Because at the end I think that every entrepreneur fell in love with his item. And then he starts working and maybe recognize that it's a trash because it's something that only he likes it. And this is something hard because you have to test with the market" – Case 2

5.4.3. Both-side barriers

Both-side barriers are related to the transactional aspect among a platform's provider and user where both actors are responsible for a challenge.

- **Affordability**

Affordability issues of platform services are mostly connected to small and medium size enterprises or individual customer since marginal profit from such clients are low:

"Individual delivery, consumer delivery there are no much profit on it"; "Not all offices can afford to bring lunch for all team members. So, being low-cost is very important" – Case 1

"We work with small local restaurants particularly in San Francisco and then in New York. It's more difficult for restaurants because we do... We paid... One the volume of surplus that they have, it's generally really small. So, it's like 50 pounds or maybe a 100 pounds, so to them it's more necessary we worth it to paid for someone to come to pick it up" – Case3

5.4.4. Institutional barriers

Institutional barriers are related to the government and state institution involvement. It includes:

- **Lack of digital connectivity**

Considering the digital nature of a platform, it is significant to have a proper digital infrastructure which is a responsibility of the government. Some rural areas are still struggling with digital connectivity due to low quality or even absence of signal:

“Most of the people from last mile they don’t have digital access; “I am like the headquarter, I don’t see it in my computer [because of lack of signal]. So, people might be doing like every day their transactions but then in my statistic there is nothing happening” – Case 4

- **Lack of governmental support**

Respondents mentioned the importance of the support from the government in terms tax benefits, subsidies etc in order to compete with incumbents that exploiting traditional models:

“In Spain the taxes are really-really expensive” – Case 2

“We don’t have any government incentives at all, discount or something else. Brazil doesn’t work like that”; “... we don’t know what is government help. We are struggle as entrepreneurs with that kind of problems” – Case 6

- **Legal constrains**

Legal issue is a quite wide topic that concerns various aspect of platform’s business activity and different startups’ representatives highlighted the following constrains:

“California law has changed here that they don’t want to have you as an independent contractor, they do want to have you as an employer. So, you pay them full benefits, wages, health care. So, that’s about too because we are marketplace; you are trying to be as cost efficient as possible using independent contractor as Uber” – Case 1

“Whenever we need to go in the new countries, we always need to consult [about blockchain technology and cryptocurrency] what is the legislation that is currently there” – Case 4

5.4.5. Non-institutional barriers

Non-institutional barriers are related to the external actors of the AgriFood supply chain such financial institutions, research organizations etc.

- **Lack of financing**

At the initial stages of platform development it is necessary to have external source of capital from investors or financial institutions. Some respondents highlighted the challenge of insufficient capital and difficulties to access the external funding:

“You don’t have access to normal channels like banks” – Case 2

- **External factors (COVID-19)**

The external factors that not fully controlled by human cannot be neglected. In particular, some respondents mentioned the negative impact of the recent COVID-19 pandemic:

“I mean the past years were strange because of the COVID obviously. So, that was a difficult time”
– Case 3

“If we didn’t have this COVID situation we would grow more” – Case 2

To sum up, the distribution of barriers of platform-based economy in the AgriFood industry by actors responsible for its adoption is presented in the table 17:

| <i>Barriers</i> | <i>Group</i> |
|---|------------------------|
| Affordability | Both-side |
| Difficulties of digital technology adoption | Demand-side |
| Creation of professional team | Supply-side |
| Trialability | Supply-side |
| Legal constrains | Institutional side |
| Lack of government support | Institutional side |
| Lack of digital connectivity | Institutional side |
| External factors (COVID-19) | Not-institutional side |
| Lack of financing | Not-institutional side |

Table 18. Barriers of platform-based economy in the AgriFood industry by actor’s reference. Source: Own elaboration based on the semi-structured interviews

5.4.2. Identification of enablers in platform-based economy of the AgriFood industry

The first-order coding process allowed to highlight 8 enablers that can address the challenges highlighted in the previous section. They are presented in the table 18 below:

| <i>Enablers</i> | <i>Respondents</i> |
|---|--|
| Ecosystem enhancement | Case 1, Case 2, Case 3, Case 4, Case 5, Case 6 |
| Collaboration with celebrities | Case 1, Case 2 |
| Global trends | Case 1, Case 2, Case 4 |
| Support from the government | Case 1, Case 2, Case 4, Case 6 |
| Single source of information and data sharing | Case 2, Case 4, Case 5, Case 6 |
| Offline connectivity | Case 4 |
| Customer diversity | Case 1, Case 2, Case 3, Case 5, Case 6 |
| New technologies | Case 3, Case 4, Case 6 |

Table 19. Enablers identified by semi-structured interviews. Source: Own elaboration based on the semi-structured interviews

- **Ecosystem enhancement**

It is significant to create an effective and collaborating business environment to facilitate the platform-based economy growth in the AgriFood industry. It relates to sharing the best practices, collaborating with various actors within and outside the supply chain for achieving better performances, organizing special events that gather private and public entities for networking and also for getting the funding:

“We cannot thrive if the agricultural community cannot drive”; “For instance, in one country we have a really good partners that does the national association alliance or different value chain. So, all of them are organized and then they are really progressive, they want to try different things. And it is really easy to make things happen with these guys. I mean technology is one thing but there is a lot of things there actually. At the end it is actually how do you improve the value chain”

– Case 4

- **Collaboration with celebrities**

Collaboration with celebrities and influencers generate attention to a platform and, consequently, attract not only customers, but also investors:

“We brought a rapper-singer Jay-Z to invest. And after we got his name, it helped us to get on board other names like Kevin Hart, the actor-comedian, the singer Usher, there is about a dozen”
– Case 1

- **Global trends**

This enabler comprises different aspect such sustainable development orientation, new technologies development and adoption, social media integration etc. Following the global trends enable to appeal customers, employees and investors:

“So, it did a lot and helping make world a better place to have a positive mission and, you know, to make a world a safer place. That’s why it attracted a lot of great people and did a lot of great stuff” – Case 1

“They are not proud of being farmers but once we get in there with the technology, they are the one who first own that technology and they just say: “Yes, this is our generation of farmers. It’s how farming has to be done with the new technologies” – Case 4

- **Support from the government:**

The government can facilitate the growth of the platform-based startups by providing subsidies, tax benefits, incentivizing laws. However, apart from regulation, it is important to maintain the certain level of freedom to permit markets to adopt the changing environment by itself :

“It can be national support on the different value chains that they give subsidies for adopting of new technologies. For instance, they could give some R&D money for value chain to try much to adopt” – Case 4

“Less regulations would help for better balance” – Case 1

- **Single source of information and data sharing**

Having single source of information provides an access to structured data related to legislation, funding opportunities, best practices, collaboration opportunities etc. It will simplify the business activity of platforms in the AgriFood industry:

“Information is power. At the end, you need to have access to a lot of that” – Case 2

- **Offline connectivity**

As stated before, rural areas where food producers operate are not equipped enough for digital connectivity. It is important to develop other ways to provide platform’s services:

“We created a competitive advantage to have offline connectivity platform” – Case 4

- **Customers’ diversity**

In order to sustain in the changing environment it is required to target different customer segments to diversify the revenue channels. For instance, the representative of a startups from cluster “Service Provider” that managing companies’ food wastes matching them with non-profits highlighted that in order to overcome economical difficulties during the COVID-19 pandemic they were forced to search for new clients:

“During COVID or even before COVID it was mostly just tech offices and other cater events and in COVID we had to diversified because nobody was in office obviously. So, we had changed thing up of it” – Case 3

Besides, three interviewees mentioned the necessity to work with big companies because it helps them to cover the costs and be profitable:

“So, but in office orders the orders size was in average thousand dollars just for 50 people. So that made us have a higher profit margin” – Case 1

- **New technologies**

New technologies enable to improve the services provided different actors of the AgriFood supply chain by platforms:

“we developed the matching algorithm and CISCO AI helped us with AI portion which will help us to predict how much surplus there will be at donates side before we get there” – Case 3

“the main use of the platform is basically record keeping. So, we provide the platform where people can reliably say: “Okay, the data I put into AgUnity platform is immutable because it’s a Blockchain, right?” – Case 4

Thus, the table below shows how the identified enablers can cover the challenges of the platform-based economy in the AgriFood industry:

| <i>Barriers</i> | <i>Group</i> | <i>Enablers</i> |
|---|--------------|---|
| Affordability | Both-side | Customers’ diversity; New technologies (cost efficiency) |
| Difficulties of digital technology adoption | Demand-side | Single source of information and data sharing |
| Creation of professional team | Supply-side | Global trends |

| | | |
|------------------------------|------------------------|---|
| Trialability | Supply-side | Support from the government; Ecosystem enhancement |
| Legal constrains | Institutional side | Support from the government |
| Lack of government support | Institutional side | Support from the government |
| Lack of digital connectivity | Institutional side | Offline connectivity; Support from the government |
| External factors (COVID-19) | Not-institutional side | Not controlled |
| Lack of financing | Not-institutional side | Ecosystem enhancement; Support from the government; Collaboration with celebrities |

Table 20. Barriers and enablers of platform-based economy in the AgriFood industry. Source: Own elaboration

6. Discussion

This section aims to summarize the results highlighted in the previous section 5. The theoretical contributions of this research arise from the findings presented in the previous chapter. The research questions formulated in the Section 3 enable to fill the gaps in the literature state of the art through implementing practical methodology described in Section 4.

6.1. RQ1: “What are the characteristics (market share, geographical distribution, supply chain stages distribution, financial analysis) of platform-based sustainable startups market in the AgriFood industry?”

In the current literature related to the AgriFood industry the state of platform-based startups' market is presented by Joiner and Okeleke, (2019) and Shakhovskoy et al, (2021). Their statistical analysis provides general information about penetration level and overall income of platform-based economy in the sector. Moreover, most papers consider only e-commerce companies – marketplaces. Thus, the thesis augments the state of the art with up-to-date insights regarding market share of sustainable platform-based companies in the AgriFood sectors, how they are distributed across the world, which stage of the supply chain exploited this model at a greater extent and, finally, the characteristics of the investment activity towards the platforms.

Platform-based economy takes 10% of the Agri-Food sustainable companies' market. Given the digital nature of the platform-based economy, the vast majority of these enterprises (147 items) represents Service Providers stage. As concerns the countries distribution, the United States originates the highest number of platforms - 43 platform-based companies. However, the situation changes if it is considered the country population: the outstanding results performs Estonia with 0,75 registered Agri-Food sustainable platforms per million of citizens. The investment activity in AgriFood sustainable platforms is higher in 2019 and 2020 compared with companies exploiting traditional business models because platform-based economy gains popularity in business environment. Therefore, it can be concluded that platform-based companies in Agri-Food industry gather more interest among shareholders than the rest of the database. Although, the average funding amount is twice more for not platform-based startups. It means that shareholders are not ready to invest in Agri-Food sustainable companies with platform-based model as much financials as in other enterprises in the industry.

6.2. RQ2: “Which types of platform-based startups exist in the AgriFood sector?”

Some papers try to provide classifications of platforms in agricultural system. The list includes such authors as Shakhovskoy et al., (2021) and Vlachopoulou et al, (2021). However, their taxonomy is based only on a single attribute overlooking the rest of the important factors influencing the platform-mase model. Besides, a part of academic articles apply classification not sector-specific based only on theoretical analysis.

In the current research it was carried out empirical analysis that is resulted in development of 6 clusters distinguishing by 6 attributes that relate to 2 business model aspects. The table below presents the brief description of the created classification approach where defining attributes are bold:

| Cluster | Name | Brief Description |
|---------|----------------------------|---|
| 1 | Food Delivery | Cluster 1 is focused on raising cost efficiency for Food Service actors (restaurants, bars and etc.) opening a new channel of serving customers such as delivery platforms . |
| 2 | Pure Marketplace | Cluster 2 aims at providing a tool for smallholder agricultural entities (farmers, breeders and fishers) to reach its final customer through marketplace model . Also, startups of Cluster 2 enabling to reach maximum efficiency to its users from both sides of platform. |
| 3 | Social Network | Cluster 3 is focused on the customer awareness of the AgriFood industry and the improvement of emotional satisfaction. It supports the community of foodies to share insights, recommendations, reviews of visited place, best diets and etc. It convey social value in P2P customer’s relationship . |
| 4 | Ecosystem Platforms | Cluster 4 is focused on creating the ecosystem among all actors in Agri-Food SC . In order to succeed platforms included in this cluster assure the secure and transparent space for collaborating achieved by new technologies |
| 5 | Service Providers | Cluster 5 integrates platforms that create collaboration between actors of AgriFood supply chain with service providers. Platforms enable farmers to access the market by connecting with finance organizations , to manage food waste and be involved in circular economy by connecting with NPO and etc . These platforms are intended to raise the profitability and productivity of food producers. |
| 6 | Farmers Network | Cluster 6 consists of management platforms (provide market and industry insights how to increase productivity of farming activity) that have additional feature - communication among farmers . They have an opportunity to share the successful practices and useful information with other members of the community in order to facilitate the achievement of cost and production efficiency |

Table 21. Brief Description of Clusters. Source: Own elaboration

6.3. RQ3: “How do platforms create sustainability in the AgriFood sector?”

What is missing in the state of the art is an overview of AgriFood platforms’ contribution into the sustainability from the different perspectives: economical, environmental and social based on the common sustainability framework. The thesis addresses this gap using such analysis basis as the 2030 Agenda of sustainable development by UN (Figure 4.2.3.1).

In general, AgriFood platform-based economy aims to achieve sustainable target 8.9 “by 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products”. More than third of startups fulfill the target 12.8 that highlights the importance of sustainability development awareness and information sharing. Indeed, thanks to digital nature of this kind of business model, the access to knowledge and its spreading become more available for all Agri-Food supply chain actors. Finally, platform-based enterprises bring efficiency to any AgriFood operations in different areas facilitating the connection among different actors by the definition. It fosters achieving the target 2.3 (26% of companies) linked to doubling the agricultural productivity.

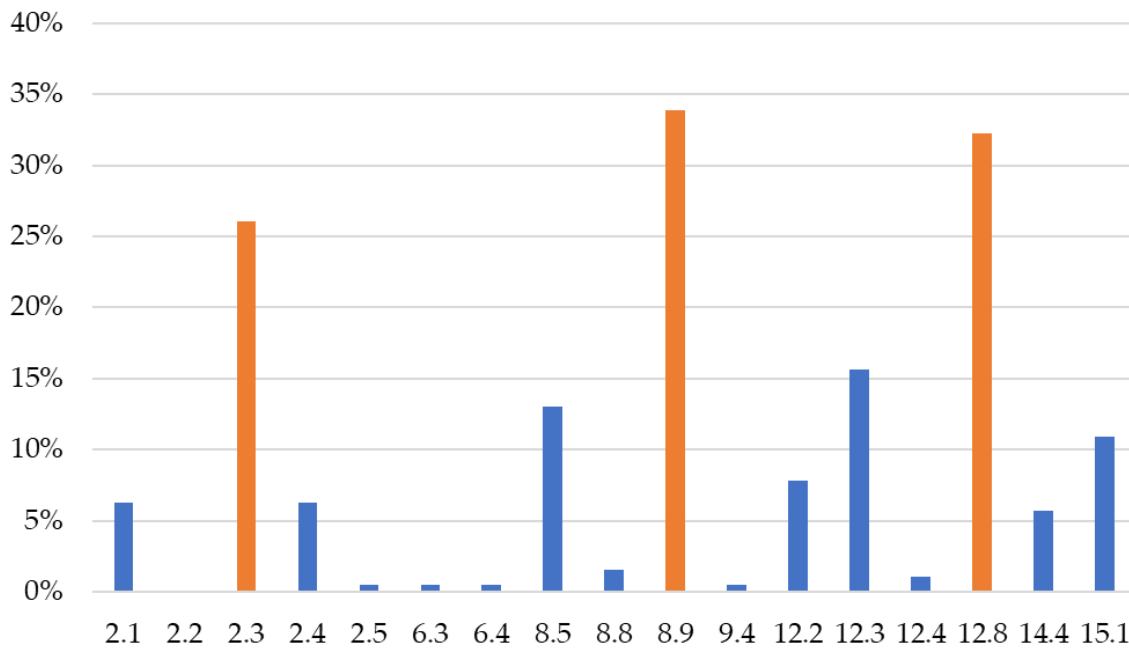


Figure 37. Platforms Distribution by Sustainable Targets. Source: Own elaboration based on the developed database

6.4. RQ4: “What are the enablers and barriers in the implementation of Platform-based startups in the AgriFood sector?”

In sections 2.5.4 and 2.5.5 research papers regarding the barriers and enablers of the platform’s development in the AgriFood industry are present. There are studies of Simatupang and Sridharan, (2002) highlighting healthy environment for collaborative economy, Shakhovskoy et al., (2021) outlining the digital connectivity challenges, Khanna et al., (2018) describing the importance of third party support among them. Nevertheless, the observed literature focused on the digitalization process or collaboration model in a whole rather than particularly to platform-based economy. Despite the digital and collaborative nature of platforms, it limits the deep understanding of what factors are stopping or facilitating their thrive. In addition, mostly the existing research used case-by-case studies lacking the comprehensive view on the topic.

Therefore, the two levels analysis of the semi-structured interviews was carried out that revealed the following challenges and enablers of the AgriFood sustainable platforms’ adoption:

| <i>Barriers</i> | <i>Group</i> | <i>Enablers</i> |
|---|--------------------|---|
| Affordability | Both-side | Customers’ diversity; New technologies (cost efficiency) |
| Difficulties of digital technology adoption | Demand-side | Single source of information and data sharing |
| Creation of professional team | Supply-side | Global trends |
| Trialability | Supply-side | Support from the government; Ecosystem enhancement |
| Legal constrains | Institutional side | Support from the government |
| Lack of government support | Institutional side | Support from the government |
| Lack of digital connectivity | Institutional side | Offline connectivity; Support from the government |

| | | |
|-----------------------------|------------------------|--|
| External factors (COVID-19) | Not-institutional side | Not controlled |
| Lack of financing | Not-institutional side | Ecosystem enhancement; Support from the government; Collaboration with celebrities |

Table 22. Barriers and enablers of platform-based economy in the AgriFood industry. Source: Own elaboration

7. Conclusions

This section provides the key implications of the current research. Section 7.1. presents the general overview of the thesis. The practical contribution of the research is described in 7.2. Section 7.3. enables to understand the limitations and future areas of the research.

7.1. General Overview

It is difficult to deny that AgriFood industry plays a really significant role in the life of mankind. Despite the fact that civilization and technology are developing, the human need for food remains unchanged. Firstly, it is the fact that any living being cannot be healthy and have enough energy without the right amount of food and water. Secondly, the Agri-food system is not just one of the subtypes of business, but an important structural unit for supporting the economies of many countries in the world. Particularly prevailing are the volume and strength of influence on the state budget in developing countries. In the data given by the statistics, one can notice, for instance, that in some developing countries the figures can reach up to a quarter of GDP (25%), but it is also worth considering that world indicators are also significant and amount to 4% of the world gross domestic product (Gautam et al., 2022).

In addition to this, it can be mentioned that this industry provides the prevailing percentage of job vacancies. Thus, the average value of employment at the stage of production reaches 25% in the world, and if will be taken only the data for developing countries, then this number can reach up to 60%. Also in another resource, the statistical results demonstrated the annual number of products which international enterprises are producing. Last year, according to the data, about 11 million tons of products were produced.

But it should be noted that over the years the situation does not look too optimistic. To do this, it is worth delving into the data on world population growth, which confirm this. Every year the world's population increases by approximately 80 million of people. Accordingly, assuming in advance, the modern world needs to rely on the data how much people need for food because it will increase proportionally, and perhaps even more strongly. The population will have a desire for agricultural products due to absolute and relative consumption.

Despite the variety of developing technologies and rapid progress, at the moment it is impossible to fully satisfy the human need (FAO 2017). And most importantly, that the increase of food demand will gradually degrade the environment around. That will lead to more greenhouse gases in the atmosphere (FAO 2017). Over the past couple of years,

many analyzes have been carried out that have a negative impact on this kind of emissions not only on the environment, but also on the human body. That's why it should be taken much more carefully into consideration that the agricultural industry is generated 10.3 % of all CHGs emission in 2019 (European Union, 2021).

The fact that should be also mentioned is that despite the vital economic growth during the last quarter of century, unfortunately, the situation with poverty and hungry is still unresolved. Nowadays, the statistic is showed that there is more than 1 billion of people live in poverty, of which 700 million live in extreme poverty.

Another problem is that modern technologies in the AgriFood sector are difficult to access, while commodity-market industries, on the contrary, are flourishing. This is especially acute in countries with a low level of income, since the interest and profitability of such work is instead reduced and the niche becomes empty. It is most strongly affected in rural areas for develop this agricultural sector or at least to stay in it.

One of the more effective ways out in this situation is a systemic solution. This approach will help change the structure from the inside. In addition to the fact that the market will indeed become more stable, all internal relations (from norms, incentives and results to the attitude of participants) will also change (IDH Farmfit, 2022).

This is also vital to know that one of the ways to reconstruct agricultural and food systems is the platform-based economy usage. It will enable a proper Agrifood supply chain by using direct digital connections among users. In 2016 the European Commission make an explanation about concept of collaborative platform. By this report it's a special model that "create an open marketplace for the temporary usage of goods or services often provided by private individuals" (European Commission, 2016). Lots of different authors all over the world mentioned this positive contribution which was the platform model implementation in the AgriFood sector. Such scientific role models as Shakhovskoy et al., (2021), Simatupang and Sridharan, (2002), Sacchi et al., (2018) Joiner and Okeleke, (2019) positevely pick out this positive economical, environmental and social type of the contributions. After a while, some valuable companies and countries' scientific representatives made a further suggestion for model improvement and adoption.

The main goal of the dissertation is to recognize and deeply understand the principles and state of the platform economy in the AgriFood industry and what possible types of platforms can exist there, what is their contribution to the sustainability development and, finally, how to create a healthy environment for the successful development of startups.

The thesis is focused on covering these topics by, firstly, creating the database of AgriFood sustainable platform-based startups. The statistical analysis of the final dataset allowed to describe the platforms' market in the AgriFood sector by such characteristics

as: supply chain stages distribution, geographical distribution and financial analysis. Then, the clustering analysis was performed using k-medoids method. It enabled to distinguish six clusters of AgriFood sustainable startups depending on value creation and value delivery factors. Moreover, the descriptive analysis of the final database based on the developed sustainable framework allowed to reveal most covered sustainable targets by each cluster and, consequently, to identify its sustainable contribution. Finally, the semi-structured interviews were conducted to define possible barriers and enablers of the AgriFood sustainable platform-based economy implementation.

7.2. Practical Implication

Platform-based economy has high potential to significantly improve not only the state of the AgriFood industry and its actors. The findings of the current research justified the importance of such business model addressing the efficiency and profitability AgriFood supply chain agents, sustainability contribution of the industry and provided valuable insights for managers and policy-makers for its implementation and development.

The major focus of the research is the classification of platform-based sustainable startups in the AgriFood industry. From a practical standpoint, the developed taxonomy helps both incumbents and newcomers better position themselves in the agricultural platforms' market. The provided clustering facilitates the benchmarking analysis within the sector. Furthermore, by underlying the features of AgriFood sustainable platforms, the classification can be exploited by startups managers as a support tool to check the correlation of various characteristics of platforms in the sector.

As regards to the sustainability contribution the AgriFood platforms can bring, the conducted analysis based on UN SDGs' targets can serve as a roadmap for startups to identify the aspects they should put efforts and the positive impact they can generate. It also helps to gain the understanding for farmers, food processors, food distributors, service providers, input and technology suppliers why they should switch to one or other platform type.

Finally, case studies analysis allowed to reveal the challenges and enablers for the development of platform-based economy in the AgriFood industry. The developed framework can be used not only by private companies but also for policy makers for the development and strategic planning the effective ecosystem of platforms.

7.3. Limitations and Future Research

In order to deep dive into the results of the research it is crucial to take into account its limitations and highlight the further field of research.

First of all, the primary object of the current research is exclusively startups. As stated before, for the database construction companies that were founded within last five years (2016-2021) were selected. The incumbents are overlooked in the analysis, therefore, the further advancement of this thesis could be the integration of the established enterprises that operate in the AgriFood sector more than 5 years.

Secondly, since the filtering and coding process of AgriFood sustainable startups were done manually using the information from the open informative sources such as Crunchbase, corporate web-sites, social media, there is a little room for subjectivity which affects the **reliability** of the findings negatively. Apart from subjectivity, manual data collection is resulted in challenges of finding necessary information. As mentioned before, due to lack of information regarding startups' revenue streams the value capturing attribute were excluded from the analysis.

Thirdly, the allocation of sustainability targets to startups was performed through automated procedure in Excel by key words. This approach helps to process a numerous dataset in a short period of time, however, it can affect the accuracy negatively. During the semi-structured interviews, it was revealed that some startups fulfil additional targets not identified during the automated coding.

Furthermore, in order to confirm the results of the clustering analysis and to fill the gap related to barriers and enablers of the platforms' development in the AgriFood sector semi-structured interviews were carried out with representatives of startups. It provided the data not available in the open sources. Although, there was a lack of contacted managers since not all reached out people responded. It resulted in the fact that one of the cluster is not covered in the case studies analysis.

Finally, considering the fact that the rise of platform-based business models happened recently, there is a lack of academic papers related to this phenomenon in the AgriFood sector. Consequently, authors working in this research area have to confirm the findings of the thesis by their studies.

Based on the foregoing, the future research papers can enrich the AgriFood platform-based economy field by analysis of not only new comers but also incumbent companies enlarging the observed period. It facilitates the **content validity** and **generalization** of the current research findings. Moreover, it is important to implement the case studies

approach engaging more interviewing entrepreneurs to have more accurate and comprehensive results. Finally, the further studies may focus on the developing and supplementing the classification proposed in this research considering attributes of value capturing business model domain. Thus, covering all three domains of a business model enables to achieve higher **content validity** of the results.

Appendix

Appendix 1: The interview protocol

Overview information:

1. Could you please tell us about yourself? What is your background? Where and what did you study?
2. What is your role in the company? In which processes are you involved?
3. How many years have you been working in the business connecting to agriculture industry/how many years have you been working in that startup?
4. Could you please tell us a bit about the company itself? Could you describe the concept of your startup?
5. How did you come up with the idea of setting up this platform? Which customer's pain was the core to generate this platform?
6. How many employees are currently involved at the startup work?
7. How long are you in the market? In which countries (cities) do you operate?
8. What's the number of your platform users?
9. Which kind of new technologies (AI, Blockchain etc.) do you implement in your startup?

Section 1. Value proposition:

1. Could you describe your key value proposition? (In other words, which concepts or characteristics of your product show a user that it is the best choice for him?)
2. What type of environmental/social/economical benefits does your startup contribute/Does your startup contribute to sustainability?
3. What's your competitive advantages in the market?

Section 2. Customer types:

1. What types of customers use your platform (restaurants, farmers, input companies and etc.)?
2. What types of users do you target?

Section 3 Challenges:

1. Which challenges did you experience during the creation of the platform? (Ex.: technological competencies and literacy of platform users, state regulation, availability appropriate infrastructure in terms of connectivity, equipment,
2. Any other barriers you are aware of?

Section 5. Enablers:

1. Which external factors do you think can facilitate your platform growth?
2. What is your main improvement area you focused on?
3. Any other enablers you are aware of?

Section 6: Clustering Analysis:

1. Which cluster suits you more?
2. Do you think that other clusters exist that we didn't mention?

Appendix 2: Verbatim Transcripts

1. HUNGRY (<https://tryhungry.com/>)

Data: March 8th 2022 19:30

Interviewer 1: Sofya Vovk Interviewer 2: Siranush Tovmasyan

Interviewee: Shy Pahlevani (Founder & President at HUNGRY)

Interviewer 1: Hello!

Interviewee: Hey! How are you, guys?

Interviewer 1: We are fine, thanks. And you?

Interviewee: Great, great! You, guys, are students in Milan?

Interviewer 1: Yes, we are students. My name is Sofya and this is Siranush. First of all, we would like to thank you so much that you grab some time to just dedicate your experience. For us it's very important because it's a part of work on our thesis and we try to do our best let's say. And just to give you a bit explanation about what we are focused on, we are working on the thesis which is about Platform-based sustainable startups in Agrifood sector: it's classification and possible enablers and barriers during startup creation. So that's why we would like to know more about your startup because we found it so fascinating and interesting during this path. So, first of all, we would like to start from your introduction part if you can. So, if you can, please, could you tell us something about yourself? About your background? What did you study? Something about that.

Interviewee: Yes, sure, I am happy to. I am Shy Pahlevani and I am the founder of HUNGRY. And we love inspiring and helping students here, so I was more than happy to help you guys. We are a tech platform that's build 8 different mobile apps. So, there is 8 apps that stitch together our tech platform and to help to answer on your question, we are sustainable because we have incredible business model. We don't own any restaurants, we don't own any delivery cars, and we just a technology, we are the marketplace. We are the marketplace where chefs can cook and then we can deliver their food for offices. And we started here in Washington D.C., I went to James Madison University in Virginia to study Technology and Entrepreneurship. I had a couple startups before this one. And before this one we had a company which called LiveSafe. It was a crime reporting mobile app to take a picture/video and be anonymous and report a crime. And take flip for that when I got 4 billionaire investors: the founder of AOL invested; the founder of FedEx invested. Four billionaires on my board. So, it was pretty cool. And in last we sold that company. So, I sold that company during COVID. And there was an app that universities can use to report sexual assaults, suicides, mental health issues, thefts. So, it did a lot and helping make world a better place to have a positive mission and, you know, to make a world a safer place. That's why it attracted a lot of great people and did

a lot of great stuff. And then HUNGRY, we tried to bring one in big name into and to make it, you know, to have a lot of energy, incredibility. So, with HINGRY our marketplace are chefs. We brought Jay-Z.

Interviewer 1: Oh!

Interviewee: We brought a rapper-singer Jay-Z to invest. And after we got his name, it helped us to get on board other names like Kevin Hart, the actor-comedian, the singer Usher, there is about a dozen: a rugby player has been invested, an MBA player, we had a box champion and there three or four actors: the actress Issa Rae invested, the actor Terry Crews from America's got talent, he is the host. And then we have a number of food people too: we have the founder of Whole Foods is on our board and the founder of Honest Tea is an investor on board. So yes, that's a little bit a background.

Interviewer 1: Wow, that's very fascinated to be honest! Well, okay, could we know how did you come up with the idea of setting up this startup? Which customer pain was the core to create this platform? What did you find?

Interviewee: As an entrepreneur you first... As an entrepreneur when you first come up with the idea you think about for consumers, you want everybody to have it. But what I've learnt over time is to make money you have to sell what the businesses. That's the better business idea. So, possibly not B2C but B2B, you know business to business. Of course, consumers use easier food at the end, so it's B2B2C. So initially we had an idea that everyone can order food and eat it, so we want to make money that way. Individual delivery, consumer delivery there are no much profit on it. So, but in office orders the orders size was in average thousand dollars just for 50 people. So that made us have a higher profit margin, so that became our target audience – offices. Office adman's, office assistance and people who order food for an office. That's our target audience.

Interviewer 1: Okay, thank you. And also, we've studied that you've already expended in all the States in USA, so let's say USA is all your market. But are you planning to maybe expand your business to different countries around? Do you have any plans about that?

Interviewee: Yes, I think the idea works everywhere. Anywhere, where is corporations and offices that need food, so it makes sense to firstly focus on the USA because we are just 4-5 years old, so we still a baby company. So, focus on the USA is important but the idea works everywhere. So, I think Europe will be a next good market. It should work anywhere.

Interviewer 1: Yes, it for sure makes sense.

Interviewee: And you guys are studying in Italy?

Interviewer 1: Yes, we are studying in Italy, in Milano, in Polytechnical University of Milan, so if you come to this country, for sure we will be so much happy to see someone who we are interviewed. To see how the business is growing in the place we are literally live now.

Interviewee: My wife brings me there every summer.

Interviewer 1: Oh, really? So, you get used to come here and you know the culture and it's needs.

Interviewee: Yes, to make the business and make money.

Interviewer 1: Yes. Maybe you have kind of analytics, so do you know what is actually the number of customers that use your platform during latest time?

Interviewee: Ah, numbers of users... I would say more stats that you could have because we have thousands of customers.

Interviewer 1: Okay.

Interviewee: Stats of the customers in each of our cities. We are in 10 cities. A lot of orders happen online but most of them happens through our sells wraps, through all our food managers or sells wraps. It happens like "Hey, I want this menu". Most of the time they don't like to order online. So, I would say 80% of our orders happen outside of the technology even if we use a lot technology to make everything happen. But actual orders most times happen by the phone or email.

Interviewer 1: Okay, also, while we are talking about platform usage, it's interesting to know which types of new technologies do you use? Maybe like Artificial Intelligence or Blockchain? Did you implement something in your startup?

Interviewee: You know everything is ben coded by our 10 developers that are here is US. You know we have very innovative stuff that we've built. We do have a food algorithm. You know, we take the food preferences of our buyers, so you can say "we like Asian food or we like Indian food". And we are also talking an approaching preference like "we like sea food, we like meat". And then we can also take their dietary restrictions. So, like "I am lactose free or I can't eat nuts". And all our food menus are tagged, with our technology they have tags. This food is Indian cuisine and had these ingredients and different dietary tags. So, based on the food preferences we are able to recommend menus.

Interviewer 1: Okay...

Interviewee: So, if you are going to restaurant, they will not ask you about your food preferences because they will have one menu. We have, you know, hundreds of chefs, so we will understand the food preference of the consumer. And also, we can come with some help, you know, to produce recommendations.

Interviewer 1: Okay.

Interviewee: Yes.

Interviewer 2: And now we would like to know more about your value proposition. So, which concepts or which characteristics of your product show to user that it is the best choice for him? Another words what is your key value proposition?

Interviewee: Sure, for us it has to be reliable is one key value proposition. When you ordering food for an office it's really important to shows up on time. It's really-really important. A lot of people don't get that right. So, reliability is very important. The other one is that food has to be, you know, delicious, you know, quality and the taste of the

food is really important. And then price is important too. Because we don't own any restaurants our chefs and delivery most are contractors, we have a very low-cost moral. And that allowed us to provide low-cost price options for our customers. So, reliability, quality, price.

Interviewer 2: And does your startup contribute to sustainability? In terms of maybe environmental, social or even economical benefits to customer?

Interviewee: Yes, all three is very important to us. On the social we have very divers team. All over team is super-super diversified. So, it's pretty impressive. That's why we have such grade diversity and investors as well. On the environmental we use, you know, compostable materials. We try not to use plastic; we try to use things that are sustainable. And we always looked to keep using things that are, you know, sustainable in their packaging, in their materials. And we also looking to make a big donation based on the carbon footprint that we have. You know, to donate in South America. We're gonna donate yearly to you know, to offset carbon footprint. So, we try to do everything.

Interviewer 1: Oh, okay. Also, because one of our parts of the thesis is concentrated on the barriers and that's why it's really interesting which challenges did you experience during the creation of the platform?

Interviewee: Which challenges...?

Interviewer 2: Which challenges did you experience during the creation of the platform? Which problems did you struggle in this process?

Interviewee: Sure, one great problem that we had was... I had this awesome developer that built our first version of technology and after 8 months he got so burnt out. He quick left. And we couldn't access the code. So, it was 8 months of work wasted. And I had to quickly hire new developers and you know to get new team members to rebuilt everything from the beginning. So, that was very stressful.

Interviewer 1: Okay... So, okay, we try to... I will ask you some specific questions about challenges...

Interviewee: Sure.

Interviewer 1: For example, have you ever faced the lack of technical competences of customers that makes complicated the platform usage?

Interviewee: Yes, I mean a lot of our customers are not tech-savvy. And, so, we have to make technologies much simpler that they will use it. So, we also have to accommodate them through the phone calls or emails because they don't want to order online. So, I would say 80% of our orders are happen on the phone and only 20% of them are self-served.

Interviewer 1: Okay, so, also if, for example, we are talking of legal point of view, do you think there is, let's say, a lack of state regulation of Platform-based economy? Have you ever struggled with the any problems from legal point of view?

Interviewee: I am sorry, I need to ask you one more time, you are lugging.

Interviewer 1: Okay, do you think there is a lack of state regulation of Platform-based economy? Have you ever struggled with the problems from the legal point of view?

Interviewee: Got it, sure, sure. Yes, twice. Once, cooking from your house what was the initial idea. Everyone who can cook from the house and deliver that was had a legal issue. You had to cook at the commercial kitchen. So, now that we do office catering our chefs are cooking a lot bigger and they are in commercial kitchen. So, there were some legal aspects around where you cook food. And then the second legal part that show I would say it's a whole independent contracts issue. Like California law has changed here that they don't want to have independent contracts, they don't want to have you as employer. So, you pay them for benefits, wages, for health care. So, that's about too because we are marketplace; you are trying to be as cost efficient as possible using depending contract as Uber. So, that's one of our legal challenges as well. The whole marketplace, workers, relationships.

Interviewer 1: Okay... Also have you ever struggled...

Interviewee: You have one more minute. You, guys, are in 15 minutes.

Interviewer 1: Yes-yes, okay.

Interviewee: So, just know that I give you a couple more minutes. I give you couple more minutes.

Interviewer 1: Okay, thank you. Do you think that affordability level can be a barrier for the customers also?

Interviewee: Which one is a barrier?

Interviewer 1: Do you think that affordability level can be also a barrier for the customer?

Interviewee: Sure, yes. Affordability definitely. Not all offices can afford to bring lunch for all team members. So, being low-cost is very important. But I will say that companies that do barring food have more money. So, our target audience is very flexible, so it's also technology companies, law firms, consulting companies. These are the businesses that bringing a lot food for the team members. So, yes, affordability matters.

Interviewer 2: Yes, we have two more quick questions, like, which external factors can facilitate your platform growth? For example, do you need support from third parties like government, professional society etc.?

Interviewee: Oh... I guess I answer for government that not to get in that way. Less regulation, less rules, yes. We don't want to government to be in that way. So...

Interviewer 2: Okay...And...

Interviewee: Less regulations would help for better balance, yes.

Interviewer 1: Do you think do you need the necessity of single sort of information for agrifood platforms dedicated to different topics like where to find funding, collaboration, legislation?

Interviewee: Yes, we can always enhance an ecosystem for entrepreneurs. I think in the US is a very good one. Warranty sees as not as biggest one in California but at allow startups to have an opportunity to stand out. But especially internationally, yes. That

should be better things and place for especially platform-based sustainable, you know, businesses. Good questions, guys. Thank you so much for your time. I was happy to know you

Interviewer 1: Thank you. Have a good day!

Interviewer 2: Thank you!

Interviewee: Yes, let's keep in touch. Bye.

Interviewer 1: Good bye.

1. Gofoodie (<https://gofoodie.app/en/>)
Data: March 10th 2022 17:00
Interviewer 1: Sofya Vovk
Interviewer 2: Siranush Tovmasyan
Interviewee: Victor Garcia Montero (CEO & Cofounder at HUNGRY)

Interviewer 1: Good afternoon!

Interviewee: Hi!

Interviewer 1: My name is Sofya and here is Siranush. Firstly, we would like to tell you thank you so much for the time you specially dedicated to us. It's very important part of our thesis work. That's why we try to do it in the best possible way. And just to give you a bit explanation about what we are doing, we are working on the thesis focused on Platform-based sustainable startups in Agrifood sector: it's classification and possible enablers and barriers during startup creation. We found your Gofoodie startup very interesting and that's why we would like to know more about what the concept is and different challenges that you've struggled during it's creation. Firstly, we would like to start from some introduction part if it's possible. Could you tell us a bit introduction about yourself? Some information your background? For example, what did you study?

Interviewee: Yes, sure. But firstly, I think Gofoodie is not so related to this interview because the first one – Gofoodie - is more technology applied to restaurants. So, it's not that kind of Agrifood then. But Guimarana (<https://guimarana.com/>) is more similar to that concept, I think. Because Guimarana is product. It is ecological vegan food. So, when you made the request, I can say that it's more about Guimarana not about Gofoodie, I think. It could be more interesting because it's more related to product.

Interviewer 2: The focus of our thesis is about Platforms, multi-sided Platforms. That's why yes, also restaurants are included in the Agrifood supply chain, so it's suitable.

Interviewee: Okay, perfect. So, let's do that. So, my background? That's interesting. I was a lawyer in other life, I used to say. I studied law in my home town in Murcia. It's south of Spain. Then I did my Erasmus in Italy too. In Geneva, so pretty close to Milano. Then I did my Master Degree in Corporate Law in MNA in Madrid. After 2 years I worked in international law firm as a lawyer. I was specifically interested in companies as a business, not like a lawyer. Then I was doing consulting for different technology

companies. And then I decided to have my own company. What about food? Because I really love food! It was my hobby, you know. When I was travelling because of my work, because of my study I was always looking for the most authentic and the best local experience. I spent a lot of time using TripAdvisor. I used also mobile and other platforms. And in these platforms, you can't look for specific dishes. It's just about restaurants. Yes, and so then we decided to create Gofoodie. Also, because we had this tendency in Instagram with influencers. Speaking about the specific dishes not about the restaurants; at the end for us it was like an evolution for the traditional website like TripAdvisor and Google map. So, using this tendency from Instagram and then yes, we created Gofoodie. So, yes, my background is that I finished in law but then I changed the sector, I changed everything. I think the main aim is join to people that can complement with you. So, for example, my parents they are even people from technology. At the end, it's the main that matter.

Interviewer 1: Okay, that's very interesting to be honest! And in general, how many years you have been working in this sector? How many years you have been working in Agrifood sector by now?

Interviewee: By now? 5 years.

Interviewer 1: That's already a solid route. And how did you come up with this idea of the company? What was the main customer pain that you found to solve?

Interviewee: Yes, from the first it was that something that I personally need because I spent a lot of time trying to look for this content on the websites. I found myself at... The content was there was at the Internet but it was not organized and it was not useful for the user to access to them. So, it was something from myself to be honest. Then I started looking for another user, I started looking for influencer for everyone who can share this pain. And then I found out that there is a lot of people with the same pain and we started work with that.

Interviewer 1: Wow, that's cool! And I see that now you are operating in Spain, right? Do you have plans also to expand your business and go to different countries? For example, in different European places?

Interviewee: Yes, well, we have company actually in 58 countries. In Italy we have lot of contact too. Our base is in Spain but you can use it whenever you are. The only requirement that has the restaurant is to be based in Google maps because we get the data from Google maps about the organization of the restaurant. But, yes, there you can see 5 languages. But if I be honest with you, after COVID we changed a lot of models, so we are not concentrated so much on this app. We are doing mostly service for the third's parties like, for example, we are bringing to them different menus and so on or different delivery solution. But in the back end, so the user doesn't see this tool. It's something we are creating for the restaurants. And now we are in the process to sell the company for an international group. One is that will arrive with kind of TripAdvisor, so it's not in

Europe yes, but it's coming to Europe. So, right now we are not working that much on the app side, you know. It's more in the back.

Interviewer 1: But it means that we catch you in the right moment. We still have the opportunity to talk to you.

Interviewee: Yes, we are happy at the end. But it's true, yes, you know, when you sell the company it's good because to get some reward it's nice. But it's not your main initiative when you start... I really think that if we didn't have this COVID situation we would grow more but ... It's good news, that's good news... I would not say that it's not so.

Interviewer 1: Yes, that's true. And also, one more question, do you have some kind of statistics maybe? How many or what's the number of users that currently use your platform?

Interviewee: Yes, currently right now not that many. But in our best time was like 40 thousand users per month.

Interviewer 1: Wow, that's really good! It's absolutely not a little.

Interviewee: Yes. It was good time.

Interviewer 1: And which kind of new technologies do you use? Like if you use, for example, Artificial Intelligence or Blockchain or maybe something else?

Interviewee: If you were an investor, I would tell you about a lot of technologies but it's not true. You have to know about that startup in that interview because at the end we can say that we have a lot of technologies but at the end in reality it's a lot of manual process. Because we are like trying this solution and then if it's working then we are investing then in technology, no? But it's true that we tried to integrate some technologies like Artificial Intelligence in order to personalize recommendations. So, the platform should recognize your taste as much as you use the platform. So, as much you will say I really like this kind of things and this kind of things; you will receive specific recommendations just for you. But to be honest that was really-really manual. Something was really automatic but at the end needed to have a lot more investments for that.

Interviewer 1: Okay, this is very interesting.

Interviewee: This is a real story that every startup will tell for you. And maybe nobody gonna tell you that but it's the truth.

Interviewer 2: Okay, we will see. We will have some interviews, so maybe it's a really common story. So, now we would like to know more about your value proposition? So, could you please describe your key value proposition? Like which concepts or characteristics of your product show for the user that its product is the best?

Interviewee: Well, I think we have two kind of value proposition. One for the client and one for the user. So, for the user it was the... Key value proposition was based on the safe time, choose correctly. So, it's going to be something that help you to find the best taste for you. You know it's like I don't have to spend a lot of time trying to compare different restaurants, compare everywhere. And then also, this is that we have the recommendation for you in that restaurant. This is good for you. Maybe not for another

one, but for your specific taste and it means just for you. Because at the end it's also a problem that maybe you went to a good restaurant but then they are famous because of some specific dishes and maybe you don't like this specific dishes. But mainly it is a good restaurant but you don't have a good experience there because you are not for those specific dishes. We were trying to help you to be there at the right restaurant where you can have specific dishes that you really want. So, yes, safe time and have a good experience.

Interviewer 2: But does your platform deliver a product that contribute in the achievement like social value? In terms of it creates community of, let's say, foodies – the people who like food? So, they communicate, share their experience?

Interviewee: Yes-yes because in order to suggest you, to recommend you a good experience if it be good just for you; we create this mode that you can find and follow people that have similar taste as you. At the end you are going to find first place from recommendations of people that you trust in that. For example, for you, maybe, it's better just one recommendation from someone that you know. So, influences that you really trust in that than 100% recommendations from anonymous people. So, because of that we created community concept.

Interviewer 2: Yes, okay. And does your startup contribute to achievement of sustainability goals? Like some environmental, social or even economical benefits?

Interviewee: Yes, we tried to think that it was the priority for Guimarana but for Gofoodie I don't know, maybe... We try to improve the gastronomic tourism to solve destination that are more like through app. I don't know this kind of things. That kind of most famous places you know. We tried to contribute with that and also, we tried also to give some possibility to have bigger and healthy options in our sells tool. Yes, but it was something... It was not our main object to be honest.

Interviewer 2: Okay, I think now we can talk about challenges.

Interviewer 1: Well, because one of our parts of the thesis also barriers and enablers, we would like to know which challenges did you struggle during the creation of the platform?

Interviewee: Well, everything that you can imagine and more.

Interviewer 1: It's like to compare startup with normal life.

Interviewee: Yes, well, I think that first of all it's really hard, no? If I have to tell you... Well, first of all I think it's to try to find the best team. The correct people and best team has to be people that are... With all professional skills and also people when you can work with them 24 hours per day, no? So, this is important. And at the end some people start work with people... When they don't like each other and after 2 months everything is going to be really-really bad, no? Because as a startup you have a lot of bad moments. And if you are not in a good environment everything is going to fall down. So, first of all, I think to find the best people. Second is to create a product which is really useful or someone really need it. Because at the end I think that every entrepreneur fell in love with

his item. And then he starts working and maybe recognize that it's a trash because it's something that only he like it. And this is something hard because you have to test with the market. You are going to be so frustrate because you really think that you are making something that people are going to understand what are you doing but maybe they don't not understand at all or even use for another things. So, you have to work really hard for that and learn. And it is easier to say than to do for real because you are spending a lot of time of your life on something, a lot of hopes and everything for this project and then it is not something you need. It's really frustrated, so you need to work as a... I don't know how to say... As a personal develop... You know what I mean? First as a personal develop or like a couch, something like that. You need to be harder; you need to be really flexible. So first of all - team, secondly a product that people really need and also not just what people but also a good timing. That something that is just really-really need. It's something like... It's not just a commodity, it's something like people have to use in 100%. And then the third is finance. Finance, I think, is something that everyone says at first but it's not the first at all. It's the third because if you already have a good team and if you have a really good product which is attractive, so you are going to have your finance. You are going to have finance.

Interviewer 1: Oh, by the way, how many employees do you have in your startup if we already started to talk about that?

Interviewee: Now, because we are working for third companies and also selling the company, we are six but we have been 16. Even 16 to 18 with someone freelance outside. But yes, in a good time we were like that.

Interviewer 1: Okay, but if, for example, we will talk specifically about challenges... Have you ever struggled with lack of technician competences of customers that made complicated the platform usage?

Interviewee: Mm... Yes, a lot of times because at the end this is what I said... When you are created a new function, new everything, you need to test all the time with reapply because if not, you have to install again when is the market. So, for example, when we created the detailed menus, we created this function with website super button. So, integrated it an app. And then we thought that this is had to be prioritized by the most popular and then they didn't like that, they wanted it in category. I don't know, this is smart things that you don't think about that. After you are really working with client and this solution. So, I think it's really normal that you are going to face a lot of challenges and technologies... You have to adapt for real propose of the client, yes.

Interviewer 1: Okay. Also, for example, have you ever struggled with the situation about the level of affordability for customers? That it was not affordable in terms of payment let's say?

Interviewee: Like the client don't pay to us?

Interviewer 1: Yes.

Interviewee: I don't think so to be honest. No, in our sector no, I don't think so. Maybe, no, they spend more time to pay us, something like that but we had good clients to be honest. They are companies, big companies... Yes, we don't have that problem.

Interviewer 1: Okay, so, maybe some legal challenges? Let's say legal state of regulation of the platform-based startups?

Interviewee: Well, we don't have that problem either because we don't create something that controversial. Or, for example, you know that delivery platform has a lot of problem with freelance and this kind of things? But we didn't. The only problem that we have is not a problem it's something that is real. Here in Spain the taxes are really-really expensive. But it's something is not like a problem it's just about play to be an entrepreneur.

Interviewer 1: Okay. From your side?

Interviewer 2: Okay. Did you always have an appropriate infrastructure to sustain your business? Like I think in your case in terms of technology? Technological infrastructure?

Interviewee: Yes. I think it was something that we did well because in our founder team we are 2 people with technical background. So, everything was created by themselves and I was a lawyer, so I also have everything organized in legal terms. So, I think, yes, we were okay in that.

Interviewer 2: Another section about what we want to know it's like opposite of challenges. It's enablers. And what do you think which external factors can facilitate your platform growth? And what is your main improvement area that you focused on now?

Interviewee: Well, I will speak in past but not about now.

Interviewer 2: Okay.

Interviewee: I think something that we work really well... For us was to be realize, for example, an influencer. We integrated a function with restaurant that you can import where you were certain time ago to Gofoodie. And then you have your personal map with all your recommendations. So, for example, any influencers that were working with us had a map with every place they had been and the specific dishes that they recommend. So, that was very useful because when influencer is traveling around it could maybe give you also the reason to travel to some cities in which influencers were even some years ago. So, you can then find a lot of possibilities with information even with some years ago date because there you can see lots of recommendation posts and it's like an influencer's map. You can find everything really easy. So, it was something that was working really well for us and then also we created a lot of relation in the sector with big companies, with media and this kind of things. We had a lot of media impact. So, I think both of them made us a lot to growth in the first years.

Interviewer 2: But did you feel the necessity of having, for example, one single source of information for Agrifood platforms? For example, about legislation or funding, where to find funds or how to create a collaboration with other platforms or even with other actors of supply chain?

Interviewee: Yes-yes, everything that make more access to new contacts always good. There are some paths for that, there I some groups for that. But yes maybe... I don't know, I haven't been thinking about that... Yes, because some of them are just for like news about startups. Another is more... Yes, this is like a mix between legislation and startups need. But yes, of course it will be nice. Information is power. At the end, you need to have an access to a lot of that, so...

Interviewer 2: Okay, and did you feel that you need support from third parties? Like government or professional societies or maybe NPO?

Interviewee: Hm, the support I need is to don't have this kind of tax. That is the most important.

Interviewer 2: So, support from government?

Interviewee: Yes-yes, from government. But yes, of course, support is always good. Especially when you only started because at the end when you are creating something that is new, that is with innovations and that kind of things are really risky. And you don't have access to normal channels like banks. And these kinds of grants, this kind of help are always work well. But to be honest, I really give up with these things. For me it's not about help. Help is more about to don't struggle me with taxes because it's impossible.

Interviewer 2: You know you are the second startup owner that said for government "just don't go into my business".

Interviewee: Yes. Other is also from the Spain?

Interviewer 2: No, from USA actually.

Interviewee: And he said that? Oh my God! If he was in Spain, it would be impossible for him.

Interviewer 2: And last section of questions that we have it's about the clustering analysis that we did. As we said our thesis is focused on the classification. So, we did cluster analysis and we end up with six clusters. I briefly (in 1 or 2 sentences) describe you each of these clusters and I will ask you which cluster do you think your startup suits more. So, the first cluster that we identified it's like a Pure marketplace startups. It's about connecting farmers/retailers with final customers through their platform. And their main goal is to achieve cost-efficiency for the both sides. The second platform is a Social Network. So, it's based on the direct network effect and it supports the community of people that love food, share insights, recommendations etc. So, the third cluster it's Food Delivery platforms. So, it connects restaurants/bars etc. with their customers. Then we have the fourth cluster. It's Farming network. So, it supports the community of farmers to share the best practices, insights, recommendations but withing farmers community to increase their productivity. The fifth cluster it's Service provider, so this cluster connects farmers or other actors of supply chain (like also restaurants or retailers) with some platforms that provide services that are not connected to Agrifood like Crowdfunding companies or NPO to manage food waste etc. The six cluster is Ecosystem platforms.

These platforms bring together all actors of supply chain: farmers again, food services like restaurants or bars, input companies etc.

Interviewee: Okay, if I need to recognize the group. We are the second one.

Interviewer 2: Yes.

Interviewee: The Social network. And we were developed in the third one too. We were also introducing some delivery options. It was really cool because it was about... Now we stopped because this time exactly we are developing for the company that is buying us. But it was about that you be able to select the delivery platform but for these specific dishes not for the restaurant. For example, you are there in Milano and you are looking for the best Focaccia, for example. So, you can compare between... I just was a focaccia lover when I was in Genova, especially in the holidays. So, you are choosing between some focaccia restaurants. So, maybe one of them just working only with UberEat, the other one is working with Glovo, another one with Deliveroo. So, we introduced our social network recommendations as an aggregator for social delivery platforms. So yes, it was something that we've developed but if you have to choose just one it will be the second one. So, it's a Social Network.

Interviewer 2: Okay. I think that's it.

Interviewer 1: Thank you so much for your time! We really appreciate it that you give so honest feedback.

Interviewer 2: It was really interesting! Thank you.

Interviewee: You are going to find a lot of great and interesting people in that sector. All the best.

Interviewer 2: Thank you so much and have a nice day!

Interviewee: Bye!

Interviewer 1: Bye!

1. Replate (<https://www.re-plate.org/>)

Data: March 10th 2022 19:00

Interviewer 1: Sofya Vovk

Interviewer 2: Siranush Tovmasyan

Interviewee: Katie Marchini (COO Replate)

Interviewer 1: Hello! Nice to meet you.

Interviewee: Hi! My name is Katie.

Interviewer 1: My name is Sofya and this is Siranush. We are very glad that you found some time to give as an interview. It's very important part of our thesis work. We would like to provide some explanation about what we are doing in our final work. So, we are

working on the thesis focused on Platform-based sustainable startups in Agrifood sector: it's classification and possible enablers and barriers during startup creation. We were searching through lots of startups and Replate looks very unique and interesting in its sector. That's why we would like to know more about what the concept is inside the company and also ask about some more detailed specific information related to its creation and usual work. From the first, we would like to start from your introduction if it's possible. Could you tell us a bit about yourself? Some information your background? What did you study and what is your career background?

Interviewee: Okay. Actually, the company I worked for we used Replate as a service and so that was how I found out about Replate. At that point when I transitioned into the Replate, the company have been around four: like 2 issuers were under 2 years and I have been in the organization for almost 4 years in May. And at that time, we have really expanded. We started at the San-Franciso area and moved then into the NY, LA, Ostin, Boston, Chicago, so we grabbed some other places in the US. And recently this year we were abroad in Expo in Dubai. And so, Dubai started this year. So, it's been kind of crazy year. Especially... I mean the past years were strange because of the COVID obviously. So, that was a difficult time. But yes, you know before, when I was a kid, I grew up in California and it's a huge agricultural hub. I was surrounded by farms and people who are experienced in working in farms. And also, I have seen lots of amounts of food security. So, that kind of field interested me from the early age. When you as a child surrounded by a food and then you see that people are not experienced in food security and you just wondering why it is like that. So, I did my undergraduate degree in Mills in Psychology. And then I had a Master's Degree in Food studies. So, it's like Food Sustain and Cultural implications of food. So, I really wanted to work in some places where we could have a positive effect on change and food security.

Interviewer 1: That's very interesting and fascinating! Especially in terms of that it's a COVID time and some companies continue to growth and expand their horizons. Okay, then could you please just tell us more about the company? Let's say how did the company come up with the idea to set up the platform? Which customer's pain was the core to generate this kind of business?

Interviewee: Yes, sure. So, Maen Mahfoud, the CEO and founder of the Replate, he came to the US from Siriya and he was going to school in US in Berkeley. And while he was there, he was really surprised how much trash there was and how much wasted food. But also, that like in Berkeley and at the same Berkeley area in particular, there is also a lot of homeless people. So, a lot of people who are hungry and it doesn't make sense for both of these things to exist. So, he knew that at the Berkley area there are a lot of tech offices and most of these tech offices offers meals. It was generally lunch but sometimes it was up to 3 meals. And so, he was wondering what happened with that surplus and will it be just put in the trash. Or it will be blenders or composted? And he started to go these offices and asked them if they would pay just 10 dollars for him to pick it up and

bring it to another non-profit with actual distribution. And they said “yes” and he grew from there through over time to started with tech offices and then... The way like we expended very quickly was working with something called like brokerage caters. So, examples of that are in the US are ZeroCater or Cater2.me. And what they do is that they are not catering companies themselves but they are platforms for places to sign up. So, they are like catering providers. Let’s say you are tech office and you want to have catering 5 days a week for your employees. Well, caters generally just offer one type of food. And you don’t want just one time of food every day of week. So, the catering brokerage offers you all these different restaurants in caters on one platform. So, we got find to work in partnership with a catering brokerage. So, that what we offer to all of these different clients. And that was really helpful to get a strict stand particularly in New York. And I would say that it was obviously that the first year and half was very slowly and we were doing a handful pickups per week and then in 2019 it was like a major broke year for us. So, it was obviously followed by COVID which was a boomer by in 2019. Because we are non-profit, so we had fill in profit money but we also had earned revenue from our service models and in that point, we were getting 20 % or not 20%. It was 40% of our revenues was earned revenue and the rest for still in profit. So, it was really nice balance and obviously that's not the case anymore because we tried to get back there and hopefully one day we will.

Interviewer 1: Okay, it’s a very interesting story! Sorry, just the connection is a bit lugging. Are you hearing us good?

Interviewee: Oh, now yes. I can see you now.

Interviewer 1: Finnaly it’s working. That’s really incredible story that let’s say for several years from the idea of little boy the helpful business start to be. And cold you also tell us a bit data information? Do you have maybe some statistics about the number of users that use your platform in that period?

Interviewee: Yes, I can tell you the situation. Well, to describe the number of users it’s a bit complicated because there are few users that are in our locations. So, for example, you know, Netflix can use us and it’s just a one user but they have 5 locations.

Interviewer 1: Yes, okay.

Interviewee: So, but I would say right now, active users that we have... They are 3 active users but there are more locations under that users.

Interviewer 1: Okay, and could you please tell us which kind of technologies do you use? For example, Artificial technology, Blockchain or different kind of technologies are into your startup system?

Interviewee: Yes, so currently we use... We have a matching algorithm that has some AI and then we work with CISCO AI to develop. So, we developed the matching algorithm and CISCO AI helped us with AI portion which will help us to predict how much surplus there will be at donates side before we get there.

Interviewer 1: Okay-okay, thank you.

Interviewer 2: And now we would like also to know about your value proposition. I mean about platform value proposition. So, could you describe your key value proposition? Which concepts and characteristics of product show customer that it is the best product in the market?

Interviewee: Yes-yes. So, I think that there is a couple of things. One thing from our value proposition, in the comparison to other food recovery organizations, is that it's so easy and simple to sign up. It's happening on a web site vs many food rescue organizations when you actually have to email, have a phone call vs our web where someone can just to sign up. When it's come from actually our service level. We don't use volunteers. We have paid drivers which is very different from the traditional non-profit models of food recovery. So, it's much more reliable when it will be otherwise. And in addition to that we provide donors with all of the statistics about their impact. So, how many pounds are then collected, how many meals that's created, how much CO2 has been diverted from the environment, how much water that saved. So, that is really important for the employee engagement on their side like we are doing the right things. But also, to help them to meet goals.

Interviewer 2: Okay. And does the platform deliver product that contribute in the achievement of sustainability aspect?

Interviewee: Yes, like what? Piece of it? Can you rephrase the question?

Interviewer 2: Okay. Let's say in another way, which sustainable goals startup is covering?

Interviewee: Oh, yes, which sustainable goals. I think mostly it's a carbon emission reduction because by recovering the food and skipping other of land fill and then land fill food release is a bad thing. So, that's why it's like the main sustainability goals. But it's also just like the water saved because that food is being utilized. So, like all of the farmed water that they need to produce in it and you know it's like the general recourses that then went into it are being utilized vs not.

Interviewer 2: Okay. And a bit about customer, which types of customers use your platform?

Interviewee: Yes, so we work with a lot of tech offices as I said. It's caters, hospitals and also universities. So, university cafeterias. We are starting to possibly work with some like the new spaces like Arenas for sports. But yes, it's mostly schools. Like any place that may have a cafeteria or something like serving meals. And then also we work with distributors, people that take food from many locations and then distribute it and also farmers markets and groceries stores.

Interviewer 2: Okay.

Interviewer 1: Oh, that's a very diversified list of places.

Interviewee: Yes, it a big diversity. And we didn't used to be so diverse. It became like that. During COVID or even before COVID it was mostly just tech offices and other cater events and in COVID we had to diversified because nobody was in office obviously. So,

we had changed thing up of it. But yes, we have a lot of diverse donors at this point. It's gonna be crazy.

Interviewer 2: But do you have also some not big enterprises but for example, some local restaurants or...?

Interviewee: Yes. We work with small local restaurants particularly in San Francisco and then in New York. It's more difficult for restaurants because we do... We paid... One the volume of surplus that they have, it's generally really small. So, it's like 50 pounds or maybe a 100 pounds, so to them it's more necessary we worth it to paid for someone to come to pick it up. But there is... So, part of that interested in part of why we have a more diversified group of donors now it's because of there was a new bill to reduce organic waste is a law sb 13.83. And this law requires to generators to donate their surplus rather than throw it away. So, that's like had a huge impact on this sector. It's just willing to impact generally this year. And it will be like fully.... In full force by 2024. So, more people will have to donate food then they are currently doing, so...

Interviewer 1: Yes, makes sense. And also, because one part of our thesis is enablers and barriers, we would like to know which challenges did you experience during creation or working of the platform? What was the most difficult one?

Interviewee: Yes. I think that the biggest challenge that is were in the Bay area is that there is a high competition for labor here. Particularly for engineers. And you know, you competing against of Google and Facebook. And they pay for their engineers 400000 dollars per year and as a non-profit that's very difficult to do. So, honestly that was one of the main challenges that we faced. And then I think that the other challenge is just a cultural shift. You know getting people, many people to think that you can donate food and that it's a legal. What is crazy because we have kind of protections and special laws for protection for donation food because there is a need like somebody is gonna sue you if you donate food and it's bad.

Interviewer 1: Wow, that's very interesting also because I had in my mind the specific question if there is a lack of state regulation for platform-based startups? It's like maybe you have struggled with some points from legal point of view? So, you have already answered on it.

Interviewee: Yes.

Interviewer 1: Okay, but for example, if we are talking about specific questions, have you ever struggled with problem that maybe... That there is a lack of technician competence of users that use your platform?

Interviewee: Yes, sometimes. I would say that both donors and recipients, so the non-profit agencies that are receiving that food use our platform... I would say that we have had harder time to get a non-profit to sign up and use it properly to schedule when they want to receive food and what kind of food they want to receive. With donors... I think that there is a little bit of laziness. And it's like we've kind of creating a problem for ourselves. We have a chat system on our website, so somebody.... If donor come to us and

ask “cancel my pick up for today very quickly”, so we will tell him “yes, of course”. But then they don’t want just to login and use the dashboard to do it by themselves and that create other problems over time. Start just from not log in they just rely on another human to do the work for them.

Interviewer 1: Yes, I guess it’s mostly like that to rely on human side will be easier for different people. Unfortunately, maybe sometimes it will be like platform is very smart and engineers are upgraded it again and again but at the end of the day it will look like someone will find some difficulties in use.

Interviewee: Yes-yes.

Interviewer 1: So, talking of the difficulties they are for sure exists.

Interviewee: Yes, obviously.

Interviewer 1: Okay, from my side I have one more question, if we are talking about data privacy or data security. Is this a barrier for your startup considering the services that you provide or you have never struggle with that?

Interviewee: I am sure we have a little bit. I mean an engineering team is very aware and like tries to do everything they can. But there is also... In California there is like stricter data privacy laws than in the rest of the US. But it doesn’t apply to the non-profits generally. So, we get a round summing up. We still following best practices but there is no like the same reporting that another organization would have to do. That’s not a non-profit.

Interviewer 1: Okay, thank you.

Interviewee: Yes.

Interviewer 2: And let’s speak now about the opposite things like enablers. Which external factors do you think can facilitate the growth of the platform?

Interviewee: Yes, I definitely think that there is then a lot of positive legislation recently. So, you know, the bill that I talked about in California but also throughout the US. There is been other food waste banks. So that really helps encourage people to sign up in donate. And then I just think in general there is... Food waste is one of those things that people I think inapparently hear about. If they even don’t care about their environmental impact peace, they still... Like most people when they through away food feel bad about it. And I think that’s the main. Honestly, when we’ve talked about what is the biggest value proposition – guilt. For customer it’s like the biggest things. Imagine the tech office, right? You feed hundred people lunch, they take their lunch and there are 5 unopened traces. And they just troughing it away in front of employees. It’s like, oh my god, you just through 5 traces of food. And office manager is the one who has to do that. And that is where is down very more food after time and that’s is like... You know, they are walking to the office they see people who are in the street and they are hungry. And you take the trace and just throw it away. So being guilty and live like that. I think it’s the ultimate value proposition. Especially for cafeteria type of places.

Interviewer 2: Actually, it's true because even if it's a small amount but I also feel guilty when I forced to through some food.

Interviewee: Yes!

Interviewer 2: And if we are talking particularly about some factors. Do you think that the support of third parties like government or some professional communities/societies or other non-profit organizations can help you to grow/to develop your startup more?

Interviewee: Yes, definitely. And I think they did. So, there is an organization called ReDEF. And they are a food waste like point essentially. And they've compiled at their website information like a bunch of information about different companies and what they lose are regarding the expiration of some food and whether they offer an extra protection if you donate food. So, that's been really helpful and like providing employees outside of ourselves. That is like an authority on that staff. Where it's like if you don't want to believe us, you can go to look at this other place which are doing the same thing. And also, the Harvard food and law policy clinic. So, they do work specifically, obviously around food, but they also do lots of work around food donation and they're the ones who have created the literature of health safe. Like legally health safe it is how to donate and how to grow the liability. And that's been really important because carbon emission is really respected at the university. And when people get the information from there and it's like under the Harvard law school; they are saying "no, really, this is like legal safe things to do?". I think for most people it's just induced competence and they like "Okay, Harvard say these things, that's why we can do it". But I think that just in general there is also the NRDC here in the US. So, Natural Resources Defense Council and they are non-profit. They just do a lot of different environmental work but they have a bunch of work around food waste. And I think like just the more people will understand how big the problem it is the better. The more incentivized people are used our services because it is like... It's one think like you see your own food waste but it's another thing to understand like, for example, we had Starbucks came to us recently with 1,5 million pounds of Kiwi. For scale size to understand that, that is 44 full tracks. Full, huge tracks. And that just insanity. In that is Starbucks in California. There manufacturing place and it's like... So, if Starbucks has that imagine what every other company has. Like everyone has contributing to this number but.... You know, Starbucks is only seeing the amount they are creating and other places are only seeing, so it doesn't... I don't think it can based the scope of the full problem... I don't think that 100% of food is wasted but it doesn't mean anything last you have examples to really understand. Okay, what does 1,5 million pounds will look like? And once you say 44 tracks... Can you imagine 44 tracks? It just insane. It's a lot. I think it's become a real problem like for them to understand that it is a real problem.

Interviewer 2: Yes.

Interviewer 1: Well, 44 tracks it's really a lot. Even when you described it still not so easy to imagine.

Interviewee: Well, even if you imagine one track that is already so much. And imagine 44! It's just... Yes. Hard to conceptualize.

Interviewer 2: Yes, sometimes it's needed just simple comparison to understand the scale and also the matter of the problem.

Interviewee: Scale. Yes, exactly.

Interviewer 2: Also, one more point about the enablers. Do you think that implementation of the new technologies, AI technologies as you said, is one of the main drivers of the development of the platform?

Interviewee: Yes, I mean... I think it's going to be more as a future driver, it's more... So, currently the biggest focus for us right now with the platform is improving the matching algorithm and work connecting to the nutrition API. So, we will have in our food rescue record like picked up a trade of spaghetti, crapes or peppers or whatever it is. This API will speed up what the nutritional information is for the pickup. Which is really important because currently food rescue it's just like measure than pounds. But obviously if it's a thousand pounds of cheeps that it is a different nutritional quality from a thousand pounds of produce. And so, we are trying to have as a shift how food rescue organization could be accountable and also trying the hold ourselves in accountable and not just donation food but be sure that we are donating the high-quality food. And I think that having access to this API where we can just pool the information is super helpful. And I think that kind of stuff was unnecessary as we are still doing the whole things but there is... This other information available is really allows us to move forward much more quickly. For example, the same things with Google maps which having API. So, you can then instead of the build out the whole map picture you can pooling these things in to the technology in AI building which I think saves many-many years of development.

Interviewer 2: Okay, it sound interesting.

Interviewee: Yes.

Interviewer 2: And like the last section of the interview is about the classification. As we said that one of the points of our thesis is clustering analysis of startup platforms. And we perform this analysis and we ended up in 6 clusters. I would like to quickly present them in one sentence each.

Interviewee: Yes.

Interviewer 2: And just ask you which cluster suits you more. So, the first cluster calls Pure Marketplace. It's aimed to connect farmers to final customers through marketplace. And the second cluster is Social Network. The startups fall into this cluster support community of people that love food. And in this community, they share insides, recommendations, review of visited places, best diets etc. Then we have cluster number three. It's a Food Delivery platform. It's general food delivery startups that connect food services like restaurants, bars with final customers. The fourth cluster is a Farming Network. So, these platforms they aimed to support farmers to create community to share the best practices, maybe some information etc. So, the cluster number five, its name is

Service Providers. These platforms enable farmers and restaurants and other actors of agrifood supply chain to access the market by connecting with finance organizations but also to manage the food waste and be involved in the circular economy by connecting NPO. And we have cluster six – Ecosystem startups. These platforms they bring together all actors of agrifood supply chain to collaborate. It's like transparency secure space for collaboration.

Interviewee: Yes. So, I would say that we fit either kind of 2 – the Delivery piece and one is with Circular Economy piece.

Interviewer 2: Okay. So, it's cluster number 3 and cluster 5.

Interviewee: Yes.

Interviewer 2: So, I think that's it with questions.

Interviewee: Okay. Yes, thank you.

Interviewer 2: We want to thank you also because it was really interesting to talk to you and to know more about your startup.

Interviewer 1: And specially to see how positive could be person even when we talk about society problems and to see how you put all your energy to do you're the best in this job.

Interviewee: Yes, thank you both and good luck!

Interviewer 1: Have a good day.

Interviewee: Thanks. You too. Bye.

Interviewer 2: Bye.

Interviewer 1: Bye.

1. AgUnity (<https://www.agunity.com/>)
Data: March 14th 2022 7:30
Interviewer 1: Sofya Vovk
Interviewer 2: Siranush Tovmasyan
Interviewee: Nurvitria Kristofikova (Program Director of AgUnity)

Interviewee: Hello!

Interviewer 1: Hello!

Interviewer 2: Good morning! For you for sure it's already not morning but for us yes. Do you hear us?

Interviewee: Yes, I can hear you. Good afternoon.

Interviewer 1: Good afternoon. Nice to meet you. My name is Sofya and this is Siranush. We are students of Polytechnic University of Milan. And as far as we mentioned in our letter, now we are working on our thesis which is about Platform based sustainable startups in Agrifood industry: it's classification and possible enablers and barriers during its creation. We are really happy that you have possibility to have meeting with us because we found your startup very interesting for the research that we are currently

doing. First of all, we would like to have an introduction part about you. So, could you please tell us a bit yourself? What is your background? What did you study?

Interviewee: Okay, can you hear me?

Interviewer 1: Yes.

Interviewee: I am just closing my zoom page, wait a second. Okay, I am Nurvitria. My background... I have my Bachelor Degree in Industrial Engineering. After that I went to banking. So, I went to work for one of the international banks, so Standard Chartered Bank for a year. But at that time, I figured that I didn't want to stay in banking industry because I wanted to go into development. As an engineer I couldn't get into the NGO or the UN or this type of things. So, I had to find something else. Basically, at that time it's just happened that it was not opening. So, I went to study... I got a scholarship to go to Europe, to Switzerland to study Financial Engineering. Which is not what I am for but at that time it was exciting and I wanted to see how finance can be made for good. So, that was my idealism. But studying Financial Engineering for a year I realized that they are not caring about poverty or people who have needs. They just make millionaires become billionaires. So, I thought to change totally my study. After first year I went to Geneva to study Development. I was studying in Lausanne and then I moved to Geneva in Switzerland to study Development. So, there I finally got to feel like this is what I am passionate about. And in Development basically I got to be introduced for the first time with Social Science, so Political Science, Anthropology, Sociology, Microeconomics, Macroeconomics. So, all of those things gave me basically perspectives how local contacts really define what kind of solutions can work. And every single community might have almost all the indigenous wisdom they should have. So, that's when I started to do development and I worked with UN. I've worked with UN for many years, I was there for 7 or 8 years as consultant. I worked with ILO – International Labour Organization based in Geneva but also, I worked with Asian Pacific Office and also in Jakarta from Indonesia. And then I moved to Jakarta. I still work with ILO for many years and in ILO there is the Department that is called Enterprise Development. So, basically, I was specializing myself as Micro and Small Enterprise Development Specialist. In that case usually what I am handling are not just the urban companies, not enterprises but mostly rural enterprises. That usually involves corporations, unions and the way how rural people, a lot of them are farmers, how they go improve their life. Through the means of business or financial inclusions. So, I am specializing on that and for many years I call myself as Micro and Small Enterprise Development Specialist and also Financial Inclusion Specialist. And I worked with the UN and after a while I got the be really thought up with the UN system. And then I went to consultant some smaller international organizations like GIZ and also, I was working with my countries' ministries. And that's just about that a friend of mine got to know that AgUnity is opening at that time. And we had at that moment 5 or 6 people in the company. And they wanted somebody who will take care of the programs. So, basically, they had their packed

technology team guys and then they need somebody who can go to the grounds, so actually to be deployed to the grounds, so as actually get to be adopted as simply as possible by the local people. I got into that and then it has been almost 4 years. Yes, so it's 3 years and 3 quarters. So, it has been great journey so far. Sorry, so my Master was in International Development Studies and that's it. I had Bachelor and then my Master.

Interviewer 1: Wow, that really fascinating path that you did! It's encouraging people.

Interviewee: Yes, it's fun.

Interviewer 1: Even more than that. Also, could you please tell us a bit company itself? Could you describe the concept of the startup where are you working now?

Interviewee: Sorry, before I answer. Did you interview some other people or you just interviewed me?

Interviewer 1: Well, actually...

Interviewee: I want to know what have you known or what have you heard from other people.

Interviewer 1: Yes, for sure.

Interviewee: From others in that community.

Interviewer 1: Yes, we actually have already a few interviews with people from different countries. Someone was from USA, someone from Spain, someone once again from USA. So, yes, we have already had this kind of experience.

Interviewee: Okay, but from AgUnity you have never had any interview with anybody else, right? Only with me?

Interviewer 1: No, we hadn't. Only with you, yes.

Interviewee: Okay. So, basically, we are tech company, so we found ourself in tech. Or Ag – Tech company. So, it's a financial technology or agricultural technology. Basically, what we are offering is a supply chain platform that is back to find Blockchain. So, every single day that is direct up to the cloud we enable the securitization for the Blockchain. I am not the most technical person. I am going to give you as much as I can understand and hopefully you can understand too. Sorry, what is your background?

Interviewer 1: My background, my Bachelor Degree was in Civil Engineering and hers Economics. But now we are studying in Management Engineering.

Interviewer 2: But our track, our direction is Digital Business, so we have some experience in Blockchain, AI.

Interviewee: So, you know that link, so I don't have to deeply describe you.

Interviewer 2: Yes.

Interviewee: Yes, it's easier to explain. So, basically, what we offer is a platform where everybody in the value chain actors or actually value chain, can participate and then communicate within themselves. And the main use of the platform is basically record keeping. So, we provide the platform where people can reliably say: "Okay, the data I put into AgUnity platform is immutable because it's a Blockchain, right?". And the base

of what we are offering is record keeping of the transactions of the farmers. So, withing farmers to the middleman, from middleman to the transporter, from transporter maybe to satisfiers coming. They have to put in some data into the batches. Maybe there is the buyer or the union or different processive things when it processed. So, you if can imagine different value chain and we are talking with really grown agricultural commodities. It can be coffee, mays, coco, vegetables and each of them has different value chain processes. Some needs to be dried, some needs to be fermented, some needs to be packed, some needs to be merged or like merged to smaller package or to merged into the bugger package or dispatched into the different packages. So, all of these processes are enabled through our system. So that people like any kind of corporative or union can easily, reliably contact conduct it to their business and operation with our app. And, for instance, the ones that usually didn't... They didn't ever to have even great app because it's too complicated, you need so much management, or managers and capability to do that. And most of the last mile and before the last mile because they are the last one who have an access, who has access to all this. So, most of the people from last mile they don't have digital access and they usually don't have a signal and lot of them don't have just normal literacy. So, it's really hard for them to start using not complicated stuff that they usually have at the moment. So, with this we enable this sort of community to start thinking about: "Okay, can you make more grades that you can have like a better level of premium price list for your produces? Can you start to manage your processes better? (Because usually they just don't want to start processing because it's too complicated as well)". Now, I am going to formatting for 7 days because anyway it's already hard for us just to make things happen. And then they have the storage of 40% but they don't care because it's really hard from them to manage it otherwise. That requires more quality insurance, that requires more record keeping, at day-to-day record keeping. So, with the platform you are hoping that this union and corporative they think about "Okay, because we can confidently manage our records every day and then rely on keeping of those records, we can start to think about more sophisticated products. We can diversify products; we can have more premium coco beans instead of shitty one that we usually buy from our suppliers". So, the that's one. And then another thing is that when you have your platform where every single person in the value chain can actually rely on the data that has already been uploaded it created trust. And this is the biggest currency in the AgUnity. So, with the platform you are expecting people to start trusting the data and when they start to trust the data – they trust the people. And when they trust the people more farmers are able to cooperate within themselves which means usually... It usually like I just do my formatting alone and then everybody do from their own because they do not trust other ones. And then at the end half of these people they don't actually know any farm and then 50% of the whole bugs is just because people are really not having any trust to each other. Why are they not start to trust to each other that they can reliably now say that "Okay it's fine. I am going to start to rely on you and I trust you as my processor".

And then they can have more and more... Like better quality insurance for the whole big batch. And then with that bigger batch they can actually access bigger market. So, bigger market is better capability for them to invest on facilities for the productive instead of individual once because it's gets cheaper if you buy for collective. So, yes, all in all it should improve the productivity. It should also improve the operation efficiency of the people because they start to communicate and they know exactly what is the price. A lot of people who use our technology they are test that: "Oh, usually I spent a whole day finding a new buyer and looking around in the local market. But then now I can finish my whole work at 10 in the morning and I can do a lot of other things". And then it translates to additional income. And they are able to relies that time that was just wasted before. So, does that answer your questions?

Interviewer 1: Even more than this.

Interviewee: A lot of things. But basically, trust that actually we wanted to make a platform that people can actually trust the data and then they can trust the people. When people start to trust other people within the farmers, within the farmers and the cooperatives, within the cooperatives and unions...It will make... Well, the point in the agricultural is to don't make supply chain more isolated and then all in all it should translate to the better way how it will come to the farmers. As you can imagine the mechanisms could be many for that.

Interviewer 2: Okay, we understood your key value proposition. It's if I can summarize, it's more about security and transparency in the system and also efficiency for all the actors, especially for farmers.

Interviewee: Yes, another than that usually when you find technology companies, they are usually deploying in urban areas. So, it means that it is places with ready access. So, every day you get some signals. In AgUnity we drive on making the platform that actually even without any connectivity for whole month it's fine. You cannot transact every day. We adopted technology that allows you to do peer to peer in data thinking. So, yes, basically, it allows you to do that and maybe as a farmer... In many places where we are deploying actually, they don't have the signal because of the weather or national disruption can be. A lot of different things happen on the ground. And they can do still their transactions every day maybe for a month. And after month we will ping them because we have people on the ground and actually, we are working with them. Because, yes, we haven't seen the data happen in our service for month or much bigger and it must be that something is happened on the ground. We dispatch our actions (correct actions) to check on the people. And currently if they have some problems, they can also have to find some points for. So, that's usually... That is our value proposition which is quite a competitive advantage compare to another tech companies. That is why we call ourselves, I mean our mechanism, is to connect the last mile because we are really... I mean most of the small farmers live in the last mile. Last mile in terms of the last one who have access to all of these nice things that we get used to have every day.

Interviewer 2: But if we are talking about sustainability, does your startup contribute to it?

Interviewee: So, when we are asking like what is your vision, what is the company's vision? I think our last CEO answer will be that we don't have any vision because we are doing the SDG's vision anyway. So, we are doing several of the SDG's points. The first one being the end of poverty. But there are also food security themes and then can also be later on the climate change like influences to that, right? So, yes. In terms of sustainability, it is really perspective question to answer. But basically yes. The driver of our company is that no poverty should be. It is our main driver. We see that the most poverty happens in the last mile. And a lot of times it's not because they cannot, it just because they are haven't needs to really manage themselves better. And they can actually take themselves out of poverty basically they have the tools to do some... Yes, I don't remember what are the different SDG's that we cover...

Interviewer 2: Maybe I can tell you what we identified? And then you can agree or not.

Interviewee: Okay, yes. That will help.

Interviewer 2: Okay, we used like targets that were identified for each sustainable goal. The first one we identified that the target by 2030 double the agricultural productivity and incomes of small-scale food producers. In particular family farmers, women etc. Could you agree with that?

Interviewee: Yes, well, definitely. That's the increase of productivity and I have already explained you about that one. So, yes. That's an obvious one.

Interviewer 2: Then, by 2030 insure that people everywhere have the relevant information and aware of sustainable development in harmony with nature.

Interviewee: The harmony with nature... Well, I don't know but the point is that usually the farmers don't have any the access to their own data because they don't have smartphones typically. iPhone is an exception. And 95% of the whole people that we are actually work... We dispatch our phones. And they never had any... The only 5 % they have their own smartphone before and usually it's Android from years ago. Without them having a smartphone they cannot actually record data and then they cannot have the access to their own data. So, what we are doing is that it should be data empowerment. So, when the farmers and the cooperatives... They can handle their own data; they can use it for different means. And they can for instance... The farmers can show to the banks: "Look I have been producing 300 kilograms every single month nonstop for the last 1 year. Can you give me a loan?". This type of things that they had never done it before because before, probably, they were not deep down someone in papers and then it gets lost and then they cannot reconsult it and then they cannot see if the batch is right or wrong. But when you have immutable data recorded in their smartphones. They can actually use it to access for insurance, they can access loans, they can access saving. They can access different services because they have credibility. So, I think that that's the mechanism for that point.

Interviewer 1: If I can ask, which challenges have you been struggle during the work of that platform?

Interviewee: That I struggle? Or the users?

Interviewer 2: Maybe it's better to say the startup faced. Which challenges the startup faced? For example, as you mentioned that there is a lack of technology.

Interviewer 1: Technical competence of customers, for example. That they don't have normal access to the Internet and that's why it's a quite difficult for them to be involved in that process. So, maybe you have something in your mind that you also mentioned as possible challenges?

Interviewee: Yes, there is a lot of challenges and we deal with that every day. Especially when we are trying to deploy to the last mile where usually people don't have a signal. They also don't have what is just the use of the smartphone. They never think that it is actually an important piece of stuff anyway. So, it also convincing them that it is the way to do so many different things by having a smartphone it will be another level. They probably used to have like a Candy Phone that they can call but why do they have to have a smartphone, right?

Interviewer 1: Yes, it's understandable.

Interviewee: So, convincing is one thing. Also, well, yes, there is the digital literacy problem. But we don't say that it is really a problem a lot of time because it is really new for them. They actually really eager to learn and it's never been a problem. So, for instant, with old ladies or old people or who are close or above 35 years old. These ladies they are like: "Oh, no, it's fine. I have my nieces or my cousins that can help ma to understand this". So, at the end it's all about how willing they are to learn and then there are people at the family who can help them to learn and usually they are really excited. So, this is not really a challenge... I mean it was a challenge but it's becoming an opportunity. As all challenges are actually are, right? So, how we are seeing that users actually use.... In agricultural society they don't have pride of their elder agricultural generations. They are not proud of being farmers but once we get in there with the technology, they are the one who first own that technology and they just say: "Yes, this is our generation of farmers. It's how farming has to be done with the new technologies". So, then what was the challenge... Before it was, for instant, include use and apparently, it's becoming a hype for them. And they are like: "Okay, I am going who be the one who will train the other ones. I am going to be the one who train women". So, we are using that... We are using this aspiration and we are using this spirit from the youth to have external influence on the ground. Another challenge is signal and it is a challenge. And it is something that is also our competitive advantage. As it always happens, challenge is also an opportunity. So, we created a competitive advantage to have offline connectivity platform. But at the same time, me, I am like the headquarter, I don't see it in my computer. So, people might be doing like every day their transactions but then in my statistic there is nothing happening. And it's been like 2 weeks and then 1 month and then what is happening?

And then apparent they still do their job every day just haven't been online. So, that is a challenge. Opportunity is also a challenge. Apart of that what else? There is a lot of challenges... Well, there is a Blockchain. There are not so many people who know how to build Blockchain and that's why we are trying to make people to understand how to build it. And that's a bit tricky. Like some people, for instance in Kenya, they asked us: "Can the Blockchain block our data? Or initial data". That's why are always wondering if people know what is really Blockchain means. So, this type of being... Well, because also I am the one who didn't come from tech world and I got to be the local point for the people who are also not from the tech world. I have got to talk to always with someone from the end users, I have got to talk from the UN. And then these other people who doesn't know what constitute development software means, right? Or also what does the Blockchain means? What does token or what does crypto means? So, yes, the challenges are there. And you might probably ask like how do you explain it to the farmers? It is also a challenge but it's not so much a challenge. We have some ways to explain this. So, that they can understand what does it means to secure their data. We have a way. It's actually harder to explain it to people who are thinking that they know but they don't.

Interviewer 2: Yes. It's always easier to learn something from the scratch then to try to relearn.

Interviewee: Yes.

Interviewer 2: Maybe you struggle with some issues in regulations in the area of Blockchain or also in the agricultural area? Like legal state regulations.

Interviewee: Yes, we have to always... Whenever we need to go in the new countries, we always need to consult what is the legislation that is currently there. And usually, we are really safe with that one. Like for example in Indonesia people are not supposed to has to be involved in law of KYC from the people that can actually have a crypto. So, we don't deploy all that part of our system. Like that part that can be actually found people with crypto. To design crypto. But basically, we have to also always consult the legal requirements and usually the data privacy regulations are different from one country to another one. So that we have to consult. But yes, taking all the things analyzed we usually do all the steps.

Interviewer 2: Two more questions and that's it. But which external factors do you think can facilitate the development of the startup? Like, for example, do you need the support from the third parties like government or non-profit organizations or professional societies?

Interviewee: External? Of course, regulations that would help a lot. I mean GDPR is a good thing, it should protect. But there is also a part of things... Yes, I mean the regulation about data. But about data privacy, about Blockchain, about crypto ownership that would be good... Apart of that... Well, external factors are always depending.... I mean because basically we are an ag-tech company. So, we cannot drive if the agricultural community cannot drive. So, then usually than this are enablers for our community, for agricultural

value chain. Yes, these are the enablers. For instance, in one country we have a really good partners that does the national association alliance or different value chain. So, all of them are organized and then they are really progressive, they want to try different things. And it is really easy to make things happen with these guys. I mean technology is one thing but there is a lot of things there actually. At the end it is actually how do you improve the value chain, right?

Interviewer 2: Yes.

Interviewee: So, if the value chain actors they are not doing anything, so it's really hard. It's just really, it like a lot of holes and a lot of... It stumbled a lot in our journey. But if the value chain members are really cooperative it can be in a different way. It can be national support on the different value chains that they give subsidies for adopting of new technologies. For instance, they could give some R&D money for value chain to try much to adopt. That would really help. The implementation of the really new technology. Because what we have is like a really avangard in terms of... People don't know why do we have a Blockchain. I mean it's not so hard to explain if they are open in their minds. But it's going much easier if they have already had subsidies from the government. That they can just use the money to do the cool stuff, you know. And then we can come. So, any kind of these enablers in agricultural value chain is a plus definitely. What else? Enablers could be... So, ones we are doing this platform that should connect the value chain actors but also to connect value chain actors with different services. And different services could be insurances, it can be banks, it can be... I don't know, weather forecasters. So, basically it can be different services which are relevant for the farmers. It would be good if all of these different, we don't call it enablers but supporters, will have like the same mindset. And it be that everything can be shared like sharing API, for instance, between... To integrate the software. If people are not open to it then it's really... It's just hard to make a connective platform.

Interviewer 2: Yes.

Interviewee: But yes. And maybe like to induce these events or networking that is focused on the welfare of this format of the farmers it would be something that is useful. Some people who have interest in improving the life out of these communities can go only to one place and then try to collaborate or incubate a new concept to others. It would be always good to have. Yes, I think as a startup that also has like part of the new technologies it always good to have incubation money or R&D money from whatever sources. So, that's probably the external push that we need.

Interviewer 2: Okay. And like the final question, as we said at the beginning, one of the topics of our thesis is classification. So, we did cluster analysis and we ended up with 6 clusters. And I am going to...?

Interviewee: Do you want to share screen?

Interviewer 2: Yes, I can share the screen. Just one second

Interviewee: Okay.

Interviewer 2: Sorry, we struggled with some problems with the computer. Maybe I can briefly describe to you each cluster and you will tell me which cluster suits you more?

Interviewee: Oh, actually I can see at the interview questions that you shared to me.

Interviewer 2: If you can answer without my explanation, it will be even faster and if you have any questions related to it just ask.

Interviewee: Wait a bit. I am just going to read everything.

Interviewee: I would say that our base is number 4. Hello?

Interviewer 2: Yes, we are here.

Interviewee: Number 4 but also, we are also just starting to open... It has been since the beginning as our aim, we just start to have to be open for number 6.

Interviewer 2: Okay.

Interviewee: Yes, tricky. Five and six are like... What's the difference between the Service Providers? It seems not so much difference between 5 and 6.

Interviewer 2: Service Providers they are mostly connect farmers with Service Providers like crowdfunding companies or the companies that can manage their waste or other services that are not connected to agricultural industry. Ecosystem Platform is more about all the actors of the supply chain in one platform like farmers, like input companies that provide some inputs like seeds, fertilizers and also on the platform you can communicate also with final customers or some retailers etc. And actually, Farmer Network is mostly about communication among farmers only where they can share some insides, practices, information. Maybe Ecosystem is more gathering other supply chain members.

Interviewee: So, it's only between the farmers but it's doesn't go across supply chain actors? Number 4?

Interviewer 2: Yes.

Interviewee: So, in that case it's probably 5 and 6.

Interviewer 2: Okay.

Interviewee: Yes, 5 and 6. So, the ones that is across the supply chain actors but also service providers surround it, right?

Interviewer 2: Yes. Actually, we identified you startup in cluster 6 because it's across the supply chain.

Interviewee: Yes, but we also are on the way that we always have to... Yes, we try to get these other service providers to final the services process. Yes, but I also think that you can put the startup to the cluster 6 because it's the most relevant one.

Interviewer 2: Okay, so I think that we finished with the questions. Thank you so much for your time and your very interested story. And also thank you for the startup story that you shared to us. It was really nice to hear that really inspiring story.

Interviewee: Thank you. Good luck in your thesis!

Interviewer 1: Thank you a lot and have a good day!

Interviewee: Have a good day too! Bye!

Interviewer 2: Bye!

Interviewer 1: Bye!

1. Grow Computer (<https://www.growcomputer.io/>)
Data: March 15th 2022 18:30
Interviewer 1: Sofya Vovk
Interviewer 2: Siranush Tovmasyan
Interviewee: Daniel L Nelson (Co-Founder & CEO)

Interviewer 1: Hello!

Interviewer 2: Hello!

Interviewee: Hello!

Interviewer 1: Nice to meet you. My name is Sofya and this is Siranush. Thank you so much that you grab some time to explain for us more about your startup! We are students of Polytechnic University of Milan. And as far as we mentioned in our letter, now we are working on our thesis which is about Platform based sustainable startups in Agrifood industry: it's classification and possible enablers and barriers during its creation.

Interviewee: Okay, cool! I am excited to learn more and help out however I can.

Interviewer 2: Oh, thank you so much. From the first of all, could you please give us some kind of introduction about yourself? So, could you please tell us about the place where you have been studying? What is your background? Something about that.

Interviewee: That's a long story. Well, I have it recorded. So, if you want to see the full story, I can send you the link for YouTube. Basically, I was in context of AgTech. I had a garden in my balcony in New York city. And I was trying to go away for 17 days of my honeymoon and keep my garden alive. That's it, that's all I got started. That, plus I've read once in my honeymoon, I've read book called "Abundance" by Peter Diamandis where talks about exponential change and how these changes can happen around the world. That's how I try to keep myself alive and basically what I want was like why can I see everything, control everything from an app of my phone. And what I soon learnt, what I have been learning over the last 6 year since, is that during that, is incredible difficult at any scale, at any level and that fundamentally. Is that fundamentally we've been created one way that is consistent for anybody around the world to get out product and use it in that way. That we can do something really-really cool which is to allow software to be detached from the hardware. And right so, now you and I can both be growing strawberries. And presumably for both are Grow Computer platform. Now we can share recipes, we can share data, we can share whatever information, operation, algorithms, applications, more than these things. Now it's what with Grow Computer we've been tried to do. And so, that you can challenge for that has been our building itself one product to anybody. Right? And I am sure you will like. Yes, I will stop there because I am talking about more about our hardware opportunities. So, the story is that I asked

this question for 6 years. I knew nothing about it, I am an Accountant by trade. And so, I was like enough that in New York at that time... You know, New York city from then until now is one of the Procapital hotspots on the planet for AgTech investing. And so, there was a really diverse, broad, awesome community that I was able to tap into and basically started asking people at the happy hour. Seriously, this is what I did in events and in the meeting of the companies. Do you have a farm? Do you have a ground? Can you show it to me? Why are we talking at the bar? And nobody had direct answer. And you realize over time that it's because of the uniqueness of all of these systems. That building digital platform ... That works for anybody. That is the opportunity that I was trying to get to. I think you know finally this is a cool time for us to be talking this because I think we finally figure it out of hardware model, of getting the physical world to communicate with our software in the way that works.

Interviewer 1: That's incredible to be honest. You already answered to some of my questions that I wanted to ask you next because I wanted to ask about the concept of the startup and which customer pain you tried to cover by that. But you have already gave me an answer. By the way, how many employees are currently involved at the startup work?

Interviewee: So, we are totally good strapped. We've raised 0 dollars and that's for not full time. But all our team right now, there are currently 4.

Interviewer 1: Okay.

Interviewee: And you know, I've been working with these guys for 4 years already. But we have had more. And that's not to say that I will not try to expand it again. But I think that COVID was really hard. As just a company and personally. But so, the last 2 years, not so much have gotten done. So, it was kind back off time of work.

Interviewer 1: Yes, about COVID I can absolutely understand. And do you also, for example... You don't want for now try to expand in terms of your team but would you like for example to operate in different country? Or to expand in any way from this point of view?

Interviewee: Yes, absolutely. I think what keeps me growing is that I get a chance to talk to people all over the world and I've heard from... Today, I've spent 5 thousand dollars of marketing in 3 guys in 18. I haven't spent time since. And I still have conversations from people because there is really still no kind of solution that is available in this way. When I think about that it can be really advantageous but it's also really exciting because when you see where the same innovations are trying to happen. It's awesome but everyone is doing it on their own. And I think that what we've learnt is just from a software perspective, to get it to a place where it works for anybody. That is a lot of different sciences. That if every company needs to build the same 90% of the stock they will get into. That's really inefficient. Something can be the similar what your thesis is been. What you've been try to say all along.

Interviewer 1: Okay. And could you by the way specified which kind of the new technologies do you use in your startup? For example, Blockchain or Artificial Intelligence or...?

Interviewee: Well, none of this or at least not yet.

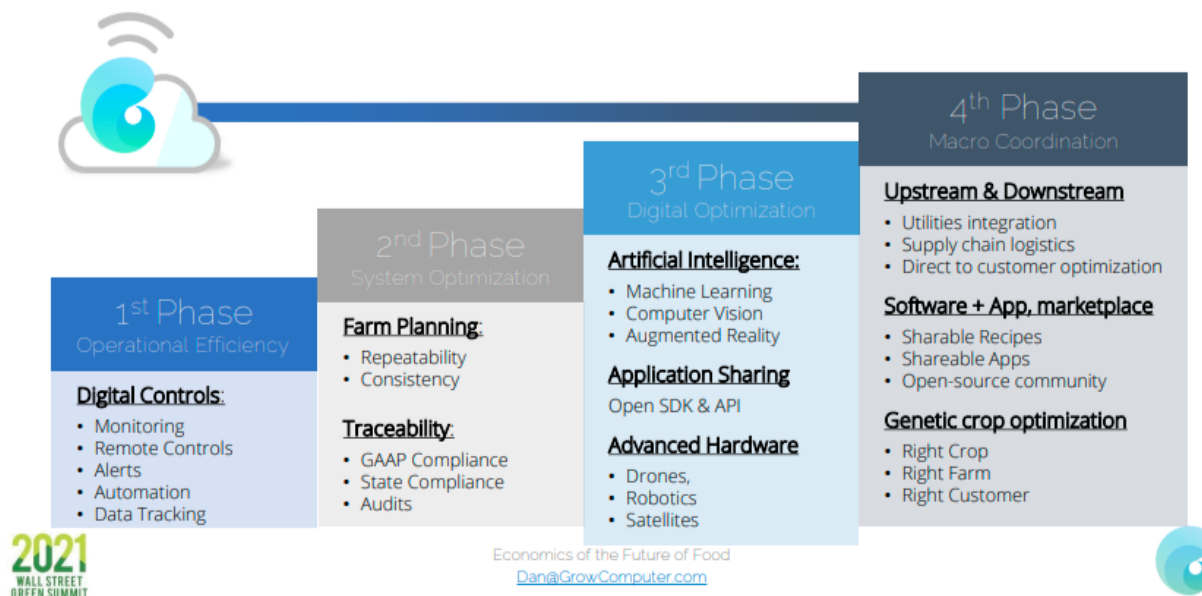
Interviewer 1: Ah, okay.

Interviewee: But there is the reason why. Well, I have some slides. Let me share with you some stuff because I think it will be helpful.

Interviewer 1: Yes, for sure.

Interviewee: Because yes, that's all very valuable type of stuff but at the end of the day, I would say that Blockchain etc. that is hard. Because you need to do so much other stuff first. And so, our new technologies are more about software model or a hardware model I should say for getting something onboard (Daniel is presenting the slide). Well, for me when I think about it: the first step of doing all this really cool stuff, is getting these systems all on the platform, right? It's just providing the digital interface to do, well, we are the first 5 functions are remote modeling, remote controls, alerts, animations and data tracking. Because I can do those 5 things for anybody. Now we get start to get it to the really exiting staff about planning, about credibility and consistency or compliance or now AI and Blockchain and Mashing learning. But in order to do that like complete tome you need a model where those algorithms can get the data that they need and at the format that they need then. And also, be able to apply to the unique farm getting those consideration and so... So, to me the challenge has been in the hardware. And so, our new innovations are not really how do we do things digitally on the software because that's better in IP since the beginning. But then it harder how does we get the people or the customers from nothing into our software platform.

DATA and digitization opens massive growth opportunities



[Interviewee is presenting Figure]

Interviewer 2: Well, that's very interesting to be honest! And even presentation describes it much better.

Interviewer 2: Okay and...

Interviewee: I have so many slides and so many resources. So, even don't count only this one. So, but what like, what your thesis are about? What are you trying to get into in your research?

Interviewer 1: Okay, so let's started from the point that we found all the possible startups which are in some different point connected to Agrifood sector and we tried to analyze it and then put into the clusters according to different features...

Interviewer 2: I can explain even more in details. So, apart from the startups are connected to Agrifood industry, they are also sustainable. Like they accomplished one of the sustainability goals.

Interviewee: Okay, yes.

Interviewer 2: And then also the point of our thesis was to achieve productivity and efficiency of Agrifood sector is also very important to collaborate. And platform-based economy is one of the ways to collaborate. So, when we constructed the database of the platforms of startups in Agrifood business industry, so the next step was to find among them platform-based and sustainable. And when we had the final database of these platforms, we performed the clustering analysis. It was like considering different attributes, for example, key value proposition of the platform or which agents of Agrifood

supply chain are involved, also which new technologies are used. So, and we ended up into 6 clusters.

Interviewee: Okay.

Interviewer 2: And also, the focus of put thesis is also how to create the platform-based environment. So, basically which are the enablers and also the challenges.

Interviewee: Yes. There are many-many challenges as you already seen so far.

Interviewer 1: Yes, we will come to this point a little bit later because it's one of the key points for us.

Interviewer 2: Yes, but so far like some startups said to us about state regulation or lack of competences of the customers like the point is they are not so tech savvy and so on. Yes. I think we can go to the next question.

Interviewee: Cool.

Interviewer 2: As I have said like one of the attributes was key value proposition. That's why we want to ask you what is your key value proposition of your startup?

Interviewee: Let's see... And so, what is our goal is to be the single digital platforms that is incorporate all of these digital controllers, sensors and actual layers. But it doesn't in such a way that we can have a one solution that works for everybody. And I think there are also our key value proposition is how do figure out where the components are or where are the things that we can really choose. Well, I am actually just saw this slide a couple of days ago and that I think is really valuable. So, this, right? So, like the nine key variables points... Like this is pretty standard all these points. But every single farm that exist is unique by design to get there... And so, our challenge is how do we sell something, how do we create something that we could sell to anybody in the world that it also works for everybody, right? Because all of these configurations were slightly different. So, the first step that we did was in 2018, we tried to make this (Daniel is showing the product). And so, we started making this and the idea is that for us the things that we know, we can do a really good job in controlling and providing the value for, are sensors. Right? Like any sort of environmental sensors were starting right now with temperature and humidity. We've done light, we've done water sensor, we've done motion, soil sensors etc. We've been doing also another sensor for it. This fail. And then we tried to go here (Daniel is showing the product). This is like the grow up. So, it was like a little computer that lives locally. This was like an Ag-computer that lives locally that is able to process for all local systems. But what we've done now is that we actually have a very good system which are all the market in 2022 is discussed about is the ecosystem. Where what we've saying is that any of this hardware components in our product - ecosystem work together within the function of our software. And so, the value there is that now if we can sell you a bundle of 4 different components that gonna be grow-hard components. The first one is cameras. Right, so cameras. Second one is air sensors with temperature and humidity. And the third one is these controllers with energy bundling. The Smart Outlet with energy control. Plus a gateway. So, that's gonna be our first bundle for hardware.

From there we gonna expend it to solar panels, protection water pumps, soils sensors, light sensors. We can drones, we can do touchscreens, we can do anything. But the whole thing is like our whole hypothesis is that we can tell anybody what configuration that they need. But farm people that are doing this kind of get this idea, temperature data, humidity and so on. And so, what we are trying to do is to say that if this ecosystem of components, any configuration works and if you want to add it that you can go from there. And the reason why I like this a lot is that it's not just food, it's not just plants and cannabis where you can see it suits. And so for us, for me personally, I have a people from every single one of these areas and I ask if our platform is works for them. So, for you if you are spending on the platform, a platform to grow food in rural farm situation it's not the similar that as the platform needed to grow chicken or to grow mushrooms or to grow fish because basically what you do is that you taking a by hour organic things, animal plant or whatever. And you growing it and you cultivating it in the artificial environment.

Interviewer 1: Wow, that was a good speech.

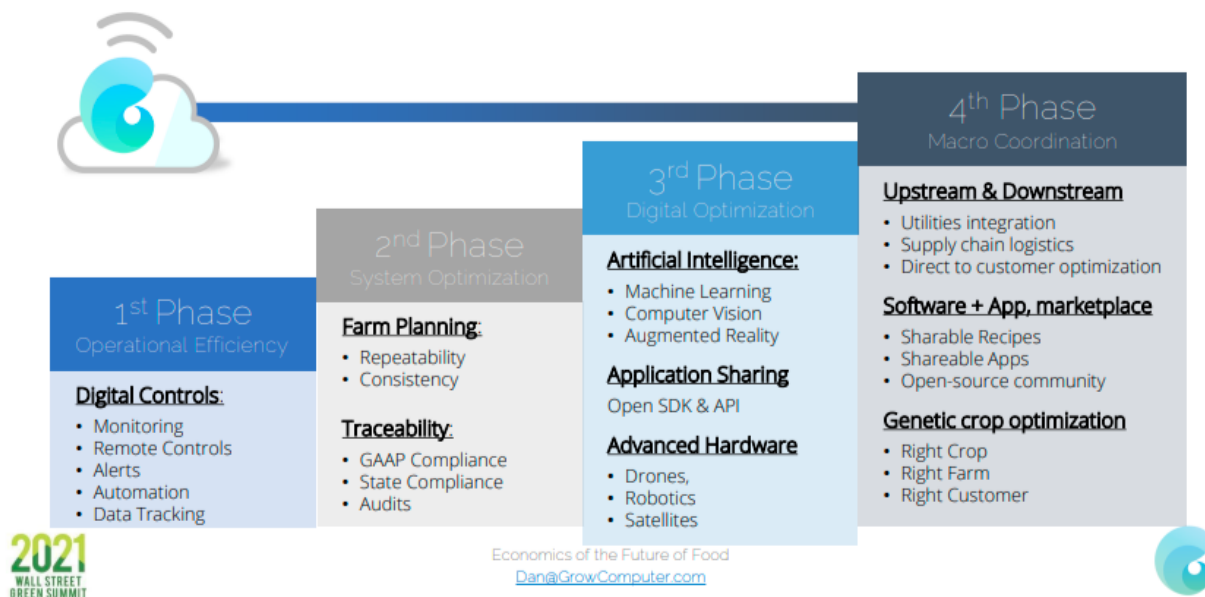
Interviewer 2: Okay, but could you say that your product can help to achieve for farmers cost efficiency or increase the productivity?

Interviewee: I want to say yes but I can't yet.

Interviewer 1: Why?

Interviewee: And the reason why is coming go back to this, right? (Daniel is presenting the slide). Is that right now with my limited team and my limited time for it what I can do is get you to this first phase.

DATA and digitization opens massive growth opportunities



[Interviewee is presenting Figure]

Interviewer 2: Okay.

Interviewee: But if you have that first phase and if you have the data and you have KPI... Could you build around these types of controls a better functioning business? And that is actually where I can speak about the other presentation that I have (Daniel is presenting the slide). It's this presentation where you have to meet the number one thing in any buildings reason why these technologies matter at all. It is because, you know, farming is getting expensive. It's not that industrial Ag doesn't work, right? This start works. It works really-really well. It just that when you look at that scale like it's getting more expensive. When that is insurance or constrains or whatever. And so, when you see that all these things are getting more expensive, to me it's like a vertical farming, it's like a technology that helps you build a better business because you can manage your revenue more consistently by using technology to monitor your crops more effectively and mitigate your loss. You do it more effectively because now your technology, when apply to your crops, might be a little more effectively get to the new market or because if you use this tech, maybe you can reduce your headcount of people that need to be in the farm by 20%. Because you can see it remotely and have all that data. So, you only will need as many hands as you allow the work in the farm unless you will have everything in your app then. And that's why all these technologies come into me and the question you just asked is "How do you apply the technology get there?". And that is something like... It's a little bit long-term. Also, one of my thesis's is that it doesn't really matter what crop are you looking at because at the end of the day it's not about the crop. Like at the end of the day for me it doesn't matter what crop it is. Every single crop has a market price where we are growing traditionally right now, right?



[Interviewee is presenting Figure]

Interviewer 2: Yes.

Interviewee: The way that we've been doing it whether it's, you know, in a field, in a farm or all over the world plus class. This is traditionally how we do it. At some level, at some price building... (Daniel is presenting the slide). Vertical might make sense; greens is might make sense if class is being appreciated.



[Interviewee is presenting Figure]

Interviewer 2: Yes, we got it.

Interviewee: (Daniel is presenting the slide) So, vertical farming to me make sense when your goal is to fight for market price in any of these different crops and that is why we are doing Grow Computer. Because we gonna help to digitize any of these crops. As they get to market efficiency where are the costs to do it vertically matching what it is to do it traditionally. Now all of these different crops have a new opportunity to be potentially donate in a new way. That's the thesis.



[Interviewee is presenting Figure]

Interviewer 2: Yes, sounds very impressive. So, I think now we can move to the interesting part of the challenges...

Interviewer 1: So, yes, if we are taking about challenges in general. From the first, from your point of view and to have more specified questions. In general, which challenges did you experience during the creation of the platform?

Interviewee: Where is the app for that? I am seriously. Where is the app for that? You know, I think we take for granted to have digital everything is our lives. Except for this. And so, when you see the world that is completely digital and you trying to get this new challenge to it. Figuring out that has been hard. You know I taught myself as accountant, I taught myself as an electrical engineer, I learnt agronomy, I learnt biology, I learnt agricultural sciences and I travelled around the world just to see it. And I fundamentally realized a lack of digital quality infrastructure. And through our unique journey of being good startup which is really valuable. Like somehow, we've got really lucky because if we were selling one of the... If I was selling one of this, like I thought it will go in 2018, we would be a bankrupt twice. But because we were able to kind of figure it out and bring a solution for hardware and software, I think we found a unique place where we gonna be able to do what we gonna add which is really kick out of all these cool use cases. Because we figure it out how to make it valuable for any customer to get the hardware that they need to be back to do what they need.

Interviewer 1: Okay, thank you. Let's try to specify our questions.

Interviewee: That's why, an adding the data.... So, data organization is a better way to do it but for me it's really... Temperature and humidity are universal data forms, right? How do you get 2 different farms to communicate on the same data infrastructure in that world? And so, it's really data on those type of data challenges on the platform.

Interviewer 1: Okay... So is...

Interviewee: Is that helpful?

Interviewer 1: Yes, for sure. Every information that you told us is really helpful. So, don't worry about it.

Interviewee: Okay.

Interviewer 2: Also, if we are trying to specify... You have talked about digitalization, a lack of app, a lack of general idea... But have you ever faced with the lack of technician competences of customer that makes complicated the platform usage, for example?

Interviewee: Absolutely. And I think not only to people not know what they don't know.

Interviewer 1: Okay.

Interviewee: Other people think that what they do know is the only way to do things. And it's like... You know, especially I do would like a cannabis progress not that that is great but there used case that are like in the top with. Every single person is essentially

doing the same thing. But they all have their own secret formula of their own alchemy to get there. And so, not only you thought you not know the real standards of the professional good way to do things but they are also cheating by their own customer experience. And so, technical competency is a huge-huge issue.

Interviewer 1: Okay. Yes, it makes sense. And also, do you think that there is a lack of state regulation of the platform-based economy? Have you ever struggled with point from the legal state point of view?

Interviewee: No, I don't think that I am the right person to answer that. I don't think that I have the right insides into regulations. But what I will say is that as capitalism does its things there is an agrégation of economic power. These are the things. So, for example, Walmart, easy United States example. If you want to sell in Walmart, you have to play by their rules, you have to learn how to sell into their system. And so, if that is going to be reconsolidated that might be the opportunity to regulate it at the same time. But how does any individual farmer plug their farm into that Walmart system?

Interviewer 1: Okay, thank you. For you?

Interviewer 2: Yes. Talking also about the previous point, do you think that the challenge can be created also because of farmers tend to keep their traditional way of doing things? Like they tend to do what they always do and don't switch into smart technologies interaction.

Interviewee: Yes, but I think for that question the demographic of who those farmers are who have that problem, are not necessarily the same people that are the newer farmers.

Interviewer 2: Okay.

Interviewee: Who are younger, who have different interactions because I know that... At least the last time I saw the statistic of the United States, the average age of the farmers, was like 60! Right? And so, if that is the average age, of course they are not going to be technically professional. Like I have knew all my parents IT work, I would not be expecting from them to learn to use the data models to make decisions on their farm, right? But at the same time, I think that you have this new entrance people that, at least what I've seen, was sometimes technically career people who have all the ideas and they understand how digital tools can help them do the job there, right? Is it grow more better? Is it grow more effectively in micro climate? Is it minimizing waste from nutrient overload pest efficiency? Is it maximizing other types of hardware robotics or automatic technology to give me the better of layout of my competition? Because at the end of the day, you know, to me it's still just the price of the consumer and I can sell you to made of the 4 dollars of a traditional part and then for 6 dollars I am going to give the things that are not even complete. And so, I think it's how you can help the people to build the smarter better results and also to be more technological in their businesses. That will allow then build better form of it.

Interviewer 2: Okay. And now let's speak about more positive thing like what helps your platform to develop? Like which factors are enable them to prosper?

Interviewee: The fact that it connects with people. This is real-real to a lot of people especially in the post COVID world where local sustainability, resiliency, local economy, self-sufficiency or whatever it is... You know, there are a lot of people have a lot of time in their homes. And they are growing things. You know, even last week or couple weeks ago, I got someone from Gabban who reached out to me, I met people from, you know, like 35 individual countries and 5 continents of young really unusual people or second career people that are looking for vertical farming, greenhouses, indoor ag, as a solution to build a business, solve the problem, train people, give focus on the new type of book, education and so... There is so much opportunity in this but to me fundamentally be entire industry has digital challenges. And if we do our job and can deliver a platform that out of the box for cost effective amount can get you to have your entire grow digitize, organize and operate in our digital platform. That is yours with all of the information that then can be a real... And it's super exciting to me.

Interviewer 2: And do you think that...

Interviewee: I am sorry we can continue a conversation later on because now I need to go to another call unfortunately. If you have some more questions, you can forward it to me to the email if you want.

Interviewer 1: Thank you so much! I think if we have extra questions, we will send it to you by email and we will really appreciate if you have the opportunity to give us the answer.

Interviewee: I would like to share some helpful staff with you that you have more information.

Interviewer 2: Thank you so much and have a good day!

Interviewee: It was so wonderful meeting here. Bye!

Interviewer 2: Bye!

1. Ecotrace (<https://ecotrace.info/>)
Data: March 18th 2022 16:30
Interviewer 1: Sofya Vovk
Interviewer 2: Siranush Tovmasyan
Interviewee 1: Maria Paula Castro (COO & Head of Innovations)
Interviewee 2: Soraya Isliker (Liaison & Marketing Specialist)

Interviewer 1: Hello!

Interviewer 2: Hello!

Interviewee 1: Hello!

Interviewee 2: Hello! I am sorry, my little delay.

Interviewer 1: No problem.

Interviewee 2: Nice to meet you.

Interviewer 1: Nice to meet you too. My name is Sofya and this is Siranush. First of all, we would like to thank you so much for your time as you found it to us because this is our final work. That's why we try to do it as better as we can. We are students of Polytechnic University of Milan. And now we are writing our thesis which is about Platform based sustainable startups in Agrifood industry: it's classification and possible enablers and barriers during its creation. First of all, we would like to start with a little bit introduction. Could you tell us about yourself? Maybe something about your background? What did you study?

Interviewee 1: Okay, I am Maria Paula and I have strong expertise in innovation. I have helped lots of startups to be driven in Brazil. I organized the incubations programs for Sebrae-SP. It's Brazilian support service for entrepreneurs. I was graduated in Linguistic in UNICAMP and I also had a postgraduate study in Business Management in IFGV.

Interviewee 2: Great!

Interviewee 1: And currently I am COO, I am the Chef of Operations in Ecotrace.

Interviewee 2: And Head of Innovations.

Interviewee 1: Yes. We have 2 or 3 roles. I am involved in basically all processes. Mostly in management and business development.

Interviewer 1: Wow, that is really interesting.

Interviewee 2: Yes, very interesting. I am Soraya. Let me just say that she is the boss and I am the liaison, okay? I am a Marketing background person and also with the technology background. And I have small English school, it's a small startup. And with Ecotrace... I am here working as a liaison. So, to make sure that we are communicating clearly. I am here to step up English.

Interviewee 1: I have been working in Ecotrace for one year. The founder and our CEO Flavio Redi already had a previous Agrifood startup in which he made an exit. With more than 15 years of expertise in Gestao Agropecuaria. Flavio came up with the idea in the field when he realized the need of the solution to create traceability. And Ecotrace is a blockchain base into the commodity traceability platform. Currently we have 5 people on board. We have 5 boys. We have already been for 6 years in the market working only in Brazil. And we use Tech such as different technologies like Blockchain, AI, IOT.

Interviewer 1: Wow, that is really interesting. You just answered half of our questions because I wanted to ask you how many years are you in the market and which kind of new technologies do you use and also about your role in the company. So, you have already covered everything.

Interviewee 1: Okay.

Interviewer 1: Okay, and if we are talking about something more specifically. I would like to know how did the owner come up with the idea of the startup? In other words, which customer pain was the core to generate this platform?

Interviewee 1: Okay, let's go. We have B2B2C business model.

Interviewer 1: Okay.

Interviewee 1: Let me see... Wait a minute.

Interviewee 2: Okay, girls, I will help to answer to this question. Well, Flavio is an agro-professional. He has been in this business for 20 years. He has a great expertise in Agro. He has already had a different startup for 15 years. And according to his experience in this field more related to beef, right?

Interviewee 1: Yes –yes.

Interviewee 2: His startup was more related to cattle. And he felt the need to have a more tracked process to have more transparently situation, to have better visibility of chain. And then with this older startup where he worked, he proposed to the partners like: “Guys, let’s do something with traceability” and these guys didn’t want. That’s why he made his exit. He left and started his own startup about traceability. And he found the technology guy in the market. So, he came up with the idea by how to serving in the field the need of traceability.

Interviewee 1: Yes. The problems we solved is to start to have more visibility back in 2008. With the report that was made by Greenpeace of Brazil in 2008 which showed that most of the first stations in Amazon is called by the carbon raising in this region. Over the years the companies such as Nespresso faced a lot of problems related to like slave like labor or child labor situation they changed.

Interviewer 2: Ah, okay-okay.

Interviewee 1: Then our solutions about chain platform in chain traceability are very connect our API with all the links of the chain. Farmers, industry, distributors, retailers and final consumers.

Interviewer 2: Okay.

Interviewer 1: Thank you, we got the point. Also, we see that you are working in Brazil but do you have any plans to expand your business to different countries? To go to different countries? For example, to any European country?

Interviewee 1: Yes.

Interviewee 2: Yes, that also a part of our job, right?

Interviewee 1: We want to get actions by adding new commodities into the process of starting nationalization and retailer solutions. We have a contact with companies from Europe like Portugal. And we are searching for clients abroad.

Interviewer 1: Okay.

Interviewee 2: They went to Dubai in Fintech Search ...

Interviewee 1: Oh yes!

Interviewee 2: And also, to Portugal last year.

Interviewee 1: Yes, I really forgot to mention it. We are starting work with Halal processes.

Interviewee 2: Yes, they are started to work with that and to send to Dubai and Portugal.

Interviewee 1: Yes, to also included Muslim country in the list.

Interviewee 2: I think that they gained a lot of visibility with the trips, with their participation in the advance. And this was in November last year. So, I believe they we are in a very good path to become globalized very soon.

Interviewee 1: And Chine, also China.

Interviewee 2: And China we also participated in 2 processes in China last year online but it's kind of acceleration in the process and so on. The things that we are doing for us are great.

Interviewer 2: Yes, it's approximately world matrix.

Interviewer 1: Yes, like you practically covered for one country in every continent in the world. Like Europe, Africa...

Interviewee 1: Yes, mostly yes.

Interviewer 1: And also, if we are talking about some kind of data analytics maybe you know what is the number of the users that a currently use your platform?

Interviewee 1: We have different users. For example, producers that we have they are 700 and also companies... They are 7 or 8 companies but we are in 58, just let's say near 60 plants of cattle and poultry companies.

Interviewer 1: That's a really good numbers by the way!

Interviewer 2: Okay, and now we would like to know more about your key value proposition. In another words, which characteristics of your platforms makes your product the best in the market for the customer?

Interviewee 1: We have Ag Tech solutions combining Blockchain and AI. Not only documental proof. Our competitors normally have only documental proof and we strongly do it... We contribute to 4 SDGs of the UN and we help to prevent slavery labor and other social and environmental problems in the value chains.

Interviewee 2: As I am a helper over here, but I believe that they install also different systems into slots of the greenhouse. Okay?

Interviewee 1: Yes.

Interviewee 2: We have this in our speech. They have devised good tracks...

Interviewee 1: We have a carcass creating system. And point is that the algorithm that point to browse the operational failures and a carcass creating system.

Interviewer 1: Okay.

Interviewee 2: We have this in the poultry rate too, with the chicken.

Interviewee 1: Yes, like a visual identification, I don't know, visualization.

Interviewee 2: Much faster and more automated, no?

Interviewee 1: Yes-yes.

Interviewee 2: They capture the imagine and then analyze it very fast if there are problems, if the composition is correct, the fat grading of the meat...

Interviewee 1: Fat grading, yes.

Interviewee 2: You know, things that in the past are used to be expected by AI and this is not accurate or dynamic.

Interviewee 1: Not standard.

Interviewee 2: Computer makes it better, so I believe that when she says “it’s not a documental” because usually in the past people just received the document list with all the data. And it was like: “Ah, if it’s okay, one, two, three, signed” and that’s it. And now, let’s say we have an entrance in this controller. Now we have everything automatized with cameras and all these IOT are very strong. And the technology; I think this should be highlighted; the technology was developed by themselves.

Interviewee 2: Yes, exactly.

Interviewee 2: It’s not that they hired another person who had all this technologies, they develop the technology. These are the highlights.

Interviewer 2: And as you said before, can you said that your platform like the first point that it’s convey, it’s like security and transparency in the Agrifood supply chain?

Interviewee 2: This is a question?

Interviewer 2: Yes, do you confirm it, let’s say?

Interviewee 2: Yes, right?

Interviewee 1: Yes.

Interviewee 2: They provide the transparency to the entire chain.

Interviewee 1: Transparency and safety. Traceability and sustainable value chain.

Interviewer 2: Okay, so you also mentioned about sustainability, could you please tell us more about it? Which of the SDG’s your startup covers?

Interviewee 2: We analyzed it through Google yesterday, right?

Interviewee 1: Yes-yes.

Interviewee 2: It’s number 17,12... Let me open here...

Interviewee 1: 9...

Interviewee 2: We had to read all guidelines about it yesterday. We know everything about it now.

Interviewer 2: But it’s good.

Interviewee 1: Okay, so, its SDGs number 2, number 8, number 9, number 12 and number 17.

Interviewer 1: Okay.

Interviewee 2: Only the food traceability.

Interviewer 2: Okay, thank you. I think at this point we can switch to another section.

Interviewer 1: Yes, and as we have already mentioned, one part of our thesis is about challenges. And I would like to know which challenges did you experience during the creation of the platform? So, which challenges have the startup been struggling during this creation?

Interviewee 2: Did you get everything?

Interviewee 1: No.

Interviewer 1: Like which problems you had during the platform creation route or even now?

Interviewee 2: Okay, understood.

Interviewee 1: We have a small team. We need more professionals. Especially in IT.

Interviewee 2: We have a lack of talents in IT. I think that there is a worldwide, I don't know. But in Brazil this is very serious because the high-level professionals are bilingual and they receiving salary in dollars and our economy just don't raise, so... They prefer to receive it in dollars to have 5 times more. So, our money is 5 times less than a dollar, so it's veery complicated to live in Brazil. So, we have a real lack. The real problem connected to professionals. I believe that it's just the biggest challenge.

Interviewer 1: Okay, that's interesting.

Interviewee 1: We have more demand than the opportunities we have.

Interviewee 2: Guys, they don't do an advertisement. They can more clients that they can support. Marketing? Forget about it. Yes, they just don't need to advertise. I think because they don't need anything that needs to grow faster but it's because of the technology development.

Interviewer 2: But do you think that a lot of people migrate, in terms of IT specialists, they migrate to another countries?

Interviewee 1: Yes.

Interviewee 2: Not all the time. Now with the pandemic I know many people in technology they just work remotely. Yes, they don't need to move to another country. That's why we have a problem. It's there.

Interviewer 1: Okay, so if we try to talk about specific challenges. Let's start with the point that maybe do you if the platform has ever struggle with the lack of technician competences from the customers? That the customer cannot understand how to work there? That it was not clear for customers how to use the platform?

Interviewee 2: Do you also ask about this kind of difficulties? Not about building?

Interviewer 1: We just ask about different problems.

Interviewee 2: Ah, everything. Okay. We don't have any operational problems with the platform or difficulties. We don't have any operational pains about the way that platform work. What they have is bigger than this, it's a smaller capacity to escalate, to have a new client.

Interviewee 1: We have some features in our world map for improvements but that's all.

Interviewer 2: But from the other side, from the customer side, have you ever received any feedback that is very difficult?

Interviewee 1: Yes, all the time. But to use our solution. But to improve our solution to their needs.

Interviewer 2: Ah, okay. So, for your customers it's easier to use your technology, your platform, right?

Interviewee 2: Yes.

Interviewer 1: They don't have difficulties, not even the producers have difficult with our platform. It's very intuitive, friendly.

Interviewee 2: The changes she is talking about is about because we support many different chains: poultry, beef... We are starting with cotton now. So, the customer has one specification about their own chain and they ask it all the time as she said.

Interviewee 1: They just only take a picture. Take their codes and that's it.

Interviewer 1: Okay, so different question. Do you think that there is a lack of state regulation in platform-based economy? In other words, is there are any... Have you seen the problems from the legal point of view? So, for example, is something from law regulation was not so easy like to perform some activities?

Interviewee 2: Okay, she said that in terms of law requirements etc. It's like the opposite because new laws have been established in terms of Blockchain or visibility, traceability or transparency...

Interviewee 1: And food safety.

Interviewee 2: And food safety, yes. We have clients looking for us regarding the needs. We are needed in terms of law to help the market to be regulated. And market agreements. So, we needed in terms of regulations and market agreements.

Interviewer 2: But does it mean that you have some benefits compering to the companies that used Blockchain for example? Benefits in taxation? I just want to know what does it mean like needed?

Interviewee 1: No, here in Brazil no.

Interviewee 2: We don't have this kind of incentives here in Brazil. We have 0 incentive. As she said that people are looking for us in terms of regulation, she was talking about the market. Okay? We don't have any government incentives at all, discount or something else. Brazil doesn't work like that.

Interviewer 2: So, let's say that government additionally doesn't help you?

Interviewee 2: Yes, we don't know what is government help. We are struggle as entrepreneurs with that kind of problems.

Interviewer 1: Also, do you think that affordability level could be a problem for the customer? In another words, do you think that sometime it can be expensive for the customer to use your platform or you have never struggled with that?

Interviewee 2: Depends on the customer. Who are you talking about? Because we have many clients and customers there.

Interviewee 1: For producers and final consumers is free our solution. They don't pay and for other (industries and retailers), it's kind of expensive. But it's necessary.

Interviewee 2: It's implementation. An implementation is a project.

Interviewee 1: We have set up fees. We are starting from 30 thousand dollars.

Interviewer 2: Okay. And now let's talk about not challenges but enablers. Which external factors do you think can facilitate your platform growth?

Interviewee 1: we have a market agreements and market commitment. Like in China, for example. China only imports soy with traceability certification started in 2023.

Interviewee 2: That's a big advantage. Is that the complete answer for the question that you asked? Because it's not so clear for us.

Interviewer 2: Okay, I will specify in that case. Let's come back to government, do you think that you need a support like from third parties like also government but maybe also from some third parties, nonprofit organizations, professional communities?

Interviewee 2: I don't think that we are third parties or things like that. The case, we have a possibility of good partnership and things like that. For example, we are working now with one of the Brazilian associations. And in the government of course. They could open policy and incentive and taxes discounts and things like that. And it will be perfect for us. And in terms of third parties and startups the government started to do some movements in that side.

Interviewer 2: And do you feel the necessity of having one single source of information? For example, where to found funding? Or regulations of some areas of the agrobusiness? Or also with which company is to find collaboration?

Interviewee 1: We have a lot of sources. We need to look for all this information. We don't have just single source of the information.

Interviewer 2: But do you think it will be better to have one single source or the system that you have now it's effective one?

Interviewee 1: Yes-yes, it's effective one. I worked with this in the past and for me it's okay.

Interviewer 2: I just wanted to ask you about one more challenge, maybe you struggle with it. But do you think maybe, let's say about farmers and producers, that they tend to use traditional approach? Don't use new technologies and they are not open for such platforms like yours?

Interviewee 1: The industry sends to us all the information in context from their supplier, farmers-suppliers, producers- suppliers. And we send to them an email inviting them to start in our platform. This is the process.

Interviewee 2: I think the question is a bit different like do farmers prefer not to use platform and just do everything like they usually do?

Interviewee 1: Our technology improves the visibility about all the process in the industry and we broadcast life of the products, we photograph all the processes. They have a lot of benefits to work with us.

Interviewee 2: So, they are not resistant.

Interviewee 1: Yes-yes.

Interviewee 2: I think that producers understand the need of technology because they have the pain. And when the solution comes, they don't resist.

Interviewer 1: Okay.

Interviewer 2: And like the final part of our interview is that we wanted to ask you about cluster analysis. As we said at the beginning, one of the key points of our thesis is classification of the startups. And we identified 6 clusters of Agrifood sustainable

platforms. And I can briefly explain each cluster and I wanted to ask you which cluster suits you more?

Interviewee 1: We read the clusters in the text that you sent. We are in 4 which in Farmers Network but mostly as a Service Provider, I think. It was number 5.

Interviewer 2: Maybe I can describe you more about clusters? Because, for example, Farming Network, it's more about communication between only farmers.

Interviewee 1: Ah, okay-okay. No, it's not we are.

Interviewer 2: And Service Providers are the platforms that have their core business is contacting like for crowdfunding platforms or nonprofit organizations that are managing for example food waste. So...

Interviewee 2: Soo... No-no.

Interviewee 1: We are an Ecosystem platform. I didn't recognize it at the cluster describing. Yes-yes.

Interviewee 2: The Ecosystem cluster is focused on creating the ecosystem among all actors in Agri-Food SC. In order to succeed platforms included in this cluster assure the secure and transparent space for collaborating achieved by new technologies.

Interviewee 1: Yes, probably.

Interviewer 2: Okay, thank you so much for your time and participation! Interviewee 2:

Interviewer 1: It was nice to meet you and have a good day.

Interviewee 2: It was nice to meet you too. Good luck in your thesis work!

Interviewer 1: Thank you so much! Bye!

Interviewee 2: Bye!

Interviewer 1: Bye!

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