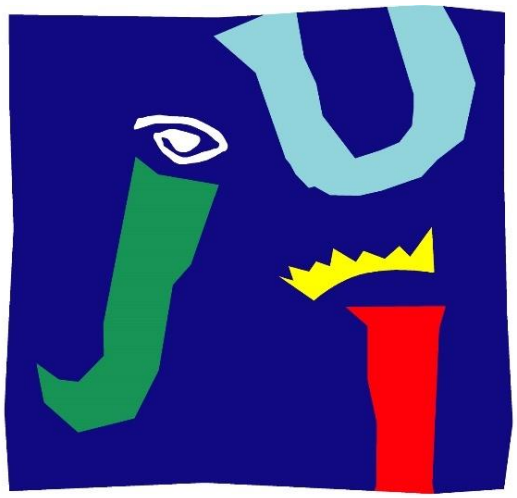

UNIVERSITAT JAUME·I

TRANSITION TO A CIRCULAR ECONOMY: ANALYSIS OF THE SITUATION IN THE SPANISH AGRO-FOOD SECTOR

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1. INTRODUCTION

In the last decades, and as a result of the climate threat to which we are subjected, the need to combine progress and economic development with environment and sustainability has been developed in society. Sustainability which is a concept that is part of nature, is becoming more and more important. Society is increasing the demand of products and services that do not harm the environment and favor the sustainability of natural ecosystems.

This is a social and economic challenge since traditionally, the economy and development of regions and nations has been based on a linear principle of extract, produce and dispose. Against this situation, the Circular Economy is an economic and productive model that guarantees sustainability and resources reduction in the production processes and that respects the environment. As defined by Aquae (2019, p. 1):

> *The circular economy is an economic concept that is interrelated with sustainability, and whose objective is that the value of products, materials and resources be maintained in the economy for as long as possible, and that the generation of waste be reduced to a minimum. The aim is to implement a new economy, circular, i.e. cyclical, instead of the linear economy that had been working at the global level. This new economy is based on the principle of closing the life cycle and utility of products, services, waste, materials, water and energy.*

This new economic paradigm changes the concept of production cycles, as described by Cerdá (2018, p. 2):

> *A circular economy is restorative and regenerative by design, and aims to always keep products, components and materials at their highest levels of use. The concept distinguishes between biological cycles and technical cycles. As envisaged by its creators, a circular economy is a positive continuous development cycle that preserves and increases natural capital, optimizes resource returns and minimizes system risks by managing finite stocks and renewable flows. It works effectively on any scale.*

Under this new circular perspective of the economy and production cycles, most resources are considered unlimited in nature, thus allowing the generation of continuous production cycles.

This new perspective and in the current socio-economic context, has a very important value and in this sense is perceived by most of the present and new consumers.

In this project, we intend to carry out an analysis of the situation in Spain in relation to the implementation of this new economic perspective. More in detail, this research will focus on the agro-alimentary sector since it is one of the most important productive sectors in our country. Through this analysis, we hope to be able to make a diagnosis of how the Spanish agro-food sector is evolving and adapting to a more sustainable and environmentally friendly production model. Thanks to this work, we hope to be able to encourage companies and institutions to work on a valuable transformation of the linear production system towards a more circular and sustainable one.

In conclusion, this work will consist of an analysis of the present situation of the Spanish agro-alimentary sector in relation to the circular economy. To accomplish this goal, first, we will try to identify and describe what are the main strategies and lines of action designed and implemented under a circular perspective. Secondly, we will try to identify and describe what are, in our opinion and according to the research carried out, the most relevant levers that can lead the agro-alimentary sector to the change of economic paradigm. Finally, we will show some firms cases of success leading the reader through those type of businesses in the agro-alimentary sector which are able to become successful when applying the proposals associated with the circular economy and the reduction of environmental impact.

2. THEORETICAL FRAMEWORK

In this chapter, we will analyze in depth, and from a theoretical perspective, the concept of circular economy. To do so, we will first compare the linear and circular perspectives of the economy. Later, we will focus our analysis on the strategies developed from a circular conception, their basic principles, as well as their most relevant benefits.

2.1. Linear perspective of the economy

In our opinion, in order to understand the concept of the Circular Economy, it would be appropriate to set out the fundamental principles of the prevailing linear economic process. Thanks to this preliminary analysis we will be able to frame the need for change towards the Circular Economy.

The linear model is based on the exploitation of natural resources to be later transformed into goods and be consumed. In other words, the linear economic process is based on what we might consider, the throwaway theory. The linear economy is based on two principles: firstly, permanent economic growth, generating industrial growth and the consequent environmental deterioration. Secondly, constant consume, which is made possible thanks to a large amount of companies that develop cheap products and accessible to the whole population, so that the development of the economy is boosted and replenished.

This model generates, what we can consider, negative externalities not only economic but also social and environmental ones. These externalities turn into negative effects such as; the impossibility of supplying certain products in cases of price volatility, supply shortages in cases of tension in the supply chains of the material resources used, increased loss of quality of life due to environmental problems caused by pollution, social inequalities between producing and consuming societies, the alterations in the environment, the desertification of the soil, and, of course or the increase in natural disasters which affect and will affect the planet in the medium and long term.

In fact, the linear economic model is based on practices established during the Industrial Revolution, where there was a constant supply of natural resources and their use was economically viable and non-polluting in a significant way. In that context, the "extract - make-remove" paradigm was not uncommon.

But today, social conditions have changed and overpopulation, as well as overexploitation, generates the need to reduce the environmental impact produced by these traditional methods of production and to open new market opportunities, towards a clean world.

Consequently, there is an opportunity to develop a new economic paradigm based on the Circular Economy. In fact, the circular economy is driven by the threat posed by the linear economy to the environment and the risks it entails. This fact has been studied by various international institutions. In 2013, the study "Towards the circular economy" by MacArthur (2013), was carried out to initiate the transformation process. In this study, it is shown that 20% of the surveyed companies recognized the need for a change in the economic model to reduce the risks produced in the environment, as well as the development of improvements in the production processes aimed at a circular perspective, more (or equally) profitable but less harmful.

We can also highlight the report “Lineal Risks” by the World Business Council for Sustainable Development, which aims to reflect the great risk to the environment of continuing with the linear strategy, mainly due to the depletion of natural resources.

As quoted in the above-mentioned report: "It is important to note that both linear business model practices and risk factors are considered here in a broad sense, which goes beyond the simple issue of access to resources” (Ramkumar et al., 2018, p. 7).

This report points out that the linear economy is associated with the availability of exhaustible resources: "non-renewable resources previously considered inexhaustible are reaching the limits of affordable supply" (Ramkumar et al., 2018, p. 7). And the impacts on the environment "are accelerating and being regulated at the local, national and international levels" (Ramkumar et al., 2018, p. 7).

Table 1 shows the problems that can arise when further developing business practices with non-renewable resources, as well as the risk factors faced by companies in this context.

Table 1: Risk matrix of the linear economy.

LINEAR RISKS MATRIX					
LINEAR BUSINESS PRACTICES					
RISKS FACTORS	MARKET	Utilize non-renewable resources	Prioritize sales of new products	Fail to collaborate	Fail to innovate or adapt
		Scarcity of primary resources	Bans on trade of waste	Limited opportunities to expand to new markets	Scarcity of resources
		Volatility of resource prices	Volatility of resource prices		Volatility of resource prices
	OPERATIONAL	Internal process failures	Worker safety issues	Supply chain inefficiencies	Inability to hire new talent
		Decreasing cost of renewables	Disruptive new business models	Disruptive new technologies	Disruptive new technologies
	BUSINESS	Changing demand for sustainable solutions	Decreasing margins from commoditization		Disruptive new business models
		Fines for legal violations	Requirements for extended producer responsibility	Fines for legal violations	More stringent environmental laws
		More stringent environmental laws			

Source: own elaboration from WBCSD (2019).

2.2. Perspective of the Circular Economy

We are in a society that needs a change and the generation of new models of production and consume characterized mainly by respect for the environment and sustainable development.

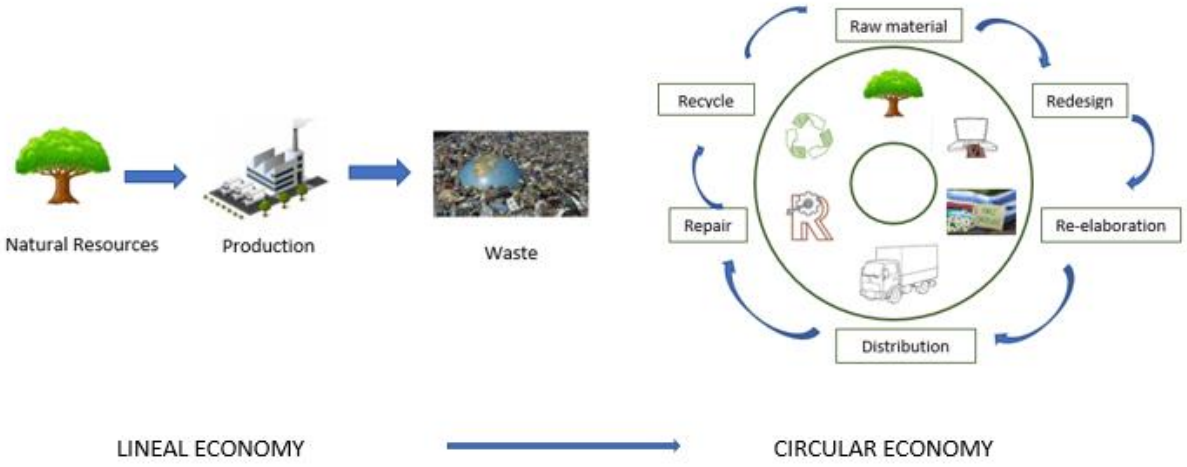
Today, there is increasing interest about the importance of producing a change in the economy due to the need to create products based on renewable resources, with economic-environmental value and socially responsible. This suggests a change towards a circular economy that could be defined as a new economic model characterized by using renewable resources to produce any type of product, making the waste we generate disappear. This new economic model must be supported by technological innovations. Thanks to the development of new skills and new ideas in society, technological innovations are seen as business opportunities.

Therefore, in the circular economy paradigm the value chain undergoes a change. This is described, in the words of Van Houten (2017, p. 43):

> *The Circular Economy represents a huge opportunity for Europe. With the perspective of a comprehensive system, it helps us to make decisions about the use of resources and the minimization of losses, and helps to provide added value to businesses and define a safe route to achieve social welfare and environmental sustainability for future generations. More importantly, under the right conditions, the Circular Economy can change the current economic diversity and, at the same time, increase employment*.

We can see the main differences between this model and the traditional one in a schematic way in illustration 1. In this figure we compare the linear economy and circular economy.

Illustration 1. Comparison between a linear and an economic model.



Source: own elaboration from Ellen MacArthur (2014).

The circular economy is an economic concept that is connected to sustainability. Its main goal is to keep the value of products, materials and resources in the economy for as a long time as possible. The generation of waste should be minimized. As described by the EMF (2016, pp. 2–3):

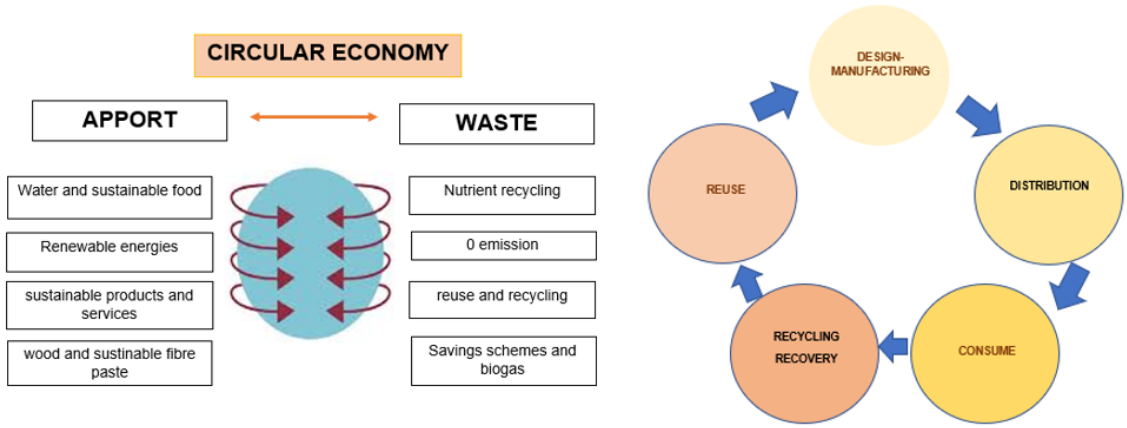
> *It is about implementing a new economy, circular, in other words, cyclical, instead of the linear economy that had been working at the global level. This new economy is based on the principle of closing the life cycle and utility of products, services, waste, materials, water and energy*.

Boulding in 1966, detailed the reason for all these environmental problems and proposed the transition from the linear to the circular economy. Therefore, the concept of the circular economy was introduced by him to avoid environmental deterioration, in words of Kenneth E. Boulding (1966, pp. 3–14)*:*

> *The circular economy proposes that, in the large-scale system of people, natural resources, science and technology, and the whole process of resource input, corporate production, consume and elimination of products, implemented in the traditional linear economy, whose development depends on the consume of resources, is transformed into an economy whose development depends on the recycling of ecological resources.*

As we can see in illustration 2, the circular economy addresses three critical areas: waste management (fundamental for the development of both economic and environmental benefits), water management and energy cycle management (both focuses on preserving the most vulnerable resources that must be rigorously cared for).

Illustration 2. Conceptual framework of the Circular Economy.



Source: own elaboration from ITEL (2019).

In order to apply the changes needed to make traditional production models more circular, technological, organizational and even social innovation will be necessary. These innovative forces will have to be the fundamental axis of the change towards the circular paradigm. In fact, the circular economy could be a new income stream and, therefore, a great opportunity for societies to improve the use of resources, giving prestige to businesses that facilitate this type of environmentally responsible technique.

The fact that waste can be reused for the manufacture of other products increases the competitivity and sustainability of nations and creates a change in production patterns, building a system adapted to the scarcity of raw materials and increasing employment in new, higher value-added sectors.

According to authors such as Qiao & Qiao (2013) "At the regional level, the circular economy is represented mainly as an eco-industrial network of symbiotic companies or industries, that is, waste will be exchanged between companies within the regional eco-industrial park" (Qiao & Qiao, 2013, p. 7).

From another perspective, according to authors such as Feng, Zhijun,.Yan, (2007, pp. 4–5):

> *The circular economy is a model of environmentally friendly economic development and can fundamentally eradicate sustained conflicts between the environment and economic development. Finally, the circular economy adopts a "green" assessment system and indicators, such as green GDP (Gross Domestic Product). In accounting and evaluation of economic development, the traditional linear economy adopts pure economic indicators such as GDP and GNP (Gross National Product). Such an assessment system fails to capture the negative impact of economic growth on the environment*.

In short, the progress towards the Circular Economy is a great opportunity for the economic growth of the most industrialized societies, which gives rise to new jobs, use of renewable resources and leaves to the margin those non-renewable resources that can generate strong impacts, not only on the environment, but also on the socio-economic level.

However, we understand the circular economy as a new philosophy that appears as a result of the need for change due to the exhaust of resources and, therefore, the requirement to establish a regenerative model.

The application of the circular economy in the economic model involve to the design of new products without waste, products that are easy to dismantle and reuse and that manufacturers can re-manufacture and distribute. According to Goleman, together with the Ellen MacArthur (2014), products can be classified into two groups, those that have biological nutrients and those that are designed to be assembled and disassembled many times in a way that favors their reuse.

After having described the concept of the circular economy, we now turn to an in-depth analysis of the different strategies that support the circular economy, as well as its principles and benefits.

2.2.1. Principles of the Circular Economy

The circular economy offers multiple tools for value creation, that are not linked to the consumption of finite resources, producing multiple products and satisfying multiple social needs.

One of the fundamental principles “is based on the fact that consumption occurs as a result of biological production cycles, which means that it is based on a series of key principles for the development of the circular economy” (ITEL, 2019, pp. 13–14).

The circular economy is based on a series of principles that, without them, it would not be possible to carry it out in any sector (ITEL, 2019; Macarthur, 2016). The most important are the following:

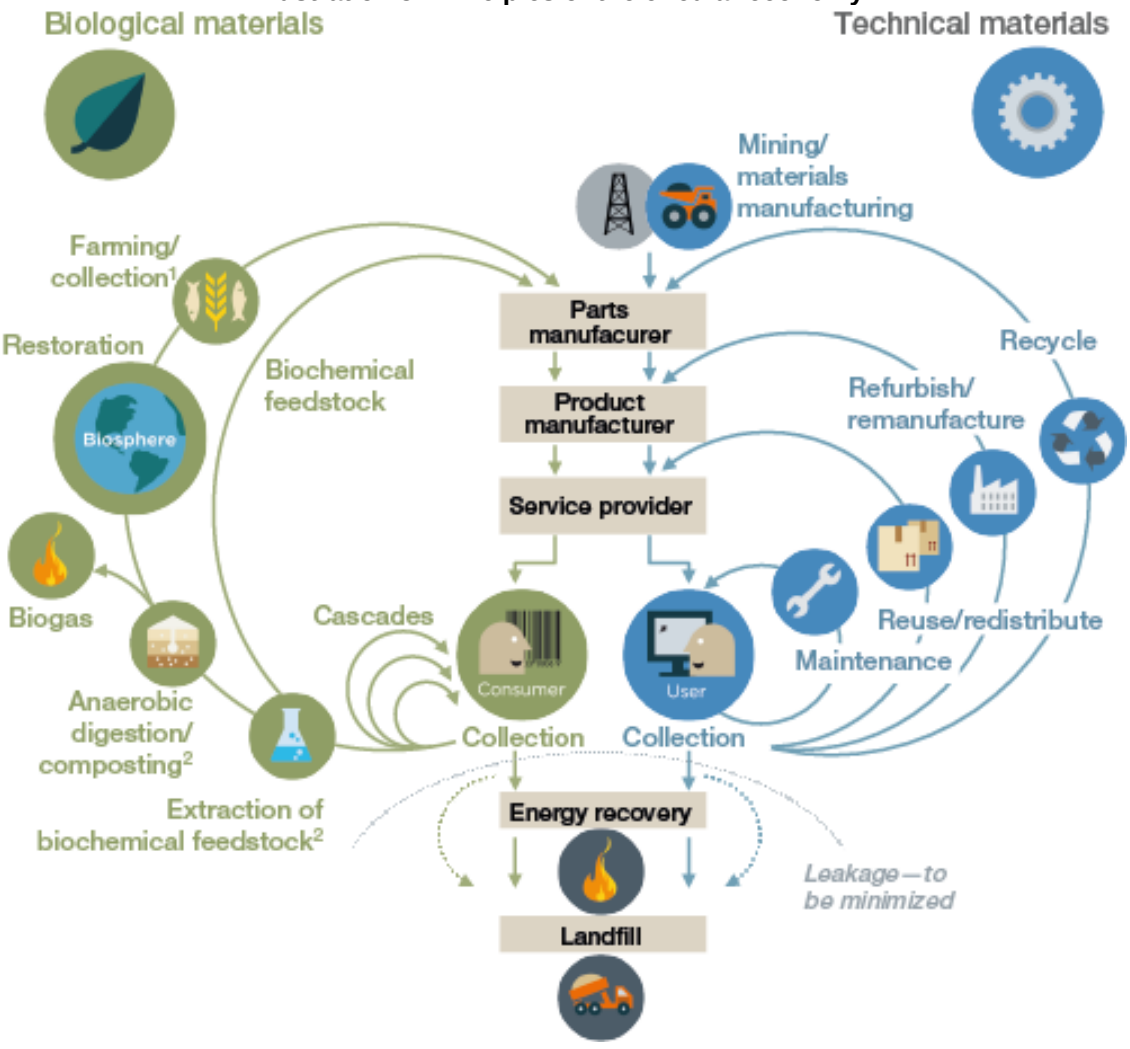
- Improving the natural capital through the control of stocks and the correct administration of the resources. It is necessary for the creation of biological cycles of production.
- The optimization of the performance of the aforementioned resources by circulating the products and materials and thus making them more useful with regeneration and optimization levers. The emphasis is focused on fostering the efficiency of the system by disclosing and discarding negative externalities. Later, in figure 3, we can see how these biological production cycles are carried out in a circular model and how these principles are applied to make the circular economy stronger.
- Waste reduction from design: companies are able to think that the waste generated can be turned into future food and reused thanks to these biological cycles. In fact, if we think that everything is interconnected, we can see that waste is part of a whole and future production with such waste is possible.
- Operation of the economy through renewable energy sources: most of the production within a circular economy is possible thanks to the creation of value that is given to the raw material in order to transform it into a product and use it. In fact, by giving value to this type of material, the negative impacts on the environment are reduced and production is improved.

These principles described in research by ITEL (2019) have contributed to environmental sustainability by reducing not only carbon dioxide emissions but also raw material consumption.

According to Espa & Econom (2018), It is estimated that up to 32% of raw materials have already reduced thanks to circular production. An improvement in productivity and as well as a soil recovery has been obtained too. This has favored the regeneration of nature.

Indeed, the increase in the value of land is achieved through the improvement in soil productivity and the reduction of waste in the value chain. In illustration 3 a summary of circular economy principles is described.

Illustration 3. Principles of the circular economy.



Source: Ellen MacArthur Foundation (EMF, 2016, p. 20).

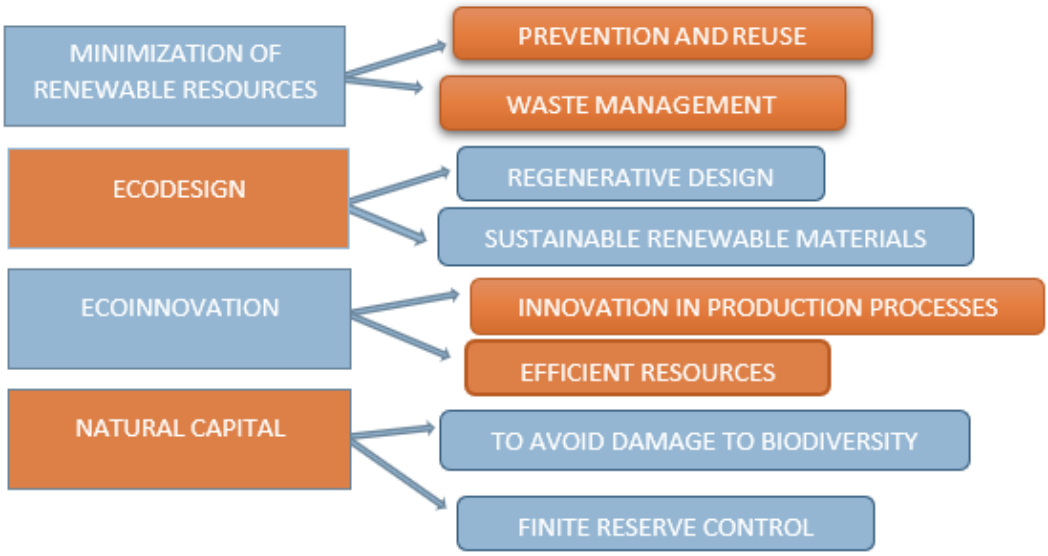
2.2.2. Strategies of the Circular Economy

To frame the circular economy into the different economic models it is essential to know how and through which elements it could be created. We are referring to a series of strategies that make growth possible by reducing resources, using more efficient technologies and creating new business models based on reuse, repair and renovation.

These strategies have been necessary to preserve natural resources, as well as to develop and implement the economy based on reuse, prioritizing the reduction of environmental impact and economic impact. In other words, "strategies are sought that allow for adequate economic development, making use of new technologies, and reducing the impact and even strengthening the environment" (Jimenez et al., 2017, p. 6).

We could argue that each strategy is a piece that makes up the puzzle of the circular economy and if we are missing any piece, this economic model could not be fulfilled. Schematically, in the illustration 4, we observe that the pieces of the puzzle that make up the strategies that support the circular economy, would be:

Illustration 4. Different strategies that support the circular economy.



Source: Own elaboration from ITEL (2019).

These strategies are worked on throughout the entire value chain, whether in changes in production processes or in the business model, with the intention of improving the production system in a holistic manner. These strategies consist in:

- Prioritize renewable and efficient resources in the production chain: this strategy generates the existence of lasting resources, which can be regenerated by favoring the efficiency of the productive processes. In other words, it is a question of developing liquid markets, in order to make the most of the volume of production that a company is capable of obtaining, as well as the interconnection of the value chain, in order to optimize chain of production and eliminate margin of error along the chain.
- Ecodesign: it is based on the concept of "regenerative design" developed by John Tillman Lyle (1994). The concept is based on the fact that "processes can restore or renew their energy and material sources" (Balboa C. & Domínguez Somonte, 2014, p. 2), generating a sustainable development capable of solving the needs of the clients. Eco-design is based on dematerialization, the use of renewable materials that are modular and durable over time.

- Eco-innovation: consist in the application of a series of innovative actions with the intention of modifying production processes or the business model. It is based on a change in which resources are used efficiently with the fundamental premise of not harming the environment. Eco-innovation processes are a key determinant of the origin of the circular economy. The establishment of the different levels of technological innovation in the circular production processes will allow the viability of the circular model. For this reason, we consider the support of public administrations in this regard to be interesting. Institutions must be aware of their potential role as sources of innovation.

- Protecting natural capital: this is one of the most important strategies to solidify the circular economic model, as it makes it more feasible to carry out sustainable activities and thus protect the environment.

- New business models. These are essential in this new economic model. The application of new technologies and staff training will allow completely new and sustainable activities to be carried out within the value chain, reducing the risk and cost of production.

These strategies are closely related in the processes of generating new value chains under the perspective of the circular economy. Thus, we should establish a flow consisting of the recognition of new business opportunities that are capable of creating value in a context of circular resource use, the creation of value through sustainable

processes that take advantage of resources obtained in a sustainable manner and, finally, the establishment of who will offer this value to the market and how in a sustainable manner.

2.2.3. Benefits of the Circular Economy

The circular economy, according to Ellen MacArthur Foundation (2019) is destined to generate a series of benefits at different levels. Otherwise the change towards this new economic paradigm will be slower and have less impact than desired. Not only will there be improvements in technology, but companies will obtain very high benefits compared to the application of the linear method. In the section, we propose to describe some of those benefits that we consider most interesting.

In relation to the impact that the circular model generates at an environmental level, we can consider that it is clear and direct. The circular economic model, according to the study "España Circular 2030", carried out by Ministerio de Agricultura y Pesca (2018) is already beginning to produce benefits for the environment because its application has generated a 24% reduction in the consumption of energy and raw materials in Spain, generating a 20% reduction in carbon emissions in sectors such as food, transport and construction, it has also favored the consumption of biofuels by up to 10% of total fuels.

In fact, we can conclude that, as Canu (2017) claims, the main benefits of a circular economic design are the reduction of the consumption of raw materials and the reduction of the production cost of products and services resulting in a reduction of carbon emissions at the time of production.

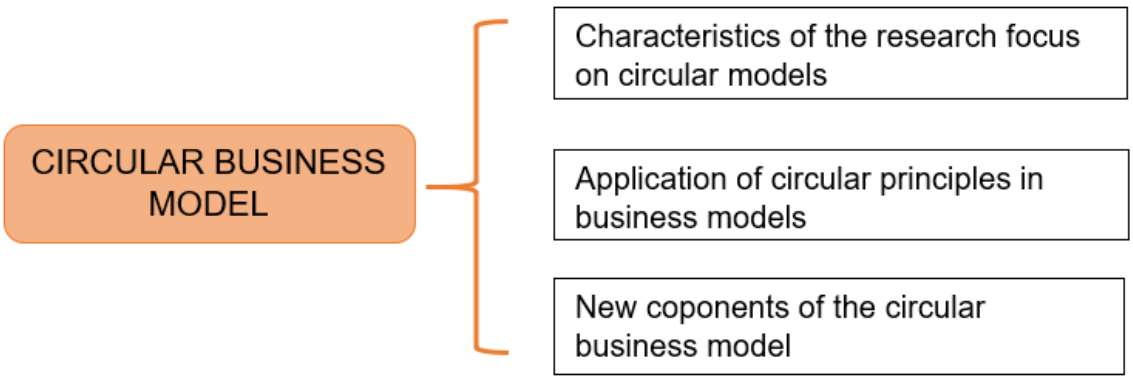
According to Ellen MacArthur (2014), in relation to the improvement of companies results, in the Spanish context it has been observed how companies that change their paradigm towards the principles of the circular economy have experienced changes both in the improvement of efficiency, through cost reduction, and in the improvement of their results, giving way to increases in turnover. It is estimated that the move from a business model to the circulating model improves efficiency by approximately 12% and increases turnover by 20%.

This new economic model also leads to job creation. In Europe, the foundation Ellen MacArthur (2014), estimates that approximately 180,000 jobs have been created through waste management to be brought back into the economy through selective niche markets and business models with predominantly circular technology.

From a different perspective, the circular economy has also allowed the development of new business opportunities. Analysts such as Lewandowski (2016), highlight the desire to develop new business models is not only to reduce costs and increase profitability for companies, but also to reduce the impact on the natural environment. This is why the circular economy places so much emphasis on developing new business models towards sustainability.

In order to develop a business model based on the circular economy it is important to follow a series of steps such as (a) focus research on circular business models, according to the principles established by the circular economy; (b) adapting these principles to the business models and (c) classifying them according to the new components. Schematically, illustration 5 describes the three most important steps in designing a business model based on the circular economy:

Illustration 5. Steps for the elaboration of Circular Business Models.



Source: Own elaboration from Lewandowski (2016).

The establishment of this new economic model leads to the recovery of material flows instead of generating waste in excessive quantities. However, it will require a fundamental change in consumer behavior, which will be reflected in purchasing behavior.

The new business models will be established on the principle of ownership, use, performance and results. Such business models will involve the need for suppliers at various levels and new methods of recycling will be established.

“The new business models include the physical transformation of products, through mechanisms of reconstruction or modernization. The recovery of pure material flows is the optimal option to consume ultimate energy to bring back the products' resources at the end of their life" (Planing, 2014, p. 4).

3. METHODOLOGY AND CONTEXT OF THE RESEARCH

3.1. Research design

The present work uses the case study as a research method. As Yin (1989) explains, thanks to this method we can carry out an analysis of a phenomenon in its own context using a variety of sources and data such as documentation, interviews (structured or semi-structured), direct observations or participant observations.

The case study methodology, is based on the analysis of a specific situation in the field of study Fondevila & del Olmo Arriaga (2013) and investigates a contemporary phenomenon within its real context. The use of the case study method can be carried out using both quantitative and qualitative data. This guarantees that the phenomenon is analyzed in a global way and from different points of view.

The case study method is considered as one of the best ways to investigate concrete phenomena in relation to the business context, since it allows observing the different behaviors of the different actors involved in the study (Yin, 1989). The phenomenon to be studied can be companies, institutions, persons or a group of persons (Fondevila & del Olmo Arriaga, 2013).

The researcher, and main precursor of this research methodology, Yin (1989) considers it especially appropriate for analyzing those phenomenon that are considered new because the empirical research examines the phenomenon in the real environment and it uses multiple sources of data. And the researcher Packer (2004) assures that this allows us to better understand the events, as well as the motivations that have originated them.

In this project, as conclusion, we will carry out an investigation through a case study of the situation of the agro-alimentary sector in the Spanish context in relation to the circular economy. More specifically, and in accordance with the classification of case study types made by Robert K Yin (2003), in which a distinction is made between explanatory, exploratory and descriptive cases, we are going to carry out research of a descriptive nature, because we intend to describe a phenomenon, such as the situation of the new economic model of the circular economy and the real context in which it occurs (the agro-alimentary sector in Spain).

Regarding the source of data used to carry out this research, we can highlight that, in general, we have used secondary sources. We have mainly resorted to reports and technical documents elaborated by relevant institutions both for the circular economy and for the agro-alimentary sector. We can emphasize, for example, the studies carried out by the Association for the Defense of Consumers and Users of Banks, Savings Banks and Insurance (ADICAE) or by the eco-innovation laboratory (Pardos M., 2018). In general, these are general diffusion reports targeting to share the most relevant information available with the whole of society.

In this way, we can see how our economy has been evolving and what goals it must achieve in order to enter such powerful sectors as the agro-food sector.

3.2. Research context. The agro-food sector in Spain

We define the agro-alimentary sector as the sector that comprises the activities of the primary sector (forestry, livestock, agriculture, and fishing) as well as the activities of the agro-industry. In short, it is the sector that transforms agricultural and livestock raw materials into agro-alimentary products for consumption. In a more detailed way, we can define the agro-alimentary sector: "The agro-alimentary sector is made up of companies that produce inputs and services, the primary production sector, the agro-alimentary transformation industry, transport and storage companies and food marketing and distribution companies" (Moreno et al., 2015, p. 17). The agro-alimentary sector is one of the sectors that has the greatest influence on society and the natural environment (Moreno et al., 2015).

The Spanish agro-alimentary sector has been added to group A of the National Classification of Economic Activities (CNAE09), which are those companies that form part of agriculture, livestock, forestry and fishing. This sector makes a very important contribution to the Spanish economy. The Spanish agro-food sector is the third most important in terms of gross value added, accounting for 25.9% of the total value of the industry (Maudos, 2018). Moreover, this is a sector in which the level of commercialization is constantly growing. This sector is made up of a large number of companies at a national level.

As explained in the report of the National Observatory of the agro-alimentary sector, in the words of Maudos (2018, p. 4).

> *"In 2018, Spanish exports of agro-alimentary goods reached a turnover of 49,502 million euros, representing 16.9% of total exports of the Spanish economy. In turn, imports of agro-alimentary products reached 37,384 million euros and accounted for 11.4% of total national imports". But many of these incomes would not be possible without the investment in R+D, which made possible improvements in technology in the production processes, representing 9% of the expenditure in the whole sector"*

Throughout the course of history, this sector has been developing and carrying out great innovations related to the use of natural resources with the aim of damaging the environment as little as possible and making resources more efficient.

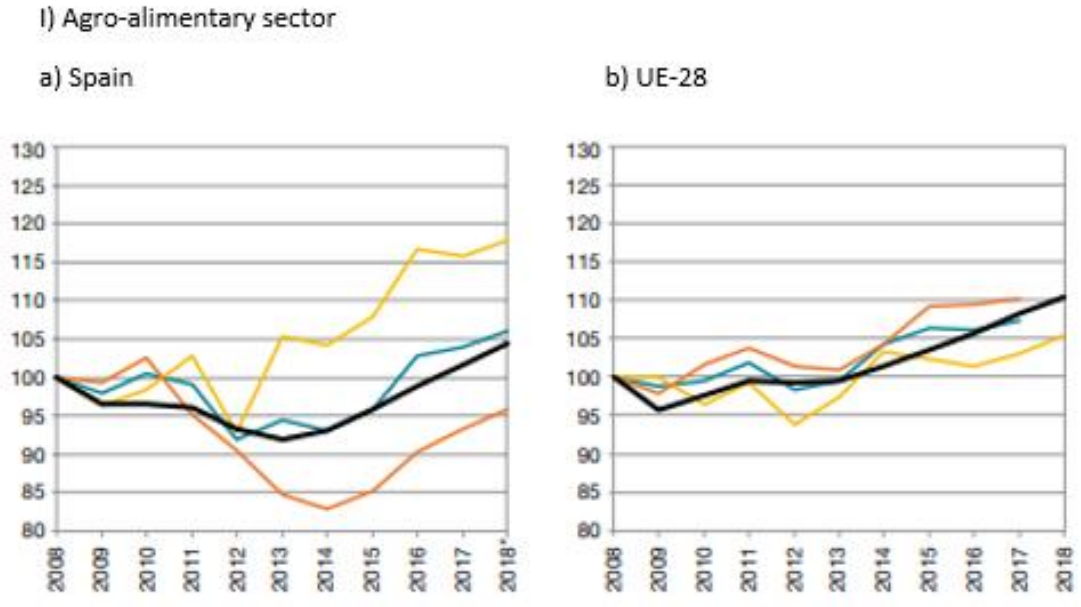
Based on data obtained from INE (2019), approximately 29,000 companies are part of this sector in Spain. Of these, 99.8% of the total are SMEs and micro-SMEs. The agro-alimentary sector also benefits Spanish society, generating new jobs year after year, accounting for approximately 21% of industrial employment. Similarly, work has been promoted in agricultural cooperatives, which represent around 15% of the total Spanish food industry and will have a turnover of approximately 26,000 million Euros annually by 2019.

Finally, the activities carried out in this sector also affect the natural environment. Based on the data obtained from INE (2019), the activity of the agro-alimentary sector covers some 50.40 million hectares, of which 25% is cultivated area. Of this area, 34% is dedicated to arable and woody crops. Approximately 35% of the surface is forested and the rest is pastureland, geographical areas, and natural meadows, occupying approximately 31%. However, agricultural holdings are in decline; according to the latest survey conducted by the National Statistics Institute (INE) on the structure of agricultural holdings, they have decreased by 2.1% compared to last year (INE, 2019).

In order to explain the evolution of the sector and to contextualize its position, show comparative charts on the agro-alimentary sector in Spain and in the European Union in 2018. After the 2012 crisis, according to the National Observatory, the sector shows a rapid recovery and transformation of the primary sector, positioning it in 2018 with 6.2% above the value registered in previous years (Maudos, 2018).

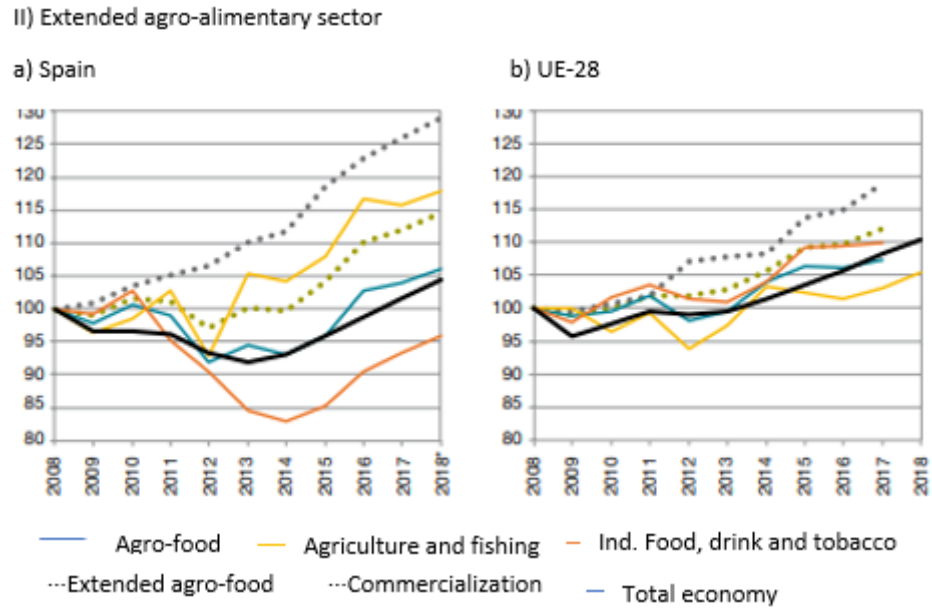
In these illustrations (illustration 6 and illustration 7) we can see the recovery that the agro-alimentary sector has had both in Spain and in the European context, becoming the very competitive and productive sector. We can see how, the European agro-food marketing is higher than that of the Spanish sector by 3.6% and 2.5%, respectively.

Illustration 6. Evolution of the agro-food sector in Spain and the EU.



Source: National Observatory on the Agro-food Sector (CESCE, 2019; Maudos, 2018).

Illustration 7. Evolution of the extended agro-food sector in Spain and the EU.



Source: National Observatory on the Ago-food Sector (CESCE, 2019; Maudos, 2018).

The agro-alimentary sector, when critical situations in the country occur, is among the sectors that best manage national crises. This is because food is part of the strategic economic and social ambit which is able to guarantee the functioning of the system even in critical situations. Periods of crisis usually determine stages of reduced profitability and drowning of the sector. However, thanks to the Common Agricultural Policy (CAP), it is possible to perform and develop new strategies that solidify the sector and can supply products and make the sector more profitable and productive.

Currently, the main risk factor that exists is, "the critical crisis caused by the hatching of the Covid-19 has shown that agro-alimentary sector is a strategic economic in the functioning of a society" (Mercaolid, 2020, p. 1). It has been seen how the Spanish agro-alimentary sector is able to develop different capacities to continue covering needs.

In moments of tension and difficulties such as those we are experiencing, due to the presence of a harmful virus causing COVID-19, is when we have the opportunity to calibrate the strategic importance of the sectors of Spanish society, because some of them, such as the agro-alimentary sector, is not recognized by society and is not given the same valor as other sectors. These crises "benefit" the agro-alimentary sector, because consequently it is being studied the possibility of leading the agro-alimentary sector towards the circular model. According to the magazine F&H (2020, pp. 8–9):

> *The various businesses that are harmed should be directed towards that model. The administrations will have to learn and change their social role, we will have to put the tools in place, but it will not be from today to tomorrow. We will have to invent, create, wake up with a new look and with an obsolete and exhausted industry that will have to be rethought from top to bottom.*

In the words of Braulio (2020, pp. 1–2), founder of the magazine "Economía Circular":

> *With a new geopolitical scenario of great dimension and with fear between each other, with a state-of-the-art technology that will turn us into human beings with more time for leisure and with new ways of working. Therefore, I think that to think that we are going to wake up from this bad dream and the first thing we are going to do is to pick up where we left off, is to be very illusory, that the change that we have been preaching for 10 years and that the great economists and statesmen denied and did not believe in has started traumatically and I see that there is not, and there will not be, any way back.*

Recently, the Spanish agro-food industry has been focusing part of their efforts on studying the potential of the circular economy. In order to achieve this objective, it is a question of using cleaner technologies and processes aiming to make the best use of raw materials.

An example of this type of initiative is what is known as "white biotechnology", a technology applied to organic by-products and waste with the aim of being able to extract supercritical carbon dioxide (CO2) to obtain ingredients (natural essences, natural aromas and colorant) and active principles (vitamins, antioxidants, essential oils, etc.).

In short, Ainia (2019a) states that the aim is to encourage the development of processes that are respectful of the environment and suitable for eliminating impurities. In fact, all the strategies currently developed in the agro-alimentary sector are focused on technological optimization and efficient use of resources such as energy and water in order to increase efficiency and reduce the carbon footprint.

As a synthesis of the above, according to the data obtained from Ainia (2019a) we can conclude that the sector has established a positive relationship with the economic model based on the circular economy and consequently it has been possible to develop some strategies to improve sustainability in the country's food chains through a circular perspective.

4. ANALYSIS OF THE RESULTS

In this section we will present the results obtained in this research. More in detail, we have analyzed three main lines in relation to the present situation of the circular economy in the Spanish agro-alimentary sector.

These three main lines have been:

1. General analysis of the actual situation; the basic strategies and axis of action developed in the agro-alimentary sector aimed at the circular transformation of the economy.
2. Analysis of one of the main drivers of change. Innovation and technological development.
3. Case studies as examples of the new circular economy in the agro-alimentary sector.

In the following sub-sections, we will proceed to show the main results obtained in each of these three main lines.

4.1. Circular Economy in the Agro-alimentary Sector. Basic strategies and the most relevant lines of action

One of the main objectives of this research is to analyze the impact or level of implementation of the circular economy within the agro-food sector. In this section of the research we will therefore address this objective through the analysis of the situation of the agro-food sector in relation to the circular economy.

In the words of the Minister for Ecological Transition, Teresa Ribera, it is necessary to take measures of change in the agro-food sector to combat the effects of climate change and the loss of biodiversity. "We must recover the potential of our agriculture respecting their seasons, the soil and the climatic and hydraulic characteristics of the areas where food is produced" (Ribera, 2019, p. 1). In this way, ecological agriculture, sustainable livestock farming and gastronomy are recognized as strategic sectors for reducing the impact of climate change and halting the loss of biodiversity. These are effective thanks to the implementation of tools such as the production, distribution, and consumption of food, ensuring fair treatment of workers and providing economic, social, territorial and environmental value.

In fact, Ribera (2019) assures that one of the characteristics that the development of this type of innovative strategies in the agro-alimentary sector is to bet for the sustainable livestock farming.

Consequently, there will be a necessity for reliable food, poverty reduction and, of course, a reduction in global warming. That is, to have a controlled amount of food and a good management of the resources used, so as to reduce food waste.

Next, we are going to explain how, with this type of strategy, new practices are established to improve the characteristics of the soil and avoid its erosion, so that there are improvements in both flora and fauna and therefore better productions.

More specifically, we will first describe the strategies that have been developed in this productive sector with the aim of favoring the change towards a circular economy. The implementation of these strategies has favored the development of new business models linked to a circular perspective. As highlighted Galindo & Econ (2017), in the Spanish agro-food sector, businesses associated with the circular economy generated 17% of its industrial gross domestic product in 2017.

4.1.1. Basic strategies related with the Circular Economy

The different strategies aimed at the circular transformation of the economy can be grouped into five blocks:

- **Energy strategies.**

These strategies are part of a general global context in which, beyond the agro-food world, societies have concluded that it is necessary to implement measures to achieve a change in the energy paradigm. This is only possible thanks to the introduction of a sustainable development model in the face of climate change. The emphasis here is on identifying scientific synergies for the possible energy transition.

The agro-food sector, like the rest of the sectors, is trying to adapt to this new reality through the design of measures aimed at taking advantage of the energy generated in the manufacturing and food processing processes. Indeed, these strategies are based on the fact that the heat released from the manufacturing processes is also used to heat, at the same time, the water used in the manufacture and processing of food, achieving a proper overall management of water, energy and organic matter.

Mostly, the aim is to achieve a path towards decarbonization, investing in renewable energies, so that future production will be made from non-fossil fuels. That is, achieving clean energy and introducing innovative technologies (such as photovoltaic irrigation) to support the transformation towards sustainable agriculture (Miteco, 2020).

- **Productive strategies.**

These types of strategies aim to redesign production processes so that they tend to be cleaner and more environmentally friendly. The production strategies therefore consist of designing processes aiming to reduce the environmental impact. In short, the aim is to encourage transformation towards cleaner food production and, therefore, less pollution. This is one of the major goals of the circular economy, which it is achieved by rationalizing the consumption of resources within the agro-food production processes, as well as making these production cycles self-sufficient.

Adequate waste management plays an important role in this area, as it helps to achieve cleaner production. One of the most widespread measures is the use of organic products, extracted from waste from previous productions, to feed livestock. According to Espa & Econom (2018), this reduces the amount of waste disposed of. However, it should be remembered that the circular economy pays more attention to the initial stages of the chain, product design and production to achieve greater durability, as well as easy reuse of associated waste. In this way, the final phase will generate less management effort.

Moreover, as Ihobe (2019) claims emphasis put on the extension of producer responsibility. That is, in increase the manufacturer's responsibility in those stages of recovery of the waste that its own agro-food products generate.

- **Marketing strategies.**

These strategies focus on encouraging the use of packaging and food containers that generate as little waste as possible and that this waste, if it exists, will be biodegradable. In short, they seek to improve product design with the aim of reducing the consumption of natural resources. These green strategies in terms of marketing are called circular marketing strategies which mainly try to carry out sustainable development objectives and are willing to capture the attention of the consumer, making him/her responsible to the natural environment. This is where one of the main characteristics of the circular economy comes into play, the ecodesign. This makes it possible to design containers and packaging that do not damage the natural environment, such as containers designed and produced from rice starch or bottles made from malt pulp.

Another of these marketing strategies is, for example, to design and implement return systems for reusable packaging in the drinks sector. In this way, the consumption of raw materials is minimized and with it, waste.

Marketing strategies are also based on promoting the responsible use of products, being aware that the products are backed by quality labels or certificates, as well as participating in environmental defense events.

- **Innovation strategies.**

These strategies aim to obtain new products that are environmentally friendly on a global level. They attempt, for example, to develop new product categories, based on organic by-products and low environmental impact.

In other words, going beyond the marketing of commodities such as fish, rice, or meat. In this category of strategies, we also find those that aim to take advantage of organic by-products that are part of other sectors and transform them into packaging and thus fight against food waste. The circular economy aims to stimulate innovation in areas such as reuse, renovation, and reconditioning, as well as promoting the "more food, less waste" strategy.

One of the most widespread strategies in this area is so-called "renewable gas generation". As detailed in the report Tecnológico (2018), this aims to stimulate the use and management of waste from the livestock and agricultural sectors by generating biomethane through an innovative technique. In general, this technique obtains this renewable gas by natural decomposition of organic matter from the waste. By obtaining the biomethane, a reduction in the emission of greenhouse gases is achieved, renewable energy is promoted, and the environmental management of organic waste is improved.

On the other hand, it also aims to innovate in cultivation practices such as precision farming, based on “collecting, processing and analyzing data on time and space in order to improve efficiency in the use of resources, productivity, quality, profitability and sustainability in agricultural production” (Ochoa Duarte et al., 2012, pp. 3–5).

- **Collaborative strategies.**

The collaborative economy is based on the efficient use of economic resources, through digital platforms with full confidence. It is therefore about new business models to improve social welfare. In the agro-alimentary sector, collaborative strategies are usually developed in two different areas; on the one hand, at the level of the producer-consumer relationship, it is mainly a question of proposing a model of value chain approach in which

sustainable and healthy products are offered and the whole value chain is involved, so that they can respond more easily, quickly and directly to customer's needs. Such strategies increase consumer confidence and improve production conditions for farmers.

On the other hand, at the level of the relationship between producers, an example of this type of strategy would be the identification of secondary uses for by-products. The aim is to favor synergies between companies in the sector through the purchase and sale of equipment and goods to others that no longer use and share the resources. In this way, the useful life of this equipment is prolonged, and the waste associated with the goods produced is reduced.

This type of strategy allows for benefits such as sustainable development, a key factor for the circular economy. The platforms established in the collaborative economy allow the share of underutilized actives, goods and services in exchange, or not, of money.

One digital platform that has been established is what is known as green financing through Crowdfactoring. Crowdfactoring is a form of so-called Microfinance, a type of platform that consists of financing between companies, where they obtain the resources directly from investors and each investor can contribute the amount they believe appropriate, which will generate many investors for a single operation. Crowdfactoring, appears as a circular modality, since it allows companies to anticipate the collection of their invoices, being private investors those who advance the money and obtain a return in exchange when the invoice is due. In this way, this platform has been introduced into the businesses that belong to the agro-food sector, allowing investment in the transformation of the agro-food sector in the circular environment.

According to the report written by Holger Frey, the specialized manager in Sustainable Investment (SI), this new sustainability strategy inside the agro-alimentary sector allows investing in companies that present sustainable food system designs, acting in the whole value chain, acting in problems such as resource management, food supply (RobecoSAM, 2018). This strategy is based on creating a positive impact on businesses in the different sectors and investing in food safety, sustainable processing, production, logistics and sustainable consumption. Such collaborative strategies are closely related to environmental benefits and sustainability of the natural environment, which in turn influence animal welfare and social issues.

To summarize, the following table (table 2) presents the five strategies proposed, as well as their main characteristics:

Table 2. Basic strategies in the agro-food sector.

STRATEGY	FEATURES	SPECIFIC EXAMPLES
Energy	Design of measures aimed at taking advantage of the energy generated in food manufacturing and processing processes.	Development and optimization of clean energies. Photovoltaic irrigation for a more sustainable and efficient agriculture
Productive	Design of production processes with the aim of promoting clean and environmentally friendly production, as well as the environmental impact of the entire value chain.	Design of less polluting industrial processes. Precision cultivation. Obtaining feed for livestock from production residues.
Marketing	Design sales strategies and packaging for food that minimizes the amount of waste.	Biodegradable packaging from rice starch. Bottles made from malt pulp.
Innovation	Implementation of innovation processes with the aim of favoring clean, efficient processes with low environmental impact throughout the agro-food value chain.	Use of renewable gases for the use and management of waste in processes of decarbonization or natural decomposition of organic matter. Creation of new categories of products made from organic by-products, damaging the environment as little as possible.
Collaborative	Establishment of inter-company relations to promote collaboration in the green transformation of companies.	Promotion of buying and selling between equipment companies that no longer have any use. Identification of secondary uses for by-products. Establishment of communication strategies with stakeholders to promote public awareness of the circular economy. Crowdfactoring, green financing through managers like RobecoSAM for the transformation and sustainability of the agro-food sector

Source: Own elaboration.

4.1.2. Lines of action based on the Circular Strategies

The above strategies cannot be carried out without establishing an action plan that can enable their implementation. According to the report the Ministerio de Agricultura y Pesca (2018), three fundamental lines of action have been developed within the Spanish Strategy for the Circular Economy, carried out by the Spanish government in a projection to the year 2030.

These lines of action are:

- **Line 1.**

  Sensitization and participation of the society. It is of vital importance that society is involved and aware in order to develop the circular economy. This involves making people reflect on their consumption decisions, as well as on waste separation in households.

- **Line 2.**

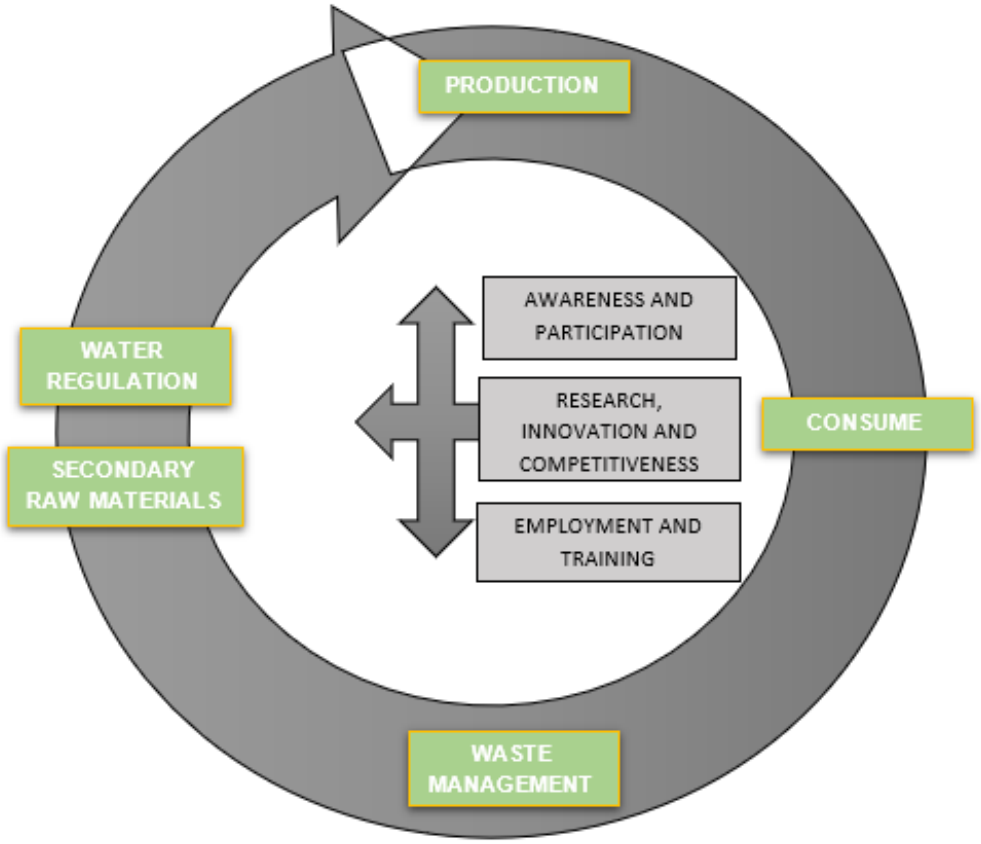
  Research, innovation and competitiveness. It must be a fundamental pillar in the transformation towards the circular economy.

- **Line 3.**

  Development of new jobs and training for them it is important because "a true transition to the circular economy is not possible without adequate training in the new paradigms" (Ministerio de Agricultura y Pesca, 2018, p. 11). Developing this plan requires digital technologies and efficiency, perseverance, and reuse of resources.

In more detail, this action plan, with these 3 main lines, focuses on 5 key aspects such as (a) production, (b) consumption, (c) waste management, (d) use of raw materials and (d) reuse of water. In illustration 8, we can see how this action plan is established around the 3 axes and the 5 key aspects.

Illustration 8. Lines of action and key aspects of the Spanish Strategy for the Circular Economy.



Source: own elaboration from Ministerio de Agricultura y Pesca (2018).

4.2. Innovation and technology as drivers of change towards a Circular Economy

The role that society and business play in the transition to the circular economy is clear. In this sense, institutions such as the Centre for Environmental and Technological Energy Research proposes that it is necessary: " Increase public awareness of how the circular economy and innovation are competitive advantages for companies, institutions, entrepreneurs and the country as a whole, thus promoting a faster and more efficient transition towards a sustainable economic model in Spain" (Castaño & Energía, 2019, p. 4).

To introduce technology and innovation in the agro-food sector is to make it possible to produce high-quality food at an affordable price and to have as little impact on the environment as possible. In short, promoting innovation and technological development is one of the main drivers of change towards a circular economy in this sector.

For this reason, in the Spanish agro-alimentary sector, a series of research projects are being carried out to develop new technologies that will make the above-mentioned strategies possible and thus advance towards the transition to a circular economy.

It is necessary to incorporate new technologies and innovation in the production processes of the agro-alimentary sector; in short, it is a question of: "improve efficiency in the use of inputs and reduce the impact of waste generation, ensuring the sustainable use of natural resources and conservation of biodiversity and ecosystems, as well as the development of sustainable food models" (Ministerio de Agricultura y Pesca, 2018, p. 41).

According with a report of the United Nations (2019) in order to guarantee a greater stability of the natural resources in the agro-alimentary field, it would be convenient to improve the efficiency between 20% and 30%, though, for example, the combination of new cultivation techniques.

In the same way, according to the report Espa & Econom (2018), it happens with the use of resources and means of production that arise from new technologies based on sustainable and intelligent agriculture, where efficiency, preservation of resources, environment and competitiveness play at the same time.

Next, we will describe different innovative initiatives related to research and technological development identified in the Spanish agro-food sector:

- **Bioenergy field.**

One of the main initiatives to implement technological development in this sector is based on the transformation of organic waste into bioenergy and bioproducts. "Bioenergy is a process that consists of reducing the use of existing fuels, thus favoring decarbonization, in favor of the production of biomass to be used in sustainable industrial production processes" (Boplat & Geoplat 2016, p. 14).

Some of the most relevant research projects have focused on the development of biorefineries and the production of biomethane.

According to European bioenergy research, there are an important number of sub-programs to effectively develop bioenergy in companies, in fact, the most important efforts are being focused on finding ecological sources of energy production. In this sense, the sustainable production of biomass and its use in biochemical processes to obtain biofuels is one of the main objectives of the innovative initiatives in the energy field.

In this way, it would be possible to ensure the sustainability of bioenergy systems in the agricultural, forestry and energy crop biomass value chains that consider the given technology for fuel conversion. Rico (2019), claims that as greater efficiency and lower carbon levels are achieved, it is easier to incorporate bioenergy as a renewable resource. In short, it is a question of achieving a balance between sustainability, social acceptance and profitability.

To this end, it is proposed to incorporate the concept of biomass as an essential concept of the circular economy. As explained in the report written for Retema magazine Pascual et al. (2015, p. 1):

> *An evolution of agroindustrial biogas plants is taking place towards new models based on the concept of biorefinery. The challenge is to reconsider the current biogas plants by expanding their range of end products and going far beyond the sale of electricity. Companies must commit to innovation by developing the potential of new platforms such as volatile fatty acids, biogas and digester, which will make it possible in the future to obtain everything from bioplastics to high-value biomasses such as microalgae.*

- **Resource Efficiency field.**

There is a broad consensus that optimizing and improving the efficient use of resources such as water and energy is one of the main drivers of change. The alimentary industries, as they move into circular models, need to establish good management of resources, water being one of the most important. It is mainly a question of redesigning management with the aim of making its use as a raw material as sustainable as possible, through the development of strategies for reuse and the use of technologies such as membrane filtration or new irrigation systems that increase the efficiency of absorption by plants (Ainia, 2019).

Reducing food waste is another factor to consider when designing innovative resource strategies. In the agro-alimentary sector, these strategies do not necessarily have to be very complex; according to the report made by the Court of Accounts Storup et al. (2016), some of the actions carried out in this sense would be, for example, the financing of silos of (place of storage of the grains of the cereal), allowing that the harvest is not wasted by the mold, rodents of stables, which allowed improvements in the quality of life of the animals, reducing the number of diseases.

In summary, authors such as Castaño & Energía (2019) state that the goal is to achieve the sustainability of all resources involved in the agro-food value chain, by studying the different behaviors of products in their natural life cycle.

- **Field of waste treatment.**

Another driver of change would be to move towards new technologies designed to treat the waste generated by the agro-food industry more efficiently. One of these technologies, and one of the most promising, is the treatment of waste by supercritical water oxidation. According to Portela & Abelleira-Pereira (2010) this technology is based on using water with temperature and pressure conditions above its critical point (T>374ºC and P>217.7 atm). Under these conditions, the water can oxidize any organic compound, allowing this technology to be able to recover energy and phosphorus.

Supercritical water oxidation, as well explained by the institution *IVEM* (2010) (Electromechanical Verification and Maintenance Engineering) is a technology that allows the treatment of industrial waste, due to its effectiveness in destroying and generating cleaner water. It is therefore an innovative process for those industrial wastes in which any organic compound must be oxidized. It is therefore a promising technology in agro-food production systems both for its environmental and socio-economic benefits.

Another of the innovative technologies, described by Ainia (2016), used for the efficient treatment of waste and being generated in the food industries is that which allows the generation of the "digestate". This is a liquid material obtained from the by-products of the digestion process of biodegradable organic materials. A temperature-controlled fermentation of the waste allows the production of biogas, which will be used in the future for the generation of heat, electricity or use as fuel in vehicles. While the material known as "digestate" will be stored until it is used in agricultural processes.

According to research on new strategies for the circular economy obtained from Competitivo (2018), he details that another of the strategies that have been carried out for the treatment of waste in the agro-food sector is the promotion of the bio-economy. In this way, activities such as the use and recovery of waste from each agricultural or livestock production are carried out, so that it can be reincorporated into the value chain. The bioeconomy allows the development of new processes for the treatment of waste and with this, its extraction to obtain sustainable bioproducts, which is related to water management.

- **Eco-design field.**

Progress in innovation and development has also been directed at the marketing area and is committed to establishing solutions related to the packaging and marketing of products. Specifically, ecodesign initiatives have been identified as from Ainia (2019b), that is, the design of new packaging based on efficiency and material and energy saving criteria. It is also proposed to extend the shelf life of products through ecological packaging which would limit food waste along the value chain and favor food safety and the sustainability of the natural environment.

In effect, through the application of new technologies in packaging, according to the FAO (2015) the global waste of agro-alimentary products could be reduced by between 7% and 25%. According to Ainia (2019b), these technologies promote food preservation through intelligent packaging capable of indicating the characteristics of the food and its storage conditions

In short, new biodegradable packaging systems have been developed to restore product transport and extend product life in a sustainable way. Recent research on the development of new packaging methods Ainia (2020), highlights that this is possible thanks to the introduction of antioxidants obtained from wastewater sugars. Through processes based on the fermentation of sugars, bioplastic is obtained, which allows the waste to be transformed into a sustainable packaging material, prolonging the shelf life of the products, and guaranteeing, in turn, alimentary certainty.

- **Field of information systems.**

Another aspect that has been considered for development and innovation, which allows for the existence of circular models, is the development of information systems and artificial intelligence as a result of the proliferation of the internet. With these new tools, it has been possible to advance in new models of management of the agro-food chain that have been based on the circular economy. As has been investigated in the magazine Ecointeligencia in the article by Ricardo (2019) the fact that customer-company relations and business networks are established through the internet allows for a more efficient management of the value chain and, therefore, an optimization of resources. Thanks to these advances in fields such as digitization, it is possible, for example, to record data automatically from all stages of production, marketing and waste management.

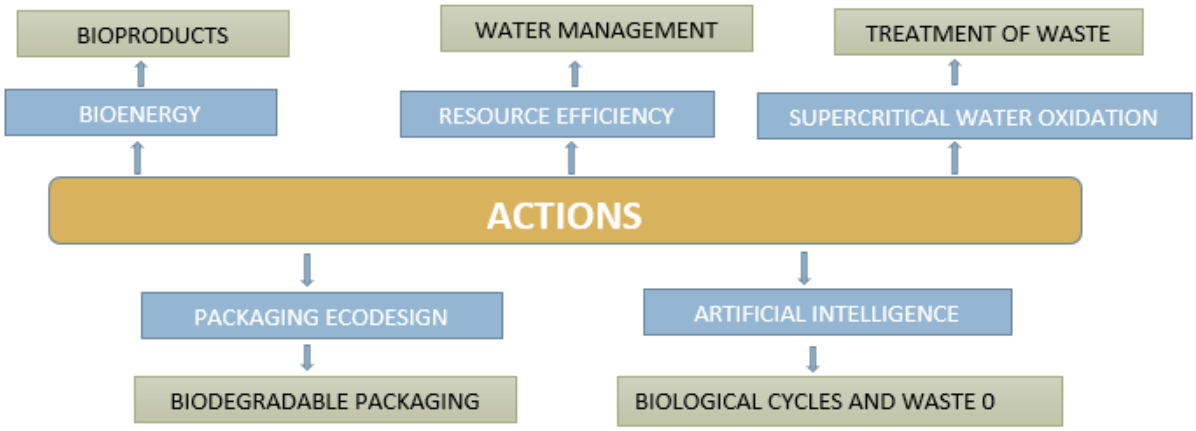
Also the Artificial Intelligence, as it stands out John Tillman Lyle (1994), can be considered as a fundamental catalyst tool of the transition towards the circular economy in the agro-alimentary sector, promoting the change towards a new regenerative design in the production. In other words, a change in which both the materials to be used and the finished products are created without producing waste in a regenerative way, maintaining their value at all times, through biological and technical cycles so that they can be used again and continue to grow.

Artificial intelligence is part of a subgroup of technologies that allow processes to adapt to different production situations with ease, learning from them and optimizing them. In other words, it is capable of improving and accelerating processes in the development of new products, components, and materials necessary for the design of new scenarios that favor sustainability. Thus, according to Ellen MacArthur Foundation (2019), artificial intelligence makes it possible to optimize circular business models: by having and analyzing a large amount of information on all elements of the value chain, it favors the optimization of flows of raw materials, products and processes in a circular fashion (improving, for example, production sorting processes or material recycling).

These new technologies make it possible, for example, to determine when the fruit is ready for harvest, when there is a balance between food supply and demand, and the valuation of food by-products. In fact, the application of artificial intelligence in the agro-alimentary sector is particularly interesting because this sector bases his business model on biological cycles, which can be optimized. It also facilitates the reduction of food waste, as well as takes advantage of and optimizes stages such as harvesting, processing, logistics and consumption.

In summary, in the following illustration (Illustration 9) we can see how the different action plans established in the field of innovation and technology are grouped together to make an agro-food sector governed by circular models possible.

Illustration 9. Innovative initiatives in the agro-food sector.



Source: own elaboration.

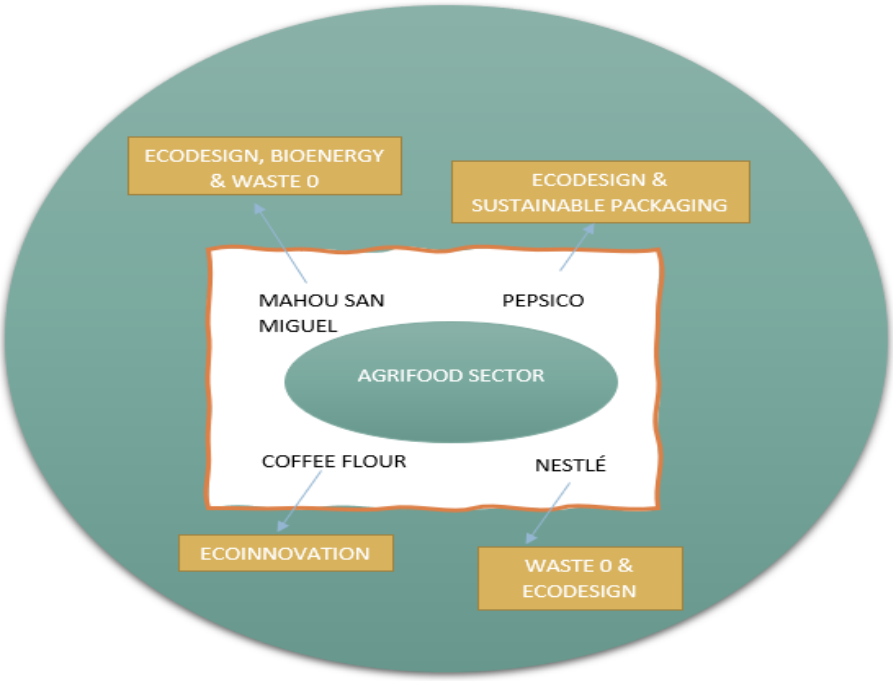
4.3. Cases of success of companies and iniciatives related to the Circular Economy

The innovation and development of technological applications for the development of circular models has led to changes at different levels in the value chain of the agro-alimentary sector and has caused both major changes in existing businesses and the emergence of new business models and opportunities.

All these opportunities generated have a common room, the respect for the environment and the generation of minimal impact on both the use of resources and the generation of waste. Moreover, they are possible thanks to the application of strategies and basic principles established by the circular economy.

Next, we show a series of success cases that we hope will serve as an example and incentive for the change towards a totally circular paradigm in the Spanish agro-food sector. The four success stories analyzed belong to different subsectors and each of them establishes different links with the Circular Economy, so we will analyze them as shown in the figure below (illustration 10):

Illustration 10. Success stories of the circular economy in the agro-food sector.



Source: own elaboration based on Galindo & Econ (2017, p. 11).

4.3.1. Mahou San Miguel. Approach to the Circular Economy through ecodesign, waste reduction and bioenergy.

Since 2009, the beer company has been committed to the circular economy by trying to improve their production processes and the design of their products in such a way as to increase their efficiency and reduce their impact. In fact, according to the report on innovation presented by Mahou-San Miguel (Innovación y Compromiso - Mahou San Miguel, 2019), the company employs on the one hand, eco-design strategies in packaging, so as to reduce the consumption of cardboard, plastics, metals and glass.

The company has also carried out other initiatives such as the production of recyclable bottles, in which beer, water or cider will be introduced, or the commitment to produce its containers with 100% recycled PET, promoting projects that will give a second life to its containers and thus achieve zero waste in landfills and protect natural areas.

Furthermore, they also focus on trying to use any type of waste generated in the production processes. Mahou-San Miguel uses the husk that remains after the grain to make its products and the yeast from the manufacturing process has been extracted and transforms it into livestock feed. Thanks to these types of initiatives, the company is able to recycle 99.5% of the waste.

The company is also trying to reduce the water used in the process by treating it and redesigning its processes, for example, by automating the cleaning processes. Finally, the firm also tries to optimize its energy resources from the use of biogas (*Mahou-San Miguel*, 2020).

4.3.2. Nestlé. Approach to the Circular Economy through waste 0 and eco-design

This company is committed to sustainable development through the reduction of food waste.

In Nestlé's Environmental Performance and Sustainability Policy Report, the company establishes as a primary principle the avoidance of loss of raw materials and food product waste, as well as consumer consumption and post-consumption, distribution, manufacturing and cultivation. To this end, it has implemented the strategy of controlling the efficiency of resources and waste obtained. That is, recovering, reusing, or recycling by-products (Nestle, 2016).

Nestlé has designed several platforms to improve resource efficiency and produce more with less waste, using technologies and processes that can optimize water or energy consumption. In this way, they have managed to reduce energy consumption by up to 25% across all product categories.

Thanks to all these measures the company has achieved 60% "zero waste" status in all its factories within 10 years

The company is willing not only to transmit this philosophy internally but also to its customers and suppliers. In fact, Nestlé carries out sustainable rural development initiatives to meet the potential needs of farmers by offering agricultural support and training programs to direct suppliers. Furthermore, it encourages society to participate in environmentally friendly practices by taking responsibility and providing training in reducing waste and food waste.

As a result, Nestlé has become part of the New Plastics Economy, in order to, according to *Nestlé en España* (2015, p. 43):

> *To deal with marine waste and participates in the Association against food waste of both Manufacturers and Distributors (AECOC). Their main objective is to reduce overproduction and protect the natural environment by raising consumer awareness of food waste, as well as improving the welfare of citizens and enhancing the quality of life.*

Another strategy aimed at transformation towards the circular economy is the introduction of new methods of packaging or sustainable packaging. They work for incorporating a type of ecological packaging that is 100% recyclable and reusable. In this way, according to data from Nestlé Global (2019), they can tackle food waste and ensure food quality and thus achieve zero net greenhouse gas emissions.

4.3.3. PepsiCo. Approach to the Circular Economy through eco-design and sustainable packaging

The company is introduced into the circular model through the development of eco-design in its packaging. Based on Greenpeace's annual assessment of the damage that plastic causes to the environment, PepsiCo has decided to introduce new designs for its product packaging made from plastics extracted from the sea. Plastic will stop being a waste product, thus boosting the circular economy and strengthening the recycling industry.

To get into the circular model, based on the interview conducted by Revista Mercado (PepsiCo, 2019) the company intends, together with the recycling industry, to develop innovative processes to strengthen the recycling system so that there is greater availability of recycled materials for future products, especially in their packaging, making possible "recycling with purpose".

The main strategy it is carrying out in the short term is to commit to 25% of its packaging being made from recycled plastics, opening up various partnerships with associations working in the world of recycling such as the Global Plastics Action Association (GPAP). According to the market magazine report (2019), "92.2% of the materials used by PepsiCo in packaging its products are recycled. By 2025, this percentage is expected to reach 100%" (Revista Mercado*:* PepsiCo, 2019, p. 1).

Encouraging packaging design with recycled plastics would not be possible if the material used is not 100% recycled. In fact, as stated in recent work (Berg 2020) great efforts are being made in this area with, for example, research into how to produce packaging from fruit skin fibres, known as Life-CitrusPack. Another innovwation developed by the company, is to manage recycling with virtual money (Portafolio, 2019).

This practice will be carried out by means of incentives and rewards for all those consumers who carry it out, since it consists of exchanging plastic waste for "ecoins", a virtual currency with which they will obtain discounts in future purchases. The aim is to make responsible use of plastics and to make society collaborate with the collection and recovery of waste.

4.3.4. Coffee Cherry CO. Approach to the Circular Economy through eco-innovation

Coffe Flour, is born as a new business model focused on the circular economy since it is based on the manufacture of flour from coffee seeds.

Indeed, while most coffee producers discard the so-called coffee cherries, which are extracted from the coffee cherries during the harvest, Coffe Flour uses them to make flour. "This type of flour has a high antioxidant content and is more nutritious than regular flour" (Galindo & Econ, 2017, p. 12).

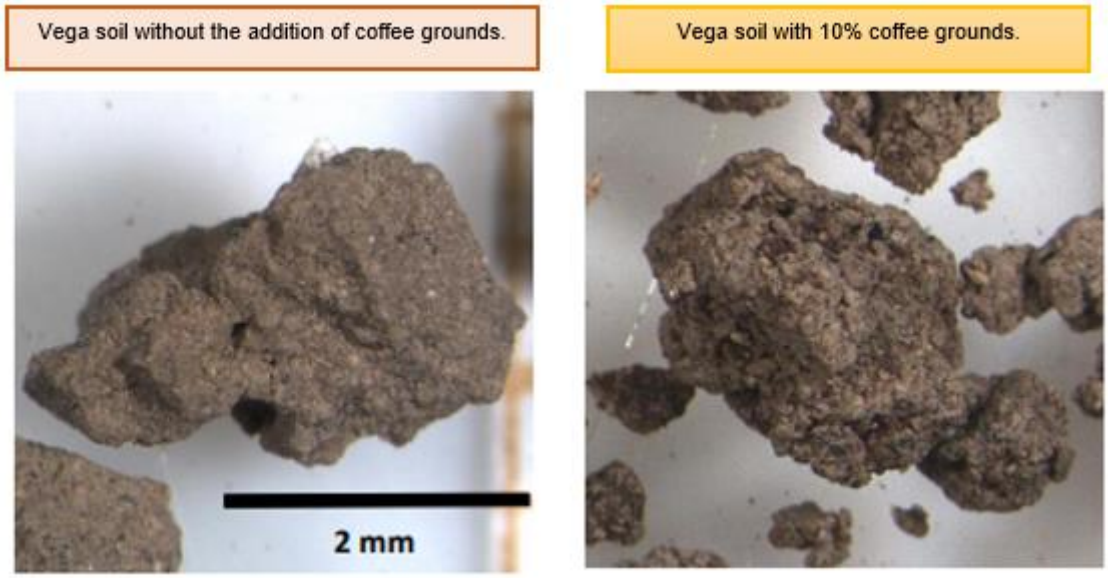
The productive process obtained through an innovation process is very simple, it consists of taking advantage of the pulp of the coffee with the intention of looking for a sustainable solution to the kilos of coffee pulp that are discarded to obtain the grain.

The intention is to incorporate the use of the pulp in the entire production process, a positive solution for the environment, favoring the reduction of waste (Sustainability - The Coffee Cherry Company, 2019).

The fact that the coffee cherries are reused and not thrown on the ground, allows the level of water pollution to be reduced, which reduces the damage that is usually caused to the soil by the existence of residues in it, favoring sustainable development and cleaner soils.

In the following illustration 11 we can compare how the coffee grounds affect the soil: on the left side we can see the soil without the coffee grounds and on the right side we can see how the soil is with 10% coffee grounds.

Illustration 11. Comparison of how waste affects the soil.



Source: (CYTED, 2020, p. 20).

This new business model originated in the framework of the circular economy, has reduced costs and its products contain antioxidant particles that favor the immune system for the human being and, with this, less fat than conventional flour (Nutrition - The Coffee Cherry Company, 2019).

5. CONCLUSIONS

As time goes by, we feel that a wish has been created in society to generate a change towards a new conception of the economic and productive models prevailing in the most developed countries. The idea is to achieve sustainable development and prevent the exhaustion of resources that are as necessary as they are limited on our planet. The circular economy is undoubtedly a new economic paradigm that bets on the future. The transition to a circular economy is a way in which the steps must be taken delicately and safely, so that we can see what the environment really needs. It is up to us whether this is done or not.

It is interesting to consider the transition to this new economic model in the field of the agro-food industry. This industry, contrary of what one might imagine, has a very important and not always positive impact on the environment and the natural resources of the planet. On the other hand, this industry is key and very important, not only for what it represents in the GDP of any economy, but also for its strategic value, as we have seen in the recent Covid-19 crisis.

The objective of this work has been to show how the new paradigm of the circular economy has impacted the Spanish agro-food sector, specifically its adaptation to existing business models and the creation of new circular models, in a way that is sustainable and respectful of the environment. We have carried out an analysis of the agro-food sector, in which we have been able to learn about both the strategies and the adaptation criteria of the circular models and, with it, the fluctuations in employment.

With this analysis, we conclude that it is important for us to focus on the circular economy, not only because the linear system of production is not sustainable, but also because it leads to a very large waste of natural resources, which do not provide common benefits. By investing in the circular economy, we allow the final waste to be converted into resources for future production, favouring social and environmental well-being. Thus, it achieves a competitive advantage that reduces dependence on external supplies.

Thanks to this study, we have also been able to see how strategies and initiatives, aimed at transforming the sector towards a more circular system, are being carried out in the agro-food sector, in particular:

(a) Energy strategies: strategies aimed at making real and effective use of the energy used in agro-food processes.
(b) Production strategies: these are based on designing clean production processes for the entire agrofood value chain.
(c) Marketing / eco-design strategies: those whose main function is to optimise the supply chain and reduce the waste generated through new packaging.
(d) Innovation strategies: they make it possible to increase the efficiency of processes with the least possible environmental impact.
(e) Collaborative strategies: their basic function is to establish relationships between companies for the green transition.

Of all these strategies analysed, some of them are, in our opinion, of vital importance. Such is the case of the strategies related to ecodesign, which allow energy efficiency during the manufacturing process of the products and, therefore, the total exploitation of the energy used. Along with these, marketing strategies, as result in the existence of biodegradable packaging, reduces the amount of waste. In the same way, the innovation strategies, which have allowed the development of artificial intelligence, facilitating progress in the management of the agro-food chain, to increase the durability of products, their reparability and recyclability. The realization of these strategies within the agro-food sector accelerates the change towards a more sustainable planet, ensuring inheritance to future generations.

In this context, in our opinion, innovation is of vital importance, in fact, we need to continue research and develop new innovative initiatives in the field of, for example, waste treatment or also in relation to improving resource efficiency. These investigations are, in our opinion, limited and instead of vital since they are the basis for the development of the circular economy in the business models of the agro-alimentary world. We cannot avoid relating the use of natural resources, which are constantly used in the agro-food industry, to environmental and social issues. One of the great problems facing the circular economy is the fact that not all products or materials are recyclable and easy to transform.

After having carried out this study, we have been able to verify that the circular economy is increasingly introduced in the agro-alimentary sector and more and more businesses perceive as necessary the development of a sustainable cycle that allows the existence and improvement of the environmental capital. However, despite this good predisposition, we have been able to observe how the transition towards the circular economy is slow due to the complexity of the agro-food transformation and product manufacturing processes. In fact, for example, in Spain the fruit and vegetable production industry are particularly relevant, where intensive production in greenhouses generates an abundant amount of vegetable waste, which is a real management problem. We think that it is necessary to continue advancing in the redesign of value chains and agro-food processes so that the transformation towards a circular economy is ever greater.

We propose, for example, to orient the innovation towards the search of new nutritional sources of natural origin, that are able to generate production in a sustainable way, as well as to the study of bioplastics to be able to reduce the use of plastics of fossil origin. There is also much work to be done in pest control, so that more sustainable and natural agriculture is possible.

In this context, management stands out as a limited and strategic waste. We need to make responsible and efficient use of water for irrigation. We have also seen that, in the agro-food sector, digitalisation is key to making the transition to a circular economy possible. This is the case with the development of collaborative platforms that have allowed for the maximum use of natural resources and the avoidance of overproduction. Intelligent devices oversee carrying out the appropriate follow-up for the control of resources and their usefulness.

Taking these factors into account, the agro-food sector has a high potential to implement the circular economy, this being one of the sectors most endowed with natural resources.

This type of initiative is made possible by innovation and technological development, which we believe will be the main drivers of change in the sector. In fact, to make the circular economy effective in the agro-food sector, it is necessary to implement measures aimed at: (a) regulating and optimizing production methods by making them more efficient; (b) designing technologies that allow for the treatment of waste from industries and its maximum reuse; (c) studying how to realize an integration of the total life cycle of the product, ranging from the extraction of raw materials to their recycling or disposal in case it is impossible to recycle or reuse; (d) providing incentives to small farmers to promote sustainability through technological development.

Finally, this work has certain limitations, such as the need to carry out a more in-depth analysis of each of the subsectors into which the Spanish agro-food industry can be divided. It is not surprising to think that the strategies and measures needed in each of these sub-sectors should be very different and according to their differential use of resources. Furthermore, the fact that circular criteria and strategies are introduced into the business models does not provide us with clear information on the maximisation of profits and reduction of the effects on the environment, so aspects such as this would need to be studied in depth.

As we have seen through this research, the circular economy is currently in full growth. We have been able to observe this when describing some initiatives that are being carried out at the level of companies such as Mahou or Pepsico among others.

However, can the circular economy really replace the linear economic model? We have seen that it can benefit both society and the natural environment more than our minds might imagine, but it is true that it still needs the support of a series of rules to make society conscious of its surroundings. Nevertheless, if these challenges are overcome and social awareness is increased, we could contemplate a total transition to circular business models.

Demonstrating its use and benefits is of vital importance for society to become aware and act, so that together we can curb the impact of climate change to which we are subjected and achieve a more environmentally friendly society. The wish for change arises from the commitment of citizens to maintain the natural environment, whether from an environmental or an economic point of view. So, if we can make this commitment a reality, we will be able to implement, in the best possible way, the new circular methods and introduce them in the business models. In this way, we will enable a transition that leads to sustainable development in which sustainable employment and thus sustainable economic growth are promoted.

The circular economy is a clear opportunity to put value on the Spanish agro-food sector, so it is important that continuous research is carried out. During this process there will not be immediate results, but if we all collaborate, the change will be real, and the results will be positive

6. LIST OF REFERENCES

Ainia. (2019). *I+D y Economía Circular, tres líneas de trabajo*. https://www.ainia.es/tecnoalimentalia/tecnologia/economia-circular/

Ainia. (2020). *Ainia-Tecnoalimentalia | Agryfood and Forestry Research and Innovation Program*. http://www.idi-a.es/en/aggregator/sources/12

AINIA. (2016). *Nuevas alternativas de tratamiento para el aprovechamiento de residuos - AINIA*. https://www.ainia.es/tecnoalimentalia/tecnologia/nuevas-alternativas-de-tratamiento-para-el-aprovechamiento-de-residuos/

AINIA. (2019a). *Economía circular en el sector alimentario, casos de éxito*. https://www.ainia.es/tecnoalimentalia/formacion/modelos-economia-circular-en-agroalimentacion-biorrefinerias/

AINIA. (2019b). *Envases innovadores contra el desperdicio de alimentos*. https://www.ainia.es/noticias/medioambiente/desperdicio-de-alimentos-y-envases/

Aquae, F. (2019). *Economía circular, esencial para la sostenibilidad | Fundación Aquae*. https://www.fundacionaquae.org/economia-circular-esencial-la-sostenibilidad/

Balboa C., C. H., & Domínguez Somonte, M. (2014). Circular economy as an ecodesign framework: the ECO III model. *Informador Técnico*, *78*(1), 82. https://doi.org/10.23850/22565035.71

Berg, E. van der. (2020). *Ecodiseño: los envases del futuro*. https://www.nationalgeographic.com.es/mundo-ng/ecodiseno-envases-futuro_15100

BIOPLAT & GEOPLAT. (2016). *Guía Práctica: Oportunidades de financiación para tecnologías y proyectos de bioenergía y geotermia*. 64.

Braulio, J. (2020). *LLEGÓ EL COVID19, PARA QUE NADA VUELVA A SER IGUAL. | Eco-Circular.com: Noticias de economía circular*. https://eco-circular.com/2020/03/24/llego-el-covid19-para-que-nada-vuelva-a-ser-igual/

Canu, M. E. (2017). *ECONOMIA CIRCULAR Y SOSTENIBILIDAD*.

Castaño, M. L., & Energía, D. De. (2019). *Economía Circular : una visión inteligente g p para el sector energético g I Cumbre de Innovación Tecnológica y Economía Circular*.

Cerdá, E. (2018). *ECONOMÍA CIRCULAR, ESTRATEGIA Y COMPETITIVIDAD EMPRESARIAL ECONOMÍA CIRCULAR*.

Competitivo, R. (2018). *Plan de Impulso a la Bioeconomía*. 1–34. http://www.itacyl.es/documents/20143/0/PlanImpulsoBioeconomiaAgroalimentaria_2019.pdf/34554980-e0c5-bcca-6420-b5c8ec857cd8

CYTED. (2020). *Oportunidades de financiación para tecnologías y proyectos de bioenergía y geotermia*. https://www.enerinvest.es/docs/recursos/guia-instrumentos-financiacion-nov-2016-geoplat-y-bioplat.pdf

Ellen MacArthur. (2014). *HACIA UNA ECONOMÍA CIRCULAR: MOTIVOS ECONÓMICOS PARA UNA TRANSICIÓN ACELERADA*. https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Executive_summary_SP.pdf

Ellen MacArthur Foundation. (2019). Artificial Intelligence and the Circular Economy: Ai As a Tool To Accelerate. *Report*, 39. https://www.ellenmacarthurfoundation.org/publications/artificial-intelligence-and-the-circular-economy

EMF. (2016). Circular Economy Policy tool kit. *Nature*, *531*(24 March 2016), 435–438. http://www.nature.com/news/the-circular-economy-1.19594

Espa, E., & Econom, O. L. A. D. E. (2018). *MINECO, MAPAMA. España Circular 2030. Estrategia Española de Economía Circular*.

F&H. (2020). *CADENA ALIMENTARIA*. www.fyh.es/simposio

FAO. (2015). *InIcIatIva mundIal sobre la reduccIón de la pérdIda y el desperdIcIo de allmentos 2 0 1 5*. http://cait.wri.org

Feng, Zhijun,.Yan, N. (2007). *Putting a circular economy into practice in China*. https://doi.org/10.1007/s11625-006-0018-1

Fondevila, J. F., & del Olmo Arriaga, J. L. i G. (2013). *El trabajo de fin de grado en ciencias sociales y jurídicas: guía metodológica*. Ediciones Internacionales Universitarias.

Galindo, M. A., & Econ, E. (2017). *Sector agroalimentario*. 2–64.

IHOBE. (2019). *Estrategia Circular*. https://www.euskadi.eus/contenidos/informacion/economia_circular/es_def/adjuntos/EstrategiaEconomiaCircular2030.pdf

INE. (2019). *España en cifras*. http://www.ine.es/prodyser/espa_cifras

Innovación y Compromiso - Mahou San Miguel. (2019). https://www.mahou-sanmiguel.com/es-es/sostenibilidad

ITEL. (2019). *INTRODUCCION A LOS PRINCIPIOS DE LA ECONOMIA CIRCULAR Y DE LA SOSTENIBILIDAD*. https://www.itelspain.com/files/pagina/pdf/20170925100953.pdf

IVEM. (2010). http://www.ivem.es/proyecto-lo2x.html

Jimenez, K., De, S. U., Aplicadas, C., & Ambientales, Y. (2017). *LA IMPLEMENTACION: ECONOMIA CIRCULAR, PROCESOS COMERCIALES Y MARKETING*.

John Tillman Lyle. (1994). *Regenerative Design for Sustainable Development - John Tillman Lyle - Google Libros*. https://books.google.es/books?hl=es&lr=&id=qB3v3gYofSUC&oi=fnd&pg=PP13&ots=Dcgkjr9I9b&sig=KBQXuMeTXDspml2oykz2Ea-ZvGA&redir_esc=y#v=onepage&q&f=false

Kenneth E. Boulding. (1966). *The Economics of the Coming Spaceship Earth*.

Lewandowski, M. (2016). Designing the business models for circular economy-towards the conceptual framework. *Sustainability (Switzerland)*, *8*(1), 1–28. https://doi.org/10.3390/su8010043

Macarthur, E. (2016). *Founding Partners of the TOWARDS THE CIRCULAR ECONOMY Economic and business rationale for an accelerated transition*.

MacArthur, E. (2013). *Founding Partners of the Ellen MacArthur Foundation 2013 CIRCULAR ECONOMY TOWARDS THE Economic and business rationale for an accelerated transition*.

Mahou-San Miguel. (2020). www.laboratorioecoinnovacion.com

Maudos, J. (2018). *Sector agroalimentario español*.

Mercaolid. (2020). Noticias. *Sector Agroalimentario*. http://mercaolid.es/?page_id=8751

Ministerio de Agricultura y Pesca. (2018). *Estrategia española Economía Circular*.

Miteco. (2020). *Estudio Ambiental Estratégico Plan Nacional Integrado De Energía Y Clima 2021-2030*. https://energia.gob.es/es-es/Participacion/Paginas/DetalleParticipacionPublica.aspx?k=236

Moreno, J., Sge, R. De, & Parodi, J. (2015). *Dirección de proyectos y contenidos*. www.foretica.org

Naciones Unidas. (2019). https://unesdoc.unesco.org/ark:/48223/pf0000367304?locale=en

Nestle. (2016). *Resumen de rendimiento*. https://www.nestle.com/sites/default/files/asset-library/documents/library/documents/corporate_social_responsibility/nestle-in-society-summary-report-2016-es.pdf

Nestlé en España. (2015). https://empresa.nestle.es/sites/g/files/pydnoa431/files/nestle-en-espana-hechos-relevantes-2015_0.pdf

Nestlé Global. (2019). https://www.nestle.com/media/news/nestle-pledges-to-reduce-food-loss-and-waste

Nutrition - The Coffee Cherry Company. (2019). https://coffeecherryco.com/nutrition/

Ochoa Duarte, A., Cangrejo, L., & Pachón, A. (2012). *Actualidad y tendencias de la Agricultura de Precisión*. *December 2012*, 0–14. https://pdfs.semanticscholar.org/e914/d431520f4cb60b9d80b123f7d43782c1aba8.pdf

Packer. (2004). *La ciencia de la investigación cualitativa - Packer, Martin - Google Libros*. https://books.google.es/books?id=1kiyDwAAQBAJ&printsec=frontcover&dq=libro+lather+p.+2004+investigacion+cualitativa&hl=es&sa=X&ved=0ahUKEwi948zP0PfoAhURzYUKHREcBNAQ6AEIODAC#v=onepage&q&f=false

Pardos M. (2018). *La economía circular en el sector agroalimentario*. 56–61. https://www.otroconsumoposible.es/publicacion/economia-circular.pdf

Pascual, A., Regueiro, L., & Silvestre, G. (2015). Evolución de las plantas de biogás agroindustrial hacia nuevos modelos basados en el concepto de biorefinería. *Retema: Revista Técnica de Medio Ambiente, ISSN 1130-9881, Año Nº 28, Nº 185, 2015, Págs. 34-40*, *28*(185), 34–40. https://dialnet.unirioja.es/servlet/articulo?codigo=5212093

Planing, P. (2014). Business Model Innovation in a Circular Economy Reasons for Non-Acceptance of Circular Business Models. *Open Journal of Business Model Innovation*, *April*, 1–11.

Portafolio. (2019). *PepsiCo promoverá el reciclaje con dinero virtual | Tendencias | Portafolio*. https://www.portafolio.co/tendencias/pepsico-promovera-el-reciclaje-con-dinero-virtual-527638

Portela, J. R., & Abelleira-Pereira, J. M. (2010). *Oxidación en agua supercrítica: una tecnología prometedora más cerca de ser implantada Energy production from wet biomass wastes by hydrothermal processes View project*. https://www.researchgate.net/publication/275521443

Qiao, F., & Qiao, N. (2013). *Prakseologia nr 154/2013 253 Circular Economy: An Ethical and Sustainable Economic Development Model*. *154*, 253–272. http://cejsh.icm.edu.pl/cejsh/element/bwmeta1.element.desklight-3ccfe695-bab5-47e5-a5ad-2499ce994f4d/c/Prakseologia_154_2013_s.253_272.pdf

Ramkumar, S., Kraanen, F., Plomp, R., Edgerton, B., Walrecht, A., Baer, I., & Hirsch, P. (2018). Linear Risks. *Circle Economy*, 14. https://www.circle-economy.com/wp-content/uploads/2018/06/FINAL-linear-risk-20180613.pdf

Revista Mercado: PepsiCo. (2019). https://mercado.com.ar/protagonistas/pepsico-reciclaje-con-proposito/

Ribera, T. (2019). *“Cambio climático y biodiversidad. Hacia una revolución del sistema alimentario.”*

Ricardo, E. (2019). *La inteligencia artificial puede acelerar la transición hacia la economía circular - ecointeligencia - cambia a un estilo de vida sostenible!* https://www.ecointeligencia.com/2019/02/inteligencia-artificial-economia-circular/

Rico, J. (2019). *Biomasa - La investigación europea en bioenergía diseña una senda para contribuir a descarbonizar con sostenibilidad - Energías Renovables, el periodismo de las energías limpias.*

RobecoSAM. (2018). *Así es la nueva estrategia de RobecoSAM para invertir en la transformación del sector agroalimentario - Valencia Plaza*. https://valenciaplaza.com/asi-es-la-nueva-estrategia-de-robecosam-para-invertir-en-la-transformacion-del-sector-agroalimentario

Robert K Yin, D. Y. (2003). *INVESTIGACION SOBRE ESTUDIO DE CASOS*. www.pdffactory.com

Storup, K., Mattfolk, K., Voinea, D., Jakobsen, B., Bain, M., Reverté i Casas, M. E., & Oliveira, P. (2016). *La lucha contra el despilfarro de alimentos: una oportunidad para la UE de hacer más eficiente el empleo de recursos en la cadena de suministro alimentario*. https://www.eca.europa.eu/Lists/ECADocuments/SR16_34/SR_FOOD_WASTE_ES.pdf

Sustainability - The Coffee Cherry Company. (2019). https://coffeecherryco.com/sustainability/

Tecnológico, F. (2018). *I FÓRUM TECNOLÓGICO: Impulsar el desarrollo del gas renovable en España*.

Van Houten, F. (2017). *Economía Circular | AMBIAFME*. http://ambiafme.es/economia-circular

(WBCSD). (2019). https://www.wbcsd.org/

Yin, R. K. (1989). *Case Study Research, Design and Methods*. Sage.