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Circular Economy in the agri-food sector: a policy overview

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Abstract. Agri-food is the second manufacturing sector in Italy, due to its strategic nature. However, it is affected by several problematics, and one of the most severe is the generation of wastes and by-products. The circular economy could be a winning approach to improve the sustainability of the food supply chain. The objective of this paper is to provide an overview of the current policy situation in Europe, with a focus on Italy. The history of circular economy policies in Europe started recently, and is continuing nowadays with the New Circular Economy Action Plan. Italy is in the top position for circularity, even if it has not yet implemented a proper circular economy policy. Future actions should concentrate on developing innovative circular models for the agri-food sector.

Keywords: circular economy, agri-food sector; sustainability, policy framework, Covid-19, circular business model.

JEL codes: L66, O13, Q18.

1. INTRODUCTION

The Covid-19 pandemic is causing a worldwide crisis, with cascading effects on the entire economic system. The growing spread of the virus has prompted governments around the world to introduce exceptional measures for its containment, such as the temporary closure of companies and businesses, which have inevitable consequences on economic and financial markets. Apparently the agri-food sector is not among the most affected, at least directly, by these measures, even if numerous factors intervene to modify the market equilibrium (De Maria *et al.*, 2020). Indeed, when compared to other Italian economic sectors, it has not suffered serious negative effects from the emergency linked to the pandemic. Its nature of strategic and essential compartment meant that most of the activities were not destined for direct closure, limiting the damages. However, it is highlighted that the virus has bequeathed some changes which, in all likelihood will last, like the attention to the *Made in Italy*, the territory, convenience, health and environmental protection and sustainability (ICESP, 2020; Nomisma, 2020). Facing these new needs will be a challenge for companies, and they will have to confront the difficulties and problems of the supply chain, to strengthen their position on the market, becoming more resilient. Among the problems, one of

the most impacting is the production of wastes. In fact, the agri-food sector is responsible for the generation of a large quantity of highly polluting waste materials, rich in valuable organic matter and moisture (Donner and de Vries, 2021). Reducing food waste has enormous potential for reducing the resources we use to produce the food we eat. Fighting food waste is a triple win: it saves food for human consumption, helps farmers, companies and consumers to save money, and lowers the environmental impact of food production and consumption, affecting the three aspects of sustainability, social – economic – environmental (Stenmarck *et al.*, 2016; Finco *et al.*, 2018).

According to the Fusion report of 2016, approximately 88 million tons of food waste are generated each year in the European Union, with associated costs estimated at 143 billion euros, of which around 31 million tonnes derive from the primary production, processing, wholesale and retail. In Italy, according to the latest ISPRA report on special waste (2021), more than 3 million tonnes of wastes were generated in 2019 from the food and beverage industry, corresponding to 11% of the total amount of waste produced by the manufacturing sector, and more than 300,000 tonnes of waste came from agricultural activities (agriculture, forestry and fishing). Losses and wastes occur along the whole supply chain (Gustavsson *et al.*, 2011), and all stakeholders have a role to play in the prevention and reduction of food waste, from those who produce and process food to those who make it available for consumption and, finally, the policy makers and authorities. Consumers too can influence the industry's behaviour, by demanding more sustainable processes (Cembalo *et al.*, 2020). Besides, consumers are directly involved by their personal attitude towards food waste (Marangon *et al.*, 2014). Rethinking the current production and consumption models and the transformation of waste into added value products need to be based on new technologies, processes, services and entrepreneurial systems that will shape the future of the global economy and society. From this perspective, the circular economy (CE) represents a game changer for the agri-food sector (Chiaraluca *et al.*, 2021). Agriculture is already involved in the circular process, as in the case of the production of biogas and digestate. On the other hand, the food industry requires much more attention and research. Agricultural and food wastes possess a huge potential to be exploited, in terms of recovery of nutrients, compounds and materials for different purposes (nutraceutical, functional foods, energy production, packaging materials) (Mirabella *et al.*, 2014). However, proper circular business models need to be established, as the agri-food sector is somehow obliged to innovate itself towards new con-

figurations, in order to close material loops and switch to a circular model (Donner *et al.*, 2020). Moreover, supply chains are complex systems that need to be fully involved in circular models, developing circular supply networks (Braz, Marotti de Mello, 2022).

In this context, the policy makers, national laws and Union regulations have an important role to guide the transition, developing resilient supply chains and sustainable businesses from the perspectives of management, technological aspects and policy perspectives (Luthra *et al.*, 2021). To our knowledge, there is a lack of papers dealing with the current political situation in Europe about the circular economy (Zarbà *et al.*, 2021). In our opinion, a summary of what Europe has done in this field could be useful for future improvement and to concretely support who wishes to face the challenges of changing the agricultural production economic model from a linear to a circular system. For this purpose, this paper aims to analyse the current policy framework regarding CE in the European Union, with a specific focus on the Italian situation. The general situation will be considered, as there are no specific norms regarding the agri-food sector. The article is organised in the following structure: section 2 describes the circular concept, section 3 analyses European policies, section 4 reports what Italy is currently doing and section 5 summarises the conclusions.

2. THE CIRCULAR CONCEPT

The concept of CE dates back in the 1980-1990s in Europe, through the work of Pierce and Turner (McDowall *et al.*, 2017). However, it is gaining increasing attention as a sustainable alternative to the traditional linear economic model “take, make, use, dispose” (Ellen MacArthur Foundation, 2015; Ghisellini *et al.*, 2016). Kirchherr *et al.* (2017) attempted to organise the blurriness that surrounds the concepts as, even if it is of great interest to both scholars and practitioners as a way to practically implement sustainable development, there is not a unique commonly accepted definition and CE means many different things to different people. In general, most authors insist on the so called “3R” principle – reduce, reuse, recycle, decoupling economic growth from resource consumption (Dupont-Inglis, 2015), in an industrial system that is itself restorative or regenerative (Ellen MacArthur Foundation, 2015). However, it is important to underline that circular economy and sustainability are not synonyms. While CE is a “regenerative system in which resource input and waste, emission, and energy leakage are minimised by closing mate-

rial and energy loops”, sustainability is a wider notion related to the “balanced integration of economic performance, social inclusiveness, and environmental resilience, to the benefit of current and future generations” (Geissdoerfer *et al.*, 2017). CE could be a concrete way to reach sustainable development, but the application of a circular model does not represent the guarantee of a sustainable process. Circular economy is also not a synonym of bioeconomy: indeed, the bioeconomy is “an economy where the basic building blocks for materials, chemicals and energy are derived from renewable biological resources” (McCormick, Kautto, 2013).

When transferring the concept of CE to the agricultural sector, a preliminary definition can be «a set of activities intended to not only ensure economic, environmental and social sustainability through practices that pursue the efficient and effective use of resources in all phases of the value chain, but also guarantee the regeneration of and biodiversity in agro- and surrounding ecosystems (Velasco-Muñoz *et al.*, 2021)».

3. THE EUROPEAN POLICY FRAMEWORK

The EU is strongly working on a modern, resource efficient and competitive economy through the circular model (European Commission, 2015). The European Parliament considers the CE as a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended, wastes are reduced to a minimum and it is possible to create further value.

The history of circular economy policies in Europe is quite recent. One of the first mentions is in a Communication of 2011 related to the efficient use of resources in Europe. One of the components identified to support European efforts in making substantial changes was the circular economy with the aim of reducing waste generation and using waste as a resource. Then, in 2014, with the Communication “Towards a circular economy: A zero waste programme for Europe”, the EU concretely posed the circular economy as the focal point to rise to challenges of global pressure on resources, by helping to decouple economic growth from resource use, to foresee a long-lasting sustainable growth. In these documents, the European Commission set up a series of measures (like establishing a new policy framework, unlocking investments, modernising waste policies) to be adopted in order to promote resource efficiency and implement a circular system, to keep the added value in products for as long as possible and eliminate waste.

The renewal pathway continued in 2015 with the publication of the first Circular Economy Action Plan, to give a new boost to jobs, growth and investment and to develop a carbon neutral, resource-efficient and competitive economy. The Action Plan sets out a policy framework that builds on and integrates existing policies and legal instruments, outlining a solid and ambitious mandate to sustain the transition towards the circular model, in order to be in line, by 2030, with the Sustainable Development Goals (SDGs) defined by the United Nations (in particular, SDG 12: Sustainable Consumption and Production).

In summary, the measures of the plan focused on:

- sustainable production (design and process);
- sustainable consumption, aiming to sensitise consumers on the themes of sustainability and waste reduction;
- better waste management, with consistent modification to the regulations of that time;
- investment in innovation and research.

Furthermore, some priority areas were identified in the plan (plastics, food waste, critical raw materials, construction and demolition biomass and bio-based products), and a set of objectives were defined for each area. In the case of food wastes, in 2015 the European Union asked for:

- the development of a common methodology to measure food waste and define relevant indicators, also creating a platform involving Member States and stakeholders;
- clarification of the legislation relating to waste, food and feed, also facilitating food donation and the use of former foodstuffs and by-products from the food chain in feed production without compromising food and feed safety;
- improvement of the use of date marking by actors in the food chain and its understanding by consumers, in particular the “best before” label.

According to these specific objectives, in 2016 the Commission launched the European Platform on Food Losses and Waste, aiming to share the best practices and develop a common methodology and indicators to measure food wastes (European Commission, 2017).

To accelerate the transition, the European Commission included in the plan the necessity to engage with stakeholders (public authorities, businesses, trade unions, consumers and civil society) to support the exchange of good practices. Following this principle, in March 2017 the European Circular Economy Stakeholder Platform (ECESP) was born as a joint initiative by the European Commission and the European Economic and Social Committee (EESC). The two institutions

work together to promote the Platform as a space for the exchange of ideas and information, to make the circular economy happen faster.

As a consequence of the strong interest of the EU to become the leader in guiding the global sustainable transition, in 2018 four amending Directives forming the so-called “Circular Economy Package” were published in the Official Journal of the European Union. Those directives were particularly addressed to end-of-life vehicles, batteries, accumulators and electronic devices (dir. (EU) 2018/849), landfill of waste (dir. (EU) 2018/850), on waste in general (dir. (EU) 2018/851) and on packaging and packaging waste (dir. (EU) 2018/852). There is not a specific directive on agricultural and food wastes; however, it is worth mentioning that dir. (EU) 2018/851, amending the so-called “Waste Framework Directive” (dir. (EU) 2008/98), also contains a series of definitions. In particular, for the scope of this paper:

- “bio waste” means biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesalers, canteens, caterers and retail premises and comparable waste from food processing plants;
- “food waste” means all food as defined in Article 2 of reg. (EC) 178/2002 (“General Food Law”) of the European Parliament and of the Council, that has become waste.

Also, there is the concept of “by-product”. In the literature, when referring to the agri-food sector, the border between waste and by-product is always labile, but from a regulatory point of view the concepts are different. While a waste is something that should be or is intended to be discarded, a by-product is a substance resulting from a production process where the primary aim is not the production of that substance. Consequently, a by-product should not be considered as waste.

In December 2019, the European Commission published the European Green Deal, a new growing strategy, aiming to transform Europe into a fair and prosperous society, with a modern, resource-efficient and competitive economy, where economic growth is decoupled from resource use. The European Green Deal sets out important new objectives in terms of circularity, as it offers great potential for new activities and jobs. At the heart of the European Green Deal, there is also the Farm to Fork Strategy (F2F), launched in May 2020, to address the challenges of a sustainable food system and promote new ways to improve it. As reported in the strategy, the transition to a sustainable food system is a huge economic opportunity to boost competitiveness. In order to ensure a sustainable production, new green business models should be developed, and the circular economy

has potential for the farmers and industry. The F2F proposes the spread of renewable energy obtained from agricultural and waste residues, to scale-up and promote sustainable and socially responsible production methods and circular business models in food processing and retail (in particular, for Small and Medium Enterprises – SMEs). The deployment of a circular and sustainable European economy can provide new business opportunities, linked in particular to making use of the food waste.

However, it was evident that the transformation was taking place at too slow a pace with progress neither widespread nor uniform. Therefore, following the fast-forward approach required by the Green Deal, in 2019 the European Commission published a report to declare the Circular Economy Action Plan completed, meaning that the expected 54 actions had been implemented or some were continuing beyond 2019. Following the conclusions of the report, the plan’s realisation accelerated the transition towards a circular economy in Europe, contributing to job creation, opening up new business opportunities and generating almost 147 billion Euros in added value.

In the face of this, and to fulfil the objectives established by the European Green Deal, in March 2020 the New Circular Economy Action Plan was released (CEAP). The CEAP resumes the aspects already considered in the previous plan (designing sustainable products, consumer involvement, circularity in productive processes), reinforcing them by making sustainable products the norm in the EU, empowerment and accountability of the consumers, ensuring less waste, enhancing circularity for people, regions and cities, making Europe the global leader in guiding the circular transition. The priority areas changed slightly (electronics and ICT, batteries and vehicles, packaging, plastics, textiles, construction and buildings, food water and nutrients). In the case of food, the European Union is now working on:

- a target definition on food waste reduction (strictly connected with the F2F Strategy);
- substituting single-use packaging, tableware and cutlery with reusable products in food services;
- facilitating water reuse and efficiency, including in industrial processes;
- the development of an Integrated Nutrient Management Plan, to stimulate the markets for recovered nutrients;
- reviewing directives on wastewater treatment and sewage sludge.

4. THE ITALIAN SITUATION

It is important to underline that Italy is in the top position for circularity in Europe (Circular Economy Network, 2021), even if it has not yet implemented a proper circular economy. Only a preliminary act “Towards a circular economy model for Italy” exists, dated back in 2017. The same year, the Bioeconomy Strategy was published. It was born in the wake of the European First Circular Economy Action Plan, aiming to implement sustainable production, through the exploitation of renewable resources and valorisation of wastes, to enhance Italian competitiveness and its leading role as a promoter of sustainable growth in Europe. The Strategy is focused on the cohesive integration of the bioeconomy and circular economy principles, to make business economically sustainable in the long term.

However, the national government is also adopting the European Directives coming from the Circular Economy Package through Legislative Decrees: Leg. Decree 116/2020 implements dir. 2018/851 and 2018/852 on waste and waste packaging; Leg. Decrees 119/2020 and 118/2020 implement article 1 and article 2 and 3 of dir. 2018/849 on batteries and electrical devices respectively; Leg. Decree 121/2020 implements dir. 2018/850 on landfill. Making a parallel with the European Directives, there is not a specific Decree referring to the agricultural sector. However, if searching for specific agri-food references, the Leg. Decree 116/2020 reports that, to promote the prevention of waste production, the National Waste Prevention Programme is adopted. Since 2013, the programme identifies specific indicators and qualitative objectives to evaluate effective waste prevention. In particular, regarding the agri-food sector, it encourages the production of waste along the entire food supply chain, it defines specific measures for the utilisation of agro-industry by-products, promotion of the short food supply chain to also favour the donation of exceeded products, incentive for the Ho.Re.Ca. channel to apply for an environmental certification, and minimisation of household food waste. For the bio wastes, the Regions and Autonomous Provinces shall favour their recycling and composting, to guarantee a high level of protection of the environment, in line with the European standards.

On the other side, the definition of by-product can be found in Decree 264/2016, which harks back to Leg. Decree 152/2006. A by-product is not a waste if:

- the substance is the result of a production process the primary aim of which is not the production of that particular substance;
- the substance will certainly be used in other processes;

- the substance can be used without any further transformation different from the industrial processing;
- the further use is legal.

The concept of by-product must not be confused with the end-of-waste status. Following article 184-ter of Leg. Decree 152/2006, a waste loses its status when subjected to recovery operations, including recycling and re-use, and if satisfies specific conditions:

- the substance is commonly used for specific purposes;
- a market or a demand exists for that specific substance;
- the substance complies with regulations and standards and meets specific requirements;
- the use of the substance is not harmful for human health.

The main difference between the two is that a by-product is never recognised as a waste, while the end-of-waste status is a requalification of a product or a substance which was initially intended to be discarded. For companies, it is important to have clear definitions and differentiations among these concepts, to facilitate the process of recovery, valorisation and re-use in a circular system. This fact is also connected with the so-called waste hierarchy: according to article 179 of Leg. Decree 152/2006, the final destination of a waste shall be chosen in accordance with the hierarchy, established to guarantee the best environmental solution. In detail, the management is done in order to prevent the generation of huge quantities of wastes; when this is not possible, wastes should be prepared to be re-used or recycled. When the recovery cannot be done (for example, organic and food wastes cannot simply be re-used as they are), energy production is a possible solution as an alternative recovery system. When none of the aforementioned solutions is possible, wastes should be disposed of.

Finally, in line with the actions undertaken by the EU, in 2018 the Italian Circular Economy Stakeholder Platform (ICESP) was created, as a mirror platform of ECESP.

It is worth remembering also that, as a consequence of the Covid-19 pandemic, Italy is now involved in the management of the National Recovery and Resilience Plan (NRRP), as requested by the European Commission with the Next Generation EU. One of the pillars of this instrument is the ecological and green transition, based also on sustainable agriculture and a circular economy. Most of the resources will be invested in this mission, planning to improve waste management and increment the production and use of renewable energy (also from agricultural scraps), involving the entire supply chain.

5. DISCUSSION AND CONCLUSIONS

Agriculture and the food industry have a huge potential in the context of a circular economy, from the efficient management of resources, valorisation and reuse of by-products and wastes, as well as the production of bioenergy and bioproducts through the adoption of sustainable production models. However, the transition from a traditional linear to a circular model is only at its dawn, and future efforts should be put into establishing strong measures and figures to guide the process. However, as described by Donner *et al.* (2020), the implementation of a circular economy requires radical changes, and the authors identified six examples of circular business models for waste valorisation: biogas plant; upcycling entrepreneurship; environmental refinery; agricultural cooperative; agropark; support structure. Following this recent classification, it is possible to say that the Italian propensity to circularity is reflected in the agri-food sector, where forward-thinking entrepreneurs already apply an innovative business model (Hamam *et al.*, 2021). From the production of renewable energy from scraps, to the recovery of highly valuable compounds from fruit skins and processing residues, Italian food and agricultural companies are trying to establish a leadership role in guiding the country towards a new, sustainable economy. While innovative models can be driven by economic reasons, or environment preservation, rather than social responsibility or initiatives of enterprising persons, technological, political and legal difficulties can create barriers interfering with the economic viability (Donner, de Vries, 2021). In synthesis, the strength of an innovative circular model in the agri-food sector is the substantial availability of high quality raw material, that can lead to the obtaining of high quality products (like functional foods) and the subsequential reduction of wastes. The scarce presence on the territory of industrial symbiosis, as well as a regulatory framework not completely delineated represent the weaknesses of the model. In addition, qualified figures are missing, to guide not only the industrial transition but also the consumer, who cannot be prone to accept products based on wastes. The exploitation of scraps as secondary raw material represents a great opportunity not only in the food sector, but also for others like textiles, construction and packaging. It contributes to job creation through new niche businesses for a more sustainable economy, of particular importance after the pandemic. Nonetheless, this transition will have a cost, which represents a huge barrier for the enterprises, as well as the fear and scepticism of consumers, who receive misleading and confusing information.

It is worth remembering that sustainability has three aspects: environmental, economic and social. When debating about the circular economy, the environmental and economic dimensions are always at the heart of the evaluation, while the social commitment is sporadically integrated. To achieve a real sustainable development, the three dimensions should not be decoupled, and the circular economy, through collaboration, education and new job opportunities, can have an important role (Mies, Gold, 2021).

This study showed that specific European and Italian policies for the application of the circular model in the agri-food sector are lacking. Nevertheless, analysing the single documents, it is possible to find elements attributable also to agriculture. This is because the agriculture and food sectors are at the basis of the Union economy, always connected with the other, even distant, supply chains. Also for this reason, industrial symbiosis, where the waste from one becomes the resource of another, is essential in order to favour the transition towards a circular model. The European Union, through tools like the Rural Development Policy and the work of Operational Groups and LEADER actions, have to speed up and encourage the shift towards CE with practical engagements, instilling consciousness about the importance of a system sustainable in all its aspects (economic, social, environmental). This will be possible only with the admixture of intents between EU and Member States. Italy, on its side, should favour the circular transition through specific legal acts and economic incentives, supporting and awarding Regional programmes or independent proposals. The spread of innovative business models, as well as industrial symbiosis, will help to reach an economically, environmentally and socially feasible sustainable development. Future research should focus on the implementation of new circular business models, with the development of case studies alongside the agri-food supply chain.

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