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**Innovation for
Sustainability in EU
policies: a
qualitative analysis
of academic papers**

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Executive Summary

This work will try to investigate the sustainability concept within the European Union framework and its relationship with innovation. Innovation is a key determinant and element to foster sustainable growth for the future of Europe, European inhabitants, and its global competitiveness. The main focus of the work is the academic discourse that links the European Green Deal, Horizon 2020, and Horizon Europe with sustainable innovation and the role of the latter in achieving a European sustainable transition. In doing so, the goal is to understand also the pillars, the key elements and limitations of the European policies, and the expected sustainable innovation in the future of the EU context. A SLR, according to the PRISMA scheme, is the methodology chosen to answer the research question.

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List of Abbreviations

ABM	Agent-Based Model
AI	Artificial Intelligence
CAP	Common Agricultural Policy
CAP	Responsible Research and Innovation
DNSH	Do Not Significant Harm
EC	European Commission
EGD	European Green Deal
EGDIP	European Green Deal Investment Plan
EIB	European Investment Bank
EIS	European Industrial Strategy
ERC	European Research Council
EU	European Union
GDP	Gross Domestic Product
JTF	Just Transition Fund
LCA	Life Cycle Assessment
LCC	Life Cycle Costing
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
R&D	Research and Development
SFSCs	Short Food Supply Chains
SLR	Systematic Literature Review
SMEs	Small and Medium Enterprises
UN	United Nations

1. Introduction

Since the first industrial revolution, the world faced an industrial era of growth and progress. Society undergoes a significant transformation and the world witnessed innovation, technological progress, demographic growth, and, needless to say, a general improvement in everyday life quality. The economic model used during the industrial revolution was the linear economy. The linear economy is a traditional economic model where resources and raw materials are converted in the production process, producing at the end of it waste (Murray et al., 2017). Murray et al. (2017) also state that this growth is unsustainable in the long run, because of the over-exploitation of natural resources, which is leading to the loss of biodiversity, and climate change, who is triggering the current and future generations. There is therefore the need to pursue sustainable growth.

In particular, focusing on the European framework and the actions taken by the European Union, it is possible to observe that different policies and strategies have been undertaken in order to promote green and sustainable growth for the future of Europe. To this extent, the European Green Deal is the new EU strategy to tackle climate change and address the current global changes, while at the same, the goal is to foster in this way a competitive Europe (Brudermüller et al., 2021). Always according to Brudermüller et al. (2021), the EGD, in particular, will support the shift toward a low-carbon economy, and the use of sustainable resources, and it plans to overcome them bringing together the tackle of climate change and the achievement of a sustainable transition. In achieving a long-term green transition, Europe should reduce the negative externalities produced and promote growth and competitiveness based on sustainable solutions. A key concept to point out is that economic prosperity and sustainability are not mutually exclusive, therefore a win-win position is achievable (Yang et al., 2022; Boons et al., 2013). The European Green Deal has a strong connection with European innovation policies. More particularly, in this work, Horizon 2020 and Horizon Europe are taken into consideration. Horizon 2020 was the EU policy to support and spread innovation for the period 2014-2020, while Horizon Europe is its successor. Both programs are composed of three main pillars, which identify the main action areas and the main allocation of financial resources (European Commission, 2021). Particularly, Horizon Europe is designed to support the spread of innovation throughout Europe to reach the objectives of the EGD (European Commission & Directorate-General of Research and Innovation, 2021).

Given the ambitions of the EU, thus the sustainable transformation of the European economy and society (European Commission, 2019), different aspects must be considered in this framework. Among them, it is possible to find the types of innovation expected, the societal response to it, the role of stakeholders involved, the industrial sector, the impact that EGD and the sustainable transition will have on it and the contribution of Horizon Europe.

The aim of this paper is to understand the linkages among the three policies above mentioned and the impact they should and could have. More precisely, the point of focus will be not only on analyzing the policies but try to understand the linkages and connections between them and sustainable innovation. In light of what has been said, the research question of the present work is:

- What is the academic discourse that links EGD, H2020, and Horizon Europe with sustainable innovation?

Furthermore, the work aims to answer also to two different subquestions, which aim is to enrich the main research question and at the same time to provide a better and broader understanding:

- What are the drivers and obstacles to innovation toward a sustainable future for Europe?
- What role does sustainable innovation play to achieve the objectives of the European Green Deal, Horizon 2020, and Horizon Europe?

To assist and support the research questions, some objectives have been set at the beginning of the work to further get the main points of the discussion and, at the same time, treat the relevant connected topics. Thence, the research objectives are:

- Identification of the pillars and main components of the EGD, Horizon 2020, and Horizon Europe;
- Understanding of potential limitations of EGD, Horizon 2020, and Horizon Europe;
- Understanding of the innovations that are more plausible to expect within the European context;
- Identification of European industries that might lead the sustainable transition.

The work will start with a conceptual background chapter. In this way, the main theoretical concepts will be explained to have a better understanding of the topic, as well as the right notions to understand the discussion at the center of the work. Initially, sustainable transitions and sustainable innovation will be the main concept explained. In doing so, the definitions and characteristics of these notions will be presented, as well as the main concepts related to them. The overview of the three EU policies, before mentioned, will follow. Alongside a general presentation of the EGD, the real heart of the present work, there will be an explanation of the general eight elements of the EGD and the complementary elements as well, such as the financial part and the inclusive concept of leaving no one behind. Since one of the main targets of the EGD is to foster innovation across Europe (European Commission, 2019), Horizon 2020 and Horizon Europe will be presented as well. The third chapter deals with the methodology chosen, a Systematic Literature Review done using the PRISMA scheme, and explains all the steps used to retrieve the articles used in the SLR. The following section contains the results gathered from the articles selected to be analyzed. Finally, the discussion chapter will discuss the evidence collected in the result section and, linking it with the conceptual background theory, try to give an answer to the research question.

2. Conceptual Background

2.1. Sustainable Innovation and Sustainable Transition

Sustainable development was defined for the first time in 1987. According to the Brundtland Commission, sustainable development is the kind of progress that satisfies the needs of the present without compromising the ones of the next generations (Ruggerio, 2021). Always according to Ruggerio (2021), for the first time in an institutional framework, there was a definition of a topic that took the stage of international discussion for many years and it still is a subject for debate. It is therefore important to ask the reason why sustainability is a fundamental aspect to take into consideration and the historical evolution of sustainability awareness. Following a short historical path, in 1972 the Massachusetts Institute of Technology published, in collaboration with the Club of Rome, the Limits to Growth. In this publication, the two parties pointed out the limits of the world's development with regard to the available but exhaustible Earth's resources, underlining that Earth's natural resources are finite and without fixing some limits, exploitation could lead to their depletion (Colombo, 2001). In the same year, the UN Environmental Programme was established, meant to promote the implementation of the environmental dimension of sustainable development and aimed to be the main international authority in environmental protection (Neale et al., 2021). The following relevant stepstone was, as already stated, the first definition of sustainable development given in the Brundtland Report, seen as a solution to the issues of resource depletion and environmental degradation (Whitfield, 2015). In 1992, at the UN Earth Summit held in Rio, there was an international attempt to design common strategies in the field of sustainability. It must be taken into consideration that the summit was attended by more than 170 different countries and they recognize the importance of pursuing sustainable principles for future policies, at both the international and national levels (Whitfield, 2015). Always according to Whitfield (2015), also the United Nations Millennium Development Goals should certainly be mentioned as well, as they are global sustainable objectives to be achieved by the year 2015, later on, updated at the RIO+20 UN conference held in 2012, where it was reaffirmed the common willingness to achieve sustainability. The new sustainable targets that follow RIO+20 are the Sustainable Development Goals (SDGs), and they already introduce signals that changes are required, in a context where the strategy is to move away from unsustainable economic models and empowers new innovations (Loorbach et al., 2017).

As it is possible to see from this short historical excursus on the main stages of sustainability assertion in the political discussion, sustainability cannot be achieved in a short time. As with every change, it requires time, effort, and also failures. The shift toward a more sustainable economy, society, and environment requires a transition, therefore it is implicit to consider a broad amount of time, and in light of these circumstances, shifts toward sustainable consumption and production practices have gained more consideration in both policy and research domains (Markard et al., 2012). Conforming to Loorbach et al. (2017), the term transition is characterized by the change of a point of equilibrium to a different one, where the change triggers a non-linear and disruptive process that involves different layers and domains. Going more into detail and by pulling together the concepts of sustainability and transition together, "sustainability transitions are long-term, multi-dimensional, and fundamental transformation processes through which established systems shifts to more sustainable models of production

and consumption” (Markard et al., 2012, p. 956). As above mentioned and marked also by Markard et al. (2012), the change towards a more sustainable reality requires a broad time frame to take place, but it is not the only attribute. By the term multi-dimensional, the authors want to underline that such a radical change affects different dimensions, such as society, economy, and science. Always according to Markard et al. (2012), it must also be considered that the dimensions affected by the sustainable transition are often characterized by reciprocal relationships. Sustainable transitions, therefore, require a certain level of collaboration among the different domains involved as well (Avelino & Wittmayer, 2016). New organizations, goods, and business models appear throughout such transitions, both replacing and complementing the current and yet old ones (Markard et al., 2012). Furthermore, the changes encompassed during the transition processes are either qualitative or quantitative (Loorbach et al., 2017).

There are different theoretical approaches and concepts in dealing with sustainable transitions. Four examples are transition management, multi-level perspective, technological innovation systems, and strategic niche management (Kivimaa et al., 2019; Markard et al., 2012). Particularly, strategic niche management is gaining always more consideration. The reason why is that niche sectors more than other places allow the development of novelties and it has been demonstrated that especially radical innovations find in niches a good developing environment and then, given the time to grow, gain the strength to compete also with established technologies (Farla et al., 2012; Markard et al., 2012). Loorbach et al. (2017) argue that besides different theories that lay under this concept, it is possible to classify different types of sustainable transitions depending on the different aspects and features the researchers are focused on, which are the “socio-technical approach, socio-institutional approach, socio-ecological approach” (p. 610). The socio-technical approach focuses mainly on the technologies adopted to reach the transition and consequently on the innovation side. The second approach instead analyzes better the sustainable transition from a sociological, and institutional perspective, alongside the notion of social innovations. The last approach, the socio-ecological one, is based on an ecological approach. According to the authors, it is possible to make a practical example with the energy sustainable transition. Analyzed from the first approach perspective, the transition will be approached considering the technologies that allowed a more sustainable energy system, while if the analysis will be conducted using the second approach the focus will be on the social consequences and the regulations, such as avoiding the creating of monopoly in this new equilibrium. Considering the energy sustainable transition from the point of view of the third approach will examine the natural-resources implications and carbon footprint (Loorbach et al., 2017)

Nevertheless, it must be considered that there is no unique and global definition of sustainable transition. According to another definition of sustainable transition, given by Loorbach et al. (2017, p. 600), sustainable transitions are “large-scale disruptive changes in societal systems that emerge over a long period of decades”. In the same article, sustainability transitions are compared to threats, as they undermine the current and stable systems with new opportunities (Loorbach et al., 2017). This definition shares different common points with the one of Markard et al. An interesting aspect here is the fact that the authors highlighted the social component of sustainable transitions. Indeed, societal consequences and stakeholders are both important aspects to take into consideration, as they are not just impacted but also an active part of the

transition. Stakeholders to take into account in this framework are customers, managers, political leaders, and industries (Rivas et al., 2021).

Sustainable transition engages different stakeholders at different levels and their reactions will determine and influence the achievement (Brudermüller et al., 2021). The distinction between individual and collective engagement levels of stakeholders is not exhaustive, because there are as well different levels at which stakeholders can impact such transitions (Gonzalez-Porrás et al., 2021). This means that alongside the different research approaches above mentioned, also stakeholder management must be taken into consideration and can contribute to the sustainability cause. For example, Gonzalez-Porrás et al. (2021, p. 216) identified four layers of stakeholder engagement:

- “Individual level;
- Firm level;
- Industry level;
- Societal level”

It is therefore clear that stakeholders can take part and give their contribution to the sustainable transition in different ways. Ultimately, political figures and international institutions are expected to be determinants in the sustainable transition framework (Robertson Munro & Cairney, 2020). An example in this sense is the European Union. The EU has always expressed its commitment to a more sustainable future, and the latest example is the European Green Deal and all the related actions and programs. The aim of the program, which will be further explained in the next paragraph, will be to set a scheme to achieve a European transition to enable a sustainable, and prosperous EU (European Commission, 2019)

An important point of reflection comes from Sarkis (2019), which affirms that such sustainable transitions if it is analyzed from the socio-technical perspective, occur with the presence of technology and innovation combined together.

And here it comes the other important theoretical concept. Innovation and new technologies are the keys in order to achieve the so-called sustainable transition. As sustainability and sustainable development have already been explained at the beginning of the chapter, it is the turn of the innovation explanation. Historically speaking, Schumpeter is considered the father of innovation. According to him, innovation was a production function that could generate different and quite unpredictable outputs and not just a static element (Godin, 2008). Innovation may affect different aspects and realities and it is not enough to simply have an idea; actions are also required in order to impact the context where innovation finds application (Clodoveo et al., 2021). Confirmed also by Loorbach et al. when the authors affirm the impact of the transition from a multilevel perspective level, the innovation processes are often characterized by three common traits: “complexity, dynamism, and uncertainty” (Silvestre & Țîrcă, 2019, p. 326). Complexity because, like sustainable transitions, usually innovation copes with interdependent factors, which means that a change in just one aspect can impact all the interconnected ones. The term dynamic, related to innovation processes, states that the elements evolve over time, therefore innovation operates in changing context. These two properties as a result make innovation uncertain (Silvestre & Țîrcă, 2019). The literature recognizes also different types of innovation, based on what it is based on and on the degree to which it differs from the previous versions. It is therefore possible to speak about product innovation, business

process, or model innovation, alongside radical or incremental innovation (Fritsch & Meschede, 2001).

It is also true that the survival and evolution of a company are strictly related to innovation, considering the competition dynamics in the different market industries. Clodoveo et al. (2021, p. 1) give a definition of innovation in the market context, in fact, “innovation is the process that allows individual companies, or entire production sectors, to create value, remain in or enter new markets, increase profitability, generate employment, and increase competitiveness”. Innovation, therefore, seems an optimal situation for companies and the whole society, since the benefits and potentials seem to be high. Given the fact that also sustainability issues have been raising awareness among people, companies now look at sustainability in a different way. If in the past years, sustainability was seen as something not able to deliver immediate financial benefits to companies (Nidumolu et al., 2009), nowadays sustainability is always more incorporated into firm business strategies and objectives, not just in the final phases but during the whole company’s logic (Boons et al., 2013). The relationship between innovation and sustainability is therefore trying to achieve a point of win-win situation where it is possible to pursue simultaneously competitiveness and sustainable transitions (Hermundsdottir & Aspelund, 2021), something possible also thanks to the fact that environmental safeguard and economic growth can coexist (Yang et al., 2022). Sustainable innovation can be defined as innovations where the process does not deliver just novelties for economic achievement but also generate positive impacts on social and environmental dimensions (Cillo et al., 2019). It can be therefore seen as a type of innovation that besides economic performance consider its long-term impact on the environment and mankind. Sustainable innovation will benefit companies by retaining their strengths, giving them new opportunities and ways to satisfy customers' needs, which are always more oriented toward sustainable products and practices (Hermundsdottir & Aspelund, 2021). What it is possible to understand from the concept of sustainable transition, is that it does not encompass a small change. As a consequence, sustainable innovation is not meant to carry small and incremental innovations (Boons et al., 2013). As stated by the authors, the sustainable transition requires innovation to carry on the transformation of production and consumption models, not just small changes. Incremental changes would be fine, but in the end, they could not be able to lead such a radical transition as the sustainable one. “Given the challenges posed by sustainable development, sustainable innovation will often be characterized by systemness and radicalness” (Boons et al., 2013, p. 3). In addition, another word that goes hand in hand with sustainable innovation is future orientation. Generally speaking, sustainable innovation implies long-term changes, in order to pursue long-term economic, social, and environmental benefits (Brudermüller et al., 2021). Speaking about sustainable innovation, another point to focus on is the stakeholders that will be impacted by this innovation (Adams et al., 2016). Hereby comes out again the concept of stakeholder engagement and its importance for the successful achievement of sustainable transitions and sustainable innovations. In this sense, particular attention must be given not only to sustainable business models and new technologies but also to everyday life aspects such as interest and routines, which characterize the social part of sustainable innovation (Amui et al., 2017).

2.2. European Green Deal Overview

The European Green Deal was presented for the first time by the European Commission president Ursula Von der Leyen in December 2019. The European Commission president defined the European Green Deal from two different perspectives. Either as the newest European strategy to pursue long-term growth or as a roadmap to a more sustainable Europe, tackling both climate and social challenges (Bongardt & Torres, 2022; European Commission, 2019).

It's fundamental to spell out that the EGD is not a law, but a strategy that set future objectives. The deal comprehends strategies, directives, and regulations, which combination aims to facilitate a sustainable transition (Wolf et al., 2021). Recalling the previous paragraph, a sustainable transition in the European context is indeed as necessary as desirable. Acknowledging the climate emergency the world is facing and the need to take clear and strong-impact actions to tackle it, the EGD is presented and proposed as an opportunity. Ultimately, the European Green Deal is the leading set of policies designed to gradually reduce the usage of limited resources and materials to pursue wealth and growth (Brudermüller et al., 2021). The concept of opportunity comes from the fact that one of the main aims of the EGD blueprint is to achieve simultaneously growth and sustainability, seen as two faces of the same coin and not as two contendings. Furthermore, the EGD states clearly that investing in sustainable solutions would lead to growth and foster European competitiveness (European Commission, 2019). Limited and scarce resources alongside intensive and unsustainable methods of production would be replaced with more sustainable ones, a higher awareness of the importance and usage of resources as well as recycling and reuse (Bongardt & Torres, 2022; Munta, 2020). According to the European Commission, the EGD addresses the mentioned elements and plans to overcome them binding together the tackle of climate change and the sustainable transition. According to the official communication presented in December 2019:

The European Green Deal is a response to these challenges. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient, and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use (European Commission, 2019, p. 2).

The plan is designed as a response to climate change on a global scale and aims to achieve climate neutrality by 2050 while managing social transitions in the fields and sectors affected by the transitions and maintaining European global competitiveness at the same time (Brudermüller et al., 2021). As a result, the current economic model will be transformed in a way that it will also benefit people's well-being and health, considering that the protection and health of Europe's inhabitants and natural capital are the basis of the strategy. The sustainable transition, foreseen by the EGD, will imply a change that will encompass both supply and demand side (Furfari & Mund, 2021). The EGD seeks to achieve simultaneously different actions: the creation of new job positions, reduction of scarce resources dependency, emissions reduction, and improvement in the recycle (Wolf et al., 2021). Taking into consideration these actions and the official communication, released by the European Commission (2019), the EGD has eight main elements, represented in the below image, and some complements.

Table 1: The European Green Deal Elements. The table summarizes the eight main elements identified by the EC as the leading ones for the EGD.

EUROPEAN GREEN DEAL'S ELEMENTS	
Number 1	Increasing the EU's climate ambition for 2030 and 2050
Number 2	Supplying clean, affordable, and secure energy
Number 3	Mobilising industry for a clean and circular economy
Number 4	Building and renovating in an energy and resource efficient way
Number 5	Accelerating the shift to sustainable and smart mobility
Number 6	From "Farm to Fork": a fair, healthy and environmentally friendly food system
Number 7	Preserving and restoring ecosystems and biodiversity
Number 8	A zero pollution ambition for a toxic-free environment

Source: Own representation from European Commission, 2019.

Element Number 1.

Being the first climate-neutral continent might be considered the main slogan to present the EGD (European Commission, 2019). Climate neutrality will be achieved when the greenhouse emissions, on a net level, are equal to zero (Abdullah, 2021). As a matter of fact, the commitment towards a cleaner Europe does not originate with the EGD but has strong roots also in past directives. The European Union was able to reduce its net emission by 23 percentage points in the 1990-2018 time frame, while the overall economic trend was more than 50% positive in this reduction (European Commission, 2019). The new target set by the EGD implies two different steps:

- Reduction of greenhouse gas emissions at least by 50% in comparison to 1990 levels;
- Achievement by the end of 2050 of zero net greenhouse emissions (Siddi, 2020).

An important stepstone in the EGD journey in terms of climate ambition was the draft of the first European Climate Law, presented just three months after the introduction of the EGD, and enforced officially on July 2021. Other than clearly stating the targets included also in the EGD, it aims at the creation of an efficient system of progress observance to have reliable quantitative data on the progress (Fetting, 2020).

Element Number 2.

When speaking about secure energy, it goes without saying that energy is one of the main resources people could have, in view of the fact that energy access is a fundamental right (European Commission, 2019). In this context, the most important words are both diversification of energy sources and decarbonization, which will be one of the most determinant variants to achieve the climate-neutrality (Munta, 2020). The major challenge will be to tackle energy poverty, still present in some areas of the EU while focusing on sustainable and renewable energy (Fetting, 2020). As stated by the European Commission, efficiency is an aspect where the efforts will be focused (European Commission, 2019). Taking into account that usage of energy constitutes almost 75% of the total greenhouse gasses produced, the EDG implies three main principles to achieve the sustainable targets:

- Focus on energy efficiency basing the future on sustainable and renewable energy;

- Tackle energy poverty and assure that everyone could have access to secure energy;
- Constitute a digitalized and interconnected European market (European Commission, 2019).

“The EU will invest more into new smart technologies including carbon capture, energy storage, hydrogen networks, and smart grids [...]. One particular concern is to ensure that the clean energy transition does not wear heavily on citizens” (Munta, 2020, P.9). Thus, the sustainable transition expected for the energy sector will have a huge impact on society, but it is thought to be affordable for everyone.

Element Number 3.

The concept of circular economy is not new in the EU background. A first Action Plan concerning the circular paradigm was introduced for the first time in 2015 (McDowall et al., 2017). The aim is to have a sustainable economic model which can foster growth in Europe. In opposition to the linear economy model, previously mentioned in the first paragraph, the circular one wants to make fundamental industries, such as the steel one, more sustainable (Ellen MacArthur Foundation, 2013). According to the Ellen MacArthur Foundation (2013), the main points that describe the concept of circularity are:

- Drastically reduction of waste;
- Renewable resources-based economy;
- Focus on the adaptability and versatility of products, extending their life-cycle.

The circular economy model, according to the provisions made by the European Commission (2019), will also modernize and allow the digitalization of such industries in a way that the European economic system will not be blocked or lowered (Brudermüller et al., 2021). The EU circular actions will be accompanied by a new and updated Circular Economy Action Plan and the main measures imply the use of sustainable and renewable resources, the extension of the usable life of products, and sustainable policies applied to products and services, alongside a better recycling system (Munta, 2020).

Element Number 4.

The construction sector is one of the most resource-intensive ones, consuming almost 40% of the total EU energy, and taking into consideration this high consumption, it is clear that among the different industries, the construction one needs particular attention. In particular, the renovation must play a significant role to achieve climate neutrality. The European building renovation rate, data updated for the year 2019, is between 0.4% to 1.2% and varies among all the Member States (European Commission, 2019). However, the value needs to increase. The EGD calls for a renovation wave, including in the plan both private and public constructions (Fetting, 2020). Pursuing renovation and having renovated buildings instead of newly built ones will have two main advantages. Among them, it is possible to find decarbonization, energy saving, and efficiency, and on the other side improvement of existing buildings (Neßhöver et al., 2021).

Element Number 5.

Transportations are one of the biggest sources of gas emissions in the European context, therefore a reduction of emissions in this sector would mean a huge step to achieve the EDG targets. Acknowledging that the mobility sector constitutes nearly 5% of the EU's GDP, both

European industries and the international supply chain depend on it (Munta, 2020). Clean mobility and multimodal transportation systems seem to be the two key focuses (European Commission, 2019). In pursuing these two main targets concerning mobility, the European Commission has to rethink the standards applied for CO₂ emissions, avoid pointless car traffic and congestion, promote more sustainable alternatives of mobility such as public transportation and cycling, and foster the use of renewable energies also in the mobility sector (Neßhöver et al., 2021).

Element Number 6.

The European standards concerning food quality and control are among the highest worldwide (Streimikis et al., 2022). The next step in this sector will be to assure that sustainability will be a key feature and, as reported by the European Commission (2019), healthy and sustainable food translates into a healthy society. The stakeholders involved will gain from new scientific and technological advancements as well as the rising public interest and demand for more sustainable sources of food (Fetting, 2020). Speaking about parties, both farmers and fishermen management will be important for implementing sustainable transitions, being the central actors of the sector (European Commission, 2019). The current Common Agricultural Policy will be revised and a new strategy From Farm to Fork will be implemented. In doing so, the EGD will tackle the use of chemical substances and land degradation while assuring food security, sustainability, and the realization of a circular economy also in the food system (Neßhöver et al., 2021).

Element Number 7.

Environmental degradation is one of the biggest consequences of the past intensive economic system. Resources exploitation, intensive use of land and soil, and climate change have been identified as the main drivers of biodiversity loss (Fetting, 2020). It is important to recognize that ecosystems contribute to essential services for humankind, such as food, water, and air supply, and at the same time, they help to mitigate the climate and lessen the effects of disasters (European Commission, 2019). The European Green Deal set a priority concerning this key area:

- Pollution reduction;
- Biodiversity protection;
- Enhancing waste disposal (Bongardt & Torres, 2022).

The Biodiversity Strategy and the 8th Environmental Action Programme are the two main directives provided by the EGD in this field. The plan is to have a specific focus on seas, oceans, and forests as natural elements to be strongly preserved (Miu et al., 2020). Furthermore, the creation of a network of protected areas on land and in the sea across Europe is a priority, in order to shelter the existing resources and try to in part restore the consumed ones (Fetting, 2020).

Element Number 8.

Pollution is a problem from different perspectives, considering it is harmful to both environment and mankind, and in order to safeguard both the EGD has a part dedicated to the achievement of a non-toxic environment (European Commission, 2019). As stated by Munta (2020), the EGD will address different types of pollution, e.g water and air pollution, with a particular focus

on the cause of that, in order to eradicate the problem and implement a long-term solution. In doing so, also some measurement criteria, air quality is among them, will be assessed and, in case, modified, with the aim of having trustable benchmarks and objectives (European Commission, 2019).

To summarize what has been said so far, the below figure summarizes the main advantages that, according to the European Commission, the EGD will bring.

Figure 1: The Benefits of the EGD. The image drafts the benefits identified by the EC that will be driven by the EGD.



Source: European Commission (2022).

Besides the 8 main areas above described, the other two aspects that need to be brought up:

- “Financing the transition
- Leave no one behind” (European Commission, 2019, p. 3).

Starting from the latter, the European Commission wants to assure that the transition will be just and fair. Sustainable transitions encompass a change that could hit the Member States with a different impact. It is a matter of fact that the European Union is a heterogeneous set of differently specialized components. It's for this reason that the EC proposed the creation of the Just Transition Mechanism, in order to draw the adjusting process easier for the areas and industries that will be disproportionately impacted by the sustainable transition (Munta, 2020). In order to promote more sustainable economies, with an ad hoc funding plan called Just Transition Fund alongside advantageous tax treatments, the goal is to leave no one behind and to make not just a sustainable transition, but an equitable one (Breil et al., 2021). The purpose of the funding system is to provide resources for changing practices and therefore rethink the European industries while protecting the most vulnerable areas and people from the consequences of climate change (Munta, 2020).

The other important concept is the way how the European Commission planned to finance the transition. Investments are needed, either public or private, acknowledging that the public sector cannot finance the sustainable transition alone (Fetting, 2020). The European Green Deal Investment Plan will involve almost one trillion euros in the next years (European Commission,

2019). Keeping in mind that the EGD is a long-term strategy, the flow of investments must be constant over time. The EGDIP is composed of two components. On one hand, money and funds come directly from the EU, while on the other hand funds and money are triggered by the EU. More than half of the funds needed will be raised through InvestEU, with more than 500€ billion coming from the EU budget (Fetting, 2020). InvestEU is an investment plan composed of three building blocks: a part devoted to funds, a portal, and an advisory hub. The aim is not just to collect money, but to create platforms and virtual meeting points in order to raise awareness and make stakeholders and investors interact. The portal provides an easy and navigable database of sustainable investment possibilities (European Union, 2022). Even though the planned budget of 1 trillion € might seem massive, “adapting to the adverse impacts of climate change can have positive outcomes for citizens in the EU while damages due to climate change are much higher than the cost of the investments needed for a green transition” (Bongardt & Torres, 2022, p.176).

Speaking about the EGD, further considerations must be taken into account. The first one is that the EGD has a strong focus on industries. Industries are identified as one of the main intervention areas. According to Negreiros et al. (2021), Europe has a strong and solid economy in addition to structured and developed infrastructures. New business models that can emerge in the European framework supported by sustainability and innovation include circular business models, carbon-free technologies, and digitalization (Geissdoerfer et al., 2020). This will require a wide portfolio of innovations along the entire value chain. The EGD already provides some ideas and predictions on the industries that will lead the sustainable transition. The following solutions were named by experts as the main forces behind achieving the goals of the EGD:

- “ Electrification
- Digital transformation
- Circular economy
- Biological transformation
- Carbon Capture and Utilization/Carbon Capture and Storage” (Brudermüller et al., 2021, p. 22).

The new European Industrial Strategy will support the EGD with the implementation of green and digital transition. By offering industries accessible, cost-effective, and clean technologies and by creating new business models, the EIS will assist the industry in lowering its carbon footprint while basing the future European competitiveness on sustainable solutions (Renda, 2021). As noted by Clayes et al. (2019, p. 12) “To achieve climate neutrality while leading global decarbonization from an industrial standpoint, Europe must become a global innovation powerhouse for clean energy, clean mobility, and smart buildings technologies”.

Finally, the last point to mention is the aspect concerning Research and Innovation, for which the EGD has planned an ad hoc plan called Horizon Europe, the successor of Horizon 2020, acknowledging the importance of fostering and promoting innovation as one of the main drivers to achieve the sustainable transition (European Commission, 2019).

2.3. Horizon 2020 and Horizon Europe

The ambitious commitment set by the EGD to reach climate neutrality by the end of 2050 requires consistent investments (European Commission, 2019). To facilitate the transition to a fairer and more sustainable economy, efforts must be made on a number of different fronts in order to address the major environmental and societal concerns of our times (Colombo et al., 2019). To achieve the objective of the European sustainable transition new alternatives must be found. Research and innovation fields will be key determinants of the European green transition. EU economies need to be rebooted sustainably, with a particular emphasis on innovations related to social aspects, technologies, and business models (Brudermüller et al., 2021). It goes without saying that Research & Development will be a determinant aspect to focus on, considering the fact that predicted and hoped investments won't happen unless the framework encourages and fosters innovation. The simultaneous transition to green technologies alongside the resulting changes in the economy and society will be boosted by R&D. As a result, the Member States will be able to create a more resilient and sustainable reality and in this way, Europe will affirm even more the world leader position in terms of sustainable innovation (European Commission & Directorate-General for Research and Innovation, 2021).

In the European Union framework, Horizon 2020 and its successor Horizon Europe are the main research and innovation programs.

Horizon 2020 was the European R&D program that covered the years 2014-2020. It was designed to position the EU as a key player in the research field, which will draw the brightest minds and facilitate communication and collaboration among scientists and brains all across the EU. It will support creative businesses and start-ups in raising Europe's competitiveness, generating new job positions, and at the same time improving the everyday life of citizens (European Commission & Directorate-General of Research and Innovation, 2014).

Horizon 2020 had three main pillars:

- Science Focus;
- Industrial Focus;
- Societal Focus (European Commission, 2022).

Horizon 2020, which placed a strong emphasis on science, industrial leadership, and addressing societal concerns, aimed to in combining research and innovation for a more prosperous future for the EU (European Commission, 2022). Horizon 2020 is divided into different programs, and each one had a different area of action, for example, post-education support is among them. Given the pillars of the program, one of the main research areas was the technological one, which was supposed to support both the first and the second pillars and to whom it was dedicated almost 40% of the total program budget (Veugelers et al., 2015). Sustainability was the second main focus of the program, where climate action and sustainable development were financed with 30% of the H2020 budget. Mitigation, adaptation, and education about climate change are among the actions identified hereby. The program, alongside the focus on technologies and sustainability, had clear objectives and targets also from a social point of view, as clearly stated by the third pillar. Among them, the most relevant ones were the achievement of the general well-being of the European citizen, food regulation and safety, and a more inclusive and secure society. Furthermore, the total budget that Horizon 2020 was able

to gather by combining private and public investors was almost 80 € billion, making it the biggest R&D European program that ever existed. (European Commission & Directorate-General of Research and Innovation, 2014). Always according to the European Commission and the Directorate-General of Research and Innovation (2014), the objective was the development at a European level of science while lowering the existing barriers to innovation, and facilitating collaborations among public and private sectors in delivering innovation. Horizon was also designed to be easy to apply. Legal entities founded in any nation around the world as well as foreign and extra-European organizations are generally eligible to participate. To participate it is necessary to submit the intended proposal of the project to develop to be financed and supported by H2020 according to the form and rules established by the European Commission. A dedicated commission then was in charge to evaluate the submitted proposals and check their affinity and congruence with the EU benchmarks (Enger & Castellacci, 2016).

Horizon 2020 ended in 2020, and the heir program Horizon Europe has an even stronger focus on sustainability, given also the fact that the program is strongly interconnected with the European Green Deal. In order to promote the sustainable transition towards a green and digital Europe, Horizon Europe will make sizable financial commitments and take an ambitious approach (Weber et al., 2019). The degree of investments will be higher compared to the previous programs and, above all, proportionate to the ambitious objective of the European Commission. By introducing the European Green Deal, the Commission pledged to achieve climate neutrality. Such a climatic shift necessitates significant investments in green technology research and innovation as well as social changes (European Commission & Directorate-General for Research and Innovation, 2021). It is therefore possible to affirm that Horizon Europe is the actual European Union program to incentivize sustainable innovation in Europe. One of the main purposes of Horizon Europe is financing research and innovation activities through tenders managed directly by the European Commission, with different types of purposes but aimed at civil and social applications. In particular, the program is designed to foster research and development initiatives that individual Member States could not carry out as effectively as with the European contribution, seeking to add value to national activities in this field (Italian Government, 2022).

Like its predecessor, Horizon Europe has three pillars:

- Focus on science and green technologies development;
- Attention toward industrial competitiveness and international challenges;
- Innovation for sustainability (European Commission & Directorate-General for Research and Innovation, 2021).

The first pillar aspires to improve European competitiveness in the science field. In doing so, the program will foster research projects through the European Research Council and the Marie Curie Actions, present also in Horizon 2020. In particular, the ERC is dedicated to high-risk research initiatives, while the latter is dedicated to promoting high education, such as Ph.D. and postdoctoral education. The second pillar aims in focusing on being a global leader in the R&D framework and also in the social sphere of the research. It encourages research on societal issues and, through the formation of clusters, strengthens technological capabilities in the industry. It also contains the Joint Research Center, which provides impartial proof and scientific results alongside technical evidence to the Member States. The innovation pillar, the

third one, seeks to position the European Union as a global leader in generating innovation (European Commission & Directorate-General for Research and Innovation, 2021). In this framework, the European Institute of Innovation and Technology, which promotes the consolidation of education, R&D, and innovation, also contributes to the affirmation of European innovation (Weber et al., 2019). Always according to Weber et al. (2019), in relation to the third pillar, the European Commission decided to establish the European Innovation Council, which is aimed to support new technologies and innovation to have a smooth introduction in the markets. Complementary to the three above-mentioned pillars, the EU identified also a parallel pillar. It can be defined also as a complementary tool to leave no one behind the concept of the EGD, which wants to foster and consolidate the research and innovation collaboration among the different entities of the Member States. In this way, knowledge sharing and transfer will be facilitated and innovation potential can grow in an equal and equilibrated way throughout Europe (European Union, 2022). According to the European Commission, “special attention will be given to ensuring vibrant cooperation between universities, scientific communities, and industry [...] in order to bridge gaps between territories, generations, and regional cultures” (2021, p. 5).

Considering that Horizon Europe is a long-term program, the planning is done every four-year period. In addition to the pillars, the European Commission identified some precise missions, which are research areas, where to focus on the research. The ones chosen for Horizon Europe are the fight against cancer, climate change-related issues, smart cities and smart mobility, and food quality (European Commission, 2022).

3. Methodology

As previously stated, the main aim of it is to try to give answers to the research questions that guide the work. Although the research questions have already been explained in the introduction part of this work, a short summary will follow. The research question would try to understand the academic discourse that links the three EU policies above mentioned and the sustainable innovation concept. In doing so, the aim is to try to identify the drivers and obstacles to the achievement of a sustainable transition in the European Union and the role of sustainable innovation in this process.

3.1. Research Design

The methodology chosen to answer the research questions is a Systematic Literature Review. The reasons why this methodology has been chosen are different. First of all, systemic reviews are reviews that comply with and summarize the information retrieved from studies that answer a clearly stated research question using systematic techniques (Page et al., 2021). The advantage of systematic reviews applied to literature is that it is able to identify research gaps and allows further investigation into them (Poklepović Peričić & Tanveer, 2019). The SLRs are also crucial in identifying emerging research fields and, in doing so, highlighting the difficulties and future challenges that remain to be overcome (Mariano et al., 2015). This methodology approach in particular allows the person conducting the research work to meet three crucial properties, which are “clarity, validity, and auditability” (Booth et al., 2012, p. 19).

1. The clarity attribute allows for a better understanding of the research field;
2. The validity attribute helps the work to overcome the potential bias that could occur, such as selection bias;
3. Auditability in the SLR is intended to be the instrument through which evaluate that the conclusions of the research are derived only from the SLR finding and not from prior knowledge or assumptions (Booth et al., 2012).

Based on these three attributes, the systematic literature review approach consists in understanding the actual status of the research, evaluating it, being able to choose the relevant literature, summarizing the findings, and then analyzing them to answer the research questions (Okoli & Schabram, 2010). Particularly, the different phases of the SLR as a methodology allow to find the existing status of the literature, conduct a selection to retrieve the pertinent work, and analyze it. This evidence leads us to see that one of the key aspects of the SLR is the fulfillment of the selection condition, which implies that just the pieces of work which are really relevant and related to the research are taken into consideration. To find the papers that will support this research work, different online databases were taken into consideration. The main online database used was Scopus. The reason behind this decision lies in the fact that Scopus is a reliable source of information and it contains a considerable amount of literature. Other databases were taken into consideration as well in the hunt for pertinent work so as not to exclude them from consideration due to the fact that they might be valuable and add value to the research. Thereby, Google Scholar was considered in the analysis as well.

3.2. The PRISMA scheme applied to the Systematic Literature Review

The systematic literature review can be divided into different phases:

1. Identification of research questions and consequent research objectives;
2. Selection of pertinent work to support and based the research on, evaluation of the selected literature;
3. Recognition of the results;
4. Discussion of the evidence gathered from the selected literature (Khan et al., 2003).

The research question phase was the first step of the Master Thesis's work. After the identification of the main topic, which is sustainable innovation and the relative EU policy strategies, there was the identification of the main research question, already presented in the introduction section. As a consequence, two subquestions arise as well as the research objectives. To address the best way the selection of pertinent work and evaluation of the founded literature phases identified by Khan et al. (2003), the PRISMA framework will be applied. The PRISMA framework has been chosen to support the SLR of this work in order to have better visualization and understanding of the steps needed to obtain the final pool of articles. PRISMA was originally created to pursue clear and objective reporting for systematic review methods (Rethlefsen et al., 2021). Moreover, the framework allows also to have a diagram and a graphic representation of the work retrieved (Page et al., 2021).

The identification phase of the PRISMA scheme, as well as Khan et al.'s selection phase (2003), is mainly composed by the creation of the research string, from which the documents to develop the SLR will be identified. The string that has been chosen to answer the research questions and meet the objectives is the following:

```
( "European green deal" OR "egd" OR "Horizon 2020" OR "Hori-  
zon2020" OR "Horizon Eu-  
rope" OR "HorizonEurope" ) AND "innov*" AND "sustainab*"
```

The first part of the research string aimed to include in the research the three EU policy strategies examined in the second chapter of the thesis, which are the European Green Deal, Horizon 2020, and Horizon Europe. Due to the fact that the strategies might be present in some works with some abbreviation or with a different language expression, the string contains more than one way to cite the same strategy, as it is possible to see from the first two concepts of the string. Considering that a common abbreviation of the European Green Deal is EGD, the decision to include the abbreviation as well in the string in order not to lose potential relevant work was made. The same reasoning applies to both Horizon 2020 and Horizon Europe. The second part of the string seeks to include in the string both innovation and sustainability concepts. For the sake of including as much literature as possible, both concepts are present with the wording "innov*" and "sustainab*". This allows, for instance, to include in the research both innovation and innovative concepts without trying to identify them all, and the same applies to sustainability-related terms. In the end, the string would give as output the works that are related to one of the European strategies and at the same time have a connection with both the innovation and the sustainability spheres.

The string above cited allowed to have 279 records screened in the Scopus database and 21 in Google Scholar. In order to identify the number of reports assessed for eligibility in the PRISMA framework, different limitations have been set in order to skim the document base of Scopus. The first limitation is related to the subject area, therefore the subject areas chosen are:

- Business, management, and accounting;
- Economics, econometrics, and finance;
- Social sciences.

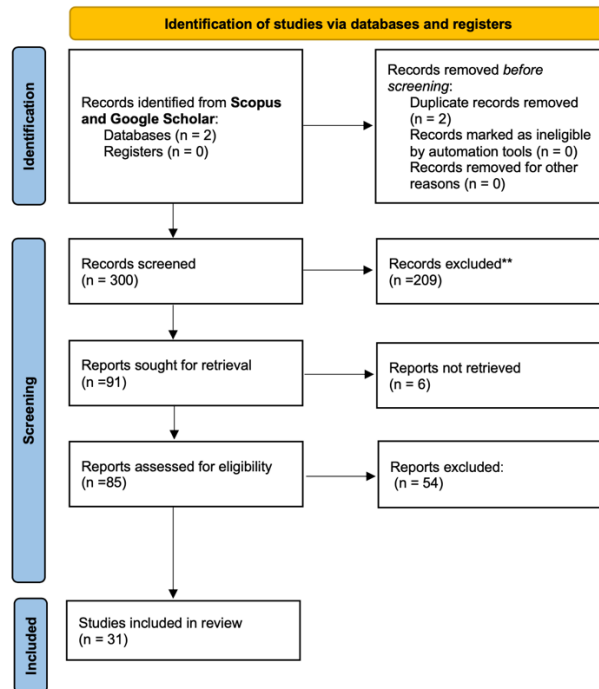
The other limitation that was introduced is related to the type of document. Articles are the type of document that will be used in the selection. This leads to the final research string:

```
(( ("European green deal" OR "egd" OR "Horizon 2020" OR "Horizon2020" OR "Horizon Europe" OR "HorizonEurope" ) AND "innov*" AND "sustainab*" ) ) AND ( LIMIT-TO ( DOC-TYPE, "ar" ) ) AND ( LIMIT-TO ( SUBJAREA, "SOC" ) OR LIMIT-TO ( SUBJAREA, "BUS" ) OR LIMIT-TO ( SUBJAREA, "ECON" ) )
```

After this step, it must be pointed out that a low number of articles were not retrieved, precisely 6 articles. In order to evaluate their relevance and assess the articles for eligibility, the abstract, the discussion, and the conclusions of the articles have been read. Furthermore, for the ones with more ambivalence, the articles were fully read to better evaluate and taking the final decision. This is the last step of the screening phase of the PRISMA framework and it is possible to associate it with the evaluation of the selected literature in Khan et al. (2003) steps. To further skim the pool of articles retrieved, other than the limitations introduced in the string, some inclusion and exclusion criteria were used as well. In particular, the main exclusion criteria were the relevance of the discussion and conclusion of the articles, thus the content and the pertinence of the results found with the research goal. Everything that was not related to some extent to sustainable innovation was excluded, even though the string was built with this aim, and of course not considering the articles not retrieved. Finally, the main inclusion criteria were the general discussion about sustainable innovation and its aspects, alongside the presence of EU policies related to them.

After this phase, the final number of articles included that will be used to conduct the SLR is 28 belonging to the Scopus platform and 3 from Google Scholar, for a total of 31 articles.

Figure 2: PRISMA flow diagram. The diagram shows the process through which the final pool of articles used in SLR was selected.



Source: Page et al., 2021.

The next phase, according to Khan et al. (2003) will be accomplished in the next chapter, where the results found by reading the selected articles after the third step of the SLR will be described and analyzed.

In order to summarize them in a way that permits to have a clear understanding of the content and to be insightful to answer the research questions, three main topics have been identified to resume the content of the articles. These arguments have been inductively identified, which means that after reading the 31 selected articles, the following aspects have been chosen:

- Sustainable Innovation;
- Overview of EU Policies;
- Future perspectives.

Lastly, in the last phase called discussion, the evidence found throughout the four precedent phases will be analyzed in order to answer the research questions.

4. Analysis and Results

This section is entitled to present the main results that come from the analysis of the articles selected for the SLR.

4.1. Sustainable Innovation Status

Among the European sustainable innovation perspectives, smart specialization is gaining increasing attention to achieve competitive advantage and economic competitiveness (Martinidis et al., 2022). Taking into account the sustainability goals set by the European Green Deal, Smart Specialization is a particular type of sustainable but regional innovation, that consists of the concept that “regions should be more specialized rather than diversified” (Lankauskienė et al., 2022, p. 2). The notion behind it is that innovation policy should encourage technology specialization around the key strengths and activities of an area. In this way, opportunities strictly related to the areas can be exploited and then shared through different forms of collaboration among different regions. Despite the potential, the main limitation identified is the kind of innovation that it could bring (Martinidis et al., 2022). According to Lankauskienė et al. (2022), radicalness is among the characteristics that innovation should have to support the sustainable transition, but one of the main concerns regarding smart specialization is the doubt that it can support a radical sustainable innovation (De Noni et al., 2021), considering the need for profound changes. What came out from this discourse is the diversity not just among the different Member States of the EU, but this must be extended also to the different areas and regions of the Member States, which implies an always more complex environment in which sustainable innovation acts. Despite the differences, only joint efforts and cooperation will lead to the achievement of climate neutrality by 2050 (Lankauskienė et al., 2022). The study of Lankauskienė et al., (2022) particularly aimed to demonstrate a way to recognize the best European area for the green transition encompassed by the EGD. Smart specialization is particularly interesting because it aims at identifying the local strengths and innovation perspectives, allowing to focus on a small range of priorities and putting in those ones all the efforts (Martinidis et al., 2022). Martinidis et al. (2022) argue that now, with the design of new and future strategies lined up with the EGD, smart specializations might play an important role and it's particularly important to design it in a way it can support sustainability. Following the same topic, Meyer (2022) underlines the importance of the social part of innovation in the smart specialization context. Considering the concept that lies behind the strengths of the smart specialization approach, social capital, and social innovations are fundamental to addressing the social part of the sustainable transition. (Meyer, 2022).

Other aspects that seem to be at the center of sustainable innovation strategies are resource efficiency and energy efficiency. In particular, the metallurgic sector seems to benefit from circular approaches regarding these two aspects. Circularity, in the EGD framework, in particular, allows both recovery and better waste management (Di Maria et al., 2022). Specifically, Di Maria et al. performed an analysis using LCA and LCC to evaluate the circular process of recovering materials and energy in the considered sector. It has emerged as a general result that the circular approach has environmental advantages but the energy consumption is still a triggering part that might hinder the process toward climate neutrality.

The same topic, energy and resources efficiency related to circularity and the EGD guidelines, was treated also by Popa et al. (2022). A particular mention goes to the European Green Deal Pact, which is a headliner to reach economic competitiveness in harmony with sustainability and energy consumption. Renewable energy will replace, according to the EGD, the old and unsustainable sources of energy (Popa et al., 2022). The authors questioned firms' alignment with the EU strategic plans, EGD, and related ones, regarding energy consumption and the shift towards sustainable and renewable sources of energy. What comes out from the study is the importance of the managerial part of the sustainable transition, more precisely in regard to the sustainable energy transition. One of the main outputs of Popa et al. (2022) is the role of governments being a key point in the transition, alongside the fact that the right regulations and policies could clear the way to circular models.

Alongside smart specialization and circularity, digitalization is an important perspective in the sustainable innovation context as well as for pursuing economic competitiveness. The primary goals of digitalization are to gather fresh data and refresh business models, in order to have data-driven competitive strategies (Šimberová et al., 2022). The digital transformation has an impact not just on industries, but it affects the whole lifestyle and society itself. The study of Šimberová et al. (2022) was mainly focused on the perceptions of SMEs regarding the digitalization trend. The results show that depending on the starting point and the digital maturity of the company, there are different visions of digitalization in terms of threats and opportunities. Consequently, it points out that not only the size of the company must be taken into consideration in the sustainability analysis, but also the base level and the perceptions towards sustainability trends (Šimberová et al., 2022).

Always speaking about digitalization, also Digital Innovation Hubs can be a tool to leverage digital competencies and solutions for the achievement of sustainable growth (Zamiri et al., 2021). In their work, Zamiri et al. (2021), after analyzing what DIHs need, suggested how to develop the right framework for digital innovation hubs operating in the sustainability field. What comes out from the study is a framework that supports the creation of these digital hubs, which is based on five dimensions: "environmental, social, economic, governance, and technological" (Zamiri et al., 2021, p.4). The correct use of these spheres, according to the authors, will help to successfully implement DIHs in the sustainability context, in a way that it can support the EGD objectives. Another perspective on digitalization comes from the work of Fernandez-Aller et al. (2021), where the research focus was the artificial intelligence future interconnected with the sustainability perspective. The core concept is related to the competitive and sustainable economy promoted by the EGD and the 2030 UN Sustainable Agenda, and the fact that according to the authors, it is relevant to analyze AI also in relation to human rights and therefore take into consideration ethical features. Acknowledging the benefits that artificial intelligence might play for the future of digitalization, also risks must be part of the discussion as well (Fernandez-Aller et al., 2021).

Recalling the main intervention areas of the EGD, the food sector and the agricultural one are part of them (European Commission, 2019). Digitalization can be also a relevant hint in the agri-food sector, especially in the deal with sustainability where digitalization can support innovative solutions. In fact, digitalization is already responsible for consistent improvements in

the agri-food industry but considering that this sector is often characterized by a lack of digital competencies and awareness, especially in most rural areas, there is still work to do (Silvestri et al., 2022). Silvestri et al. (2022) focused their effort on the study and understanding of the role of SMEs in this sector, how they deal with and approach digitalization, and how their R&D processes develop. One of the main focuses of the study was the role of business networks and if they really support digitalization. The results analyzed also two main initiatives, Tormaresca and Planetek, that were supported by Horizon 2020, and the overall conclusion confirms the importance of networking. Especially, the evidence gathered shows that the creation of strategic business networks among agro-food SMEs smooths the entrance of potential new markets and the sharing of important pieces of knowledge allows the firms not bare alone R&D costs for digital innovation (Silvestri et al., 2022). The agri-food sector sees also short food supply chains as a valid and sustainable alternative. SFSCs are characterized by the fact that, besides the economic value delivered, they contribute also to the sustainability and innovation fields. Recognizing that SFSCs can be classified into different types, even though it is not the focus of this research work, and their recent spread in Europe in the last years, their innovation potential is still not fully exploited (Chiffolleau & Dourian, 2020). Generally speaking, SFSCs are perceived as more sustainable alternatives rather than the industrial food supply chain. In the analysis conducted by Chiffolleau and Dourina (2020), SFSCs have been taken into consideration related to all the dimensions of sustainable development, showing a positive correlation.

More sustainability in the food sector is a flagship concept also for Kowalaska and Bieniek (2022), defined by the authors as a “cornerstone” (p. 609). Confirming what has previously been said by other authors in this section, thus the impact of the agri-food sector on the environment, the EGD has set clear objectives to achieve more sustainability in this sector with the Farm to Fork strategy. Kowalaska and Bieniek (2022) want to have a better understanding of the development of sustainable farming and the incentive to convey the sector toward sustainable growth, and in doing so assess how achievable the EGD targets are, whereby among them there is the reduction of chemical substances and preservation of the soil. After analyzing the existing literature on the topic, the objectives of the EGD seem quite bold to achieve and, in particular, the sustainable innovations needed to support the transition, even though the CAP’s support to organic farming. The suggestion made is to create a Green Public Procurement Policy to sustain a sustainable and organic European food sector and the use of block-chain technologies to further support it (Kowalska & Bieniek, 2022).

Responsible Research and Innovation is the other big topic that comes across different works, strictly related to Horizon 2020 and Horizon Europe (Cozzoni et al., 2021). This type of innovation overcomes just the achievement of economic progress to pursue at the same time societal, environmental, and economic sustainability (van den Hoven, 2013). Both Florin M. (2022) and Cozzoni et al. (2021) have handled the concept of RRI. In particular, Cozzoni et al. (2021) performed an Agent-Based Model analysis to understand how this type of innovation can impact the collaboration of innovation networks focusing on the additive manufacturing sector. The ABM is an analysis particularly suited to examine complex systems in which different actors and stakeholders interact with each other. The results got to show that besides the difficulty to perform the ABM, RRI is a novelty that encompasses new standards and a new

way of thinking, and the discussion underlines that one of the key features of the innovation process is the heterogeneity of actors, which should be one of the aspects to be considered, thus the social side of RRI (Cozzoni et al., 2021; Stirling, 2007). In concern to responsible research and innovation, it must be pointed out also that just recently the topic is bonded in a relationship with environmental sustainability. This aspect was part of the research questions of Ligardo-Herrera et al. (2018), whose aim was to determine the role of responsible research and innovation in tackling climate change. After a document analysis combined with a web review, the main data got were related to corporate social responsibility and sustainable innovation. As stated by Ligardo-Herrera et al. (2018), the main goal of their research was to assess the precious contribution and impact that research and innovation could have on climate change challenges. The main findings state that RRI might have a positive impact on environmental sustainability, even though there are still some barriers, such as the low awareness of the link between the two elements (Ligardo-Herrera et al., 2018). Always speaking about RRI, the work of Nazarko 2019 studied what RRI means from a firm's perspective. Although stating the close connection between RRI and Horizon 2020, the article finds out the potential benefits for an enterprise of RRI, which are advantages for both reputation and competitiveness, more integration of innovative technologies, reputational improvement, and go into an entrepreneurial vision that is not just profit-oriented (Nazarko, 2019).

Transportation and mobility are one of the eight priority interventions identified in the EGD and it must be affirmed that in the last years, the sector faced always more innovative approaches and the use of new technologies (Hyard, 2013). Particularly, the European Commission adopted the Strategic Transport Research and Innovation Agenda, which aims to highlight the main areas of intervention and the decarbonization of the sector (Tsakalidis et al., 2020). In particular, the work of Tsakalidis et al. (2020) focuses on the catalyzation of sustainable transportation and presented TRIMIS, an instrument to support policies created for the identification of the main technologies. The case study performed shows firstly the increasing funds devolved in finding sustainable alternatives to fuels and therefore the reduction of emissions, most of them related to Horizon 2020 and then its geographical location. What emerges is the contribution of TRIMIS in analyzing the existing data and the importance of finding gaps, in order to fill them with future research (Tsakalidis et al., 2020).

The next results treat eco-innovation. Particularly, the eco-innovation discourse approached by Colombo et al. (2019), focused on the what of eco-innovation, thus the EU policies related to it, and the who of eco-innovation, namely the stakeholders. After a theoretical part where the concept of eco-innovation is explained, the article keeps focusing on the presence of eco-innovation in EU policies where among the policies mentioned, Horizon 2020 stands out. The authors to understand the role of eco-innovation performed a qualitative analysis of EU policy papers Eco-Innovation Action Plan and Horizon 2020. What comes up is the not strong involvement in sustainability in the policies, not a clear definition of the stakeholders involved in the eco-innovation processes and that eco-innovation is leaving space for other concepts, such as the circular economy (Colombo et al., 2019). The conclusions remark on the need to take a stronger position in terms of sustainability, with a clear idea, which consists in affirming that the circular economy is an opportunity to implement a consistent change but also needs more research on it, which might also benefit and support the European sustainable transition. Eco-

innovation was also the research field of Constantini et al. (2016). Particularly, their objective was to underline the presence and also importance of linkages and spillovers in the eco-innovation framework. Using data from 27 EU Member States in a time horizon 1950-2009, the work provides an analysis at the sectoral level and promotes the role of intra-sectoral links to positively influence the environmental impacts. The methodology used was a theoretical background in eco-innovation, and after it, the authors set four different starting hypotheses to be tested in the empirical analysis. One clarification that must be pointed out is that the innovations considered were environmental-specific innovations. The results obtained confirmed that the effects, both direct and indirect, of eco-innovation, are reducing the negative impacts on the environmental dimension. More specifically, the main pieces of evidence found underline that eco-innovation is effective in the shift toward a more low-carbon economic model and the beneficial effects of spillovers, national and international ones (Constantini et al., 2017). In their final remark, Constantini et al. (2017) point out also the importance of sustainable value chains. Always speaking about eco-innovation, one work, in particular, had the target to identify among the eco-innovation projects, the ones that are more related to the recycling practice and, at the same time, seek a way to highlight them (Stosic et al., 2016). The whole work of Stosic et al. (2016) is focused on recycling, considering the high benefits that it can encompass according to the authors. Particularly, the evaluation model used allows to identify of crucial issues in the co-innovation context and also the main factor that influences the recycling practices, such as the importance of the social aspects in eco-innovation projects and the potential risk of them (Stosic et al., 2016).

In the sustainable innovation discourses, it is noteworthy to mention the innovation management aspect as well (Kralisch et al., 2018). Kralisch et al. (2018) with their paper wanted to examine and demonstrate that innovation management, as opposed to just project management, could be effectively used to foster sustainable technological innovations. What the authors argue is that there is a need to implement innovation management. Always according to Kralisch et al. (2018), the reason why is that it might simplify the decision-making processes in R&D field and at the same time build a proper framework to do so, even though adaptation and flexibility should be two key characteristics. Always speaking about innovation management, the work of Hernandez-Chea analyzed the concept of sustainable transition and the consequent sustainable innovation and tried to identify the most suitable business models. The results of the study marked that business models and actions are different when speaking about long-term and short-term. In pursuing a sustainable transition, the short-term focus should be on an operational level, which means adopting sustainable practices in everyday operations and promoting sustainability awareness. At the same time, the strategy should be the focus on the long-run discussion, in order to create appropriate value propositions and take advantage of sustainable economic prospects (Hernández-Chea et al., 2021).

At this point, it seems clear that sustainable innovation is related to different fields and sectors, also demonstrated by the different findings present in the current paragraph. The fact that innovation differs according to the sector, the stakeholders involved, the area, and the presence of digital solutions (Giuffrida & Mangiaracina, 2020). One of the main findings of Giuffrida and Mangiaracina et al. (2020) is the fact that, although the spread of digital innovations, they do not have a huge impact on the environmental dimension of sustainability.

4.2. Overview of EU Policies

The industrial sector is one of the key elements and one of the main areas of intervention of the EGD (Šimberová et al., 2022). In particular, in the work of Šimberová et al. (2022), it is interesting to note the role of small and medium enterprises (SMEs) in the EGD context. SMEs are one of the main drivers of digital innovation development in the EGD growth strategy according to the authors. In this sense, the conclusion drafted is that the EGD should particularly support SMEs with the reduction of entry barriers and further support and the authors also mark the fact that SMEs recognize the green transitions as an opportunity, besides the starting level of digitalization. The EGD, moreover, contains policies aimed at promoting SMEs in boosting their resilience, preventing late payments, and promoting solvency (Šimberová et al., 2022). Furthermore, the European Green Deal is not just something to achieve sustainability, but it is through sustainability that different achievements will be reached (Popa et al., 2022). Indeed, the EGD according to Popa et al. (2022), is not limited to be considered as a sustainable strategy, but it will assure the achievement of a competitive, resilient, and adaptable society and economy.

Beyond being a leader in enforcing policies, strategies, and regulations, for a long time, the EU enforced regulations about environmental preservation. The EGD is not the first European strategy to take a position in the sustainability field, and it contributes to the actual framework with updated strategies (Hedberg & Šipka, 2022). Being a sustainable innovation characterized by systemness and radicalness, according to Hedberg and Šipka (2022), the EGD enables a systemic tendency to face up environmental issues. What comes out from this article are also the problems that Europe is facing. Always according to Hedberg and Šipka (2022), one of the main aspects that cause reflection is the fact that, given the awareness of the different Member States towards sustainability challenges, there is still the tendency to look at the actions to empower depending on the single interests and perspectives. It is true that the different Member States differ in historical, economical, and social backgrounds and current situation, but the sustainable transition is not a challenge that can be addressed by single small entities. Furthermore, for the EU this is a historical period triggered by numerous challenges, from the Sars Covid-19 pandemic that hit the whole global economy and societies to the most recent Ukrainian invasion. These events may cause the political figures to take decisions that might benefit the short-term impacts without taking into consideration the long-term sustainable objective, considering also that the Member States are affected in a different way by the EGD (Hedberg & Šipka, 2022). Furthermore, the same authors make the point stating that “the EU and national leaders’ speeches and political declarations mean little if not actually implemented and enforced” (2022, p. 90).

Given that Horizon 2020 and Horizon Europe are thought and designed to support research, development, and innovation to pursue the sustainable transition, funding is still an aspect to be improved and looked at carefully. The EGD strategy and connected policies are trying to create ad hoc investments and funds strategies that can consider both the risk of innovation, given the newness of the innovation introduced into the marketplace, and the financial one. In doing so, the aim is to overcome the choices and decisions made that will bring just short-term positive effects to focus on long-term goals (Long & Blok, 2021). The idea is also in line with

what was expressed by Hedberg & Šipka (2022), thus there must be an alignment of objectives and long-term results, which must be placed before the individual needs of Member States. In this framework, Long and Blok (2021) analyzed the investments and funds challenges in niche markets. Stating that start-ups play a key role in the innovation processes, especially for them the right funds could make a difference, in contrast with established firms with stronger finances (Long & Blok, 2021). Long and Blok's (2022) conclusions identify the non-sufficient level of investments as a barrier to the achievement of the EGD objectives. In particular, the authors mark that, among the proposals made to try to facilitate access to private funds for companies operating at niche levels, there are private hedge funds and systematic leveraging.

Although recognizing the important role that the EGD plays in achieving, it must be considered that one of the main key points of the strategy, which is leaving no one behind and assure a fair transition, has some critical aspects and limitations, despite the presence of a specific fund, the JTF, created to assure that the transition is fair and equal as possible. (Sarkki et al., 2022). In particular, Sarkki et al. (2022) identified in their work a list of stakeholders and both public and private actors which could get left behind by the European sustainable transition. The concept of paradox is often used to describe leaving no one behind goal and call for flexibility. Particularly, the paradoxes identified serve as an example of how, in order to achieve this particular target, the different actors should comprehend and embrace complexities by acknowledging that, even when a policy is drafted in a fair manner, it may still end up being inequitable (Sarkki et al., 2022).

Focusing now on Horizon 2020, an analysis conducted by Pollex and Lenschow (2018) studies Horizon 2020 from the degrowth point of view. Even though sustainable and green innovation and growth are a considerable focus of Horizon 2020, the authors want to understand the dynamics of the strategy. In particular, and what makes the work particularly interesting, is that the focus is to understand which targets actually bring growth and which ones instead might have led to degrowth paths. After a theoretical background in degrowth theory and its correlation with policy papers, classical, green, and beyond GDP types of growth were analyzed by the authors. The beyond GDP growth emerged as the one most related to Horizon 2020, which means growth that does not count just economic progress but also societal benefits and well-being. Therefore the two main findings according to Pollex and Lenschow (2018) are: (i) the growth of Horizon 2020 is mainly led by technological innovation and the ICT sector, (ii) the data showed attempts to integrate GDP growth with broader development objectives, such as environmental and social ones. It is possible to affirm that, even though present, degrowth elements are very limited, and "this analysis suggests that [...] the creation of an internationally competitive market constitutes the core of the EU's political identity and may operate as a barrier for any systematic orientation toward degrowth scenarios" (Pollex & Lenschow, 2018, p. 2).

Results for Horizon 2020 and Horizon Europe are related also to RRI, part also of the sustainable innovation section. RRI implies that all the stakeholders involved in the sustainable transition work together and find cooperation to council innovation and societal values (Cozzoni et al., 2021). It is possible to find in the work of Cozzoni et al. (2021) a particular credit to

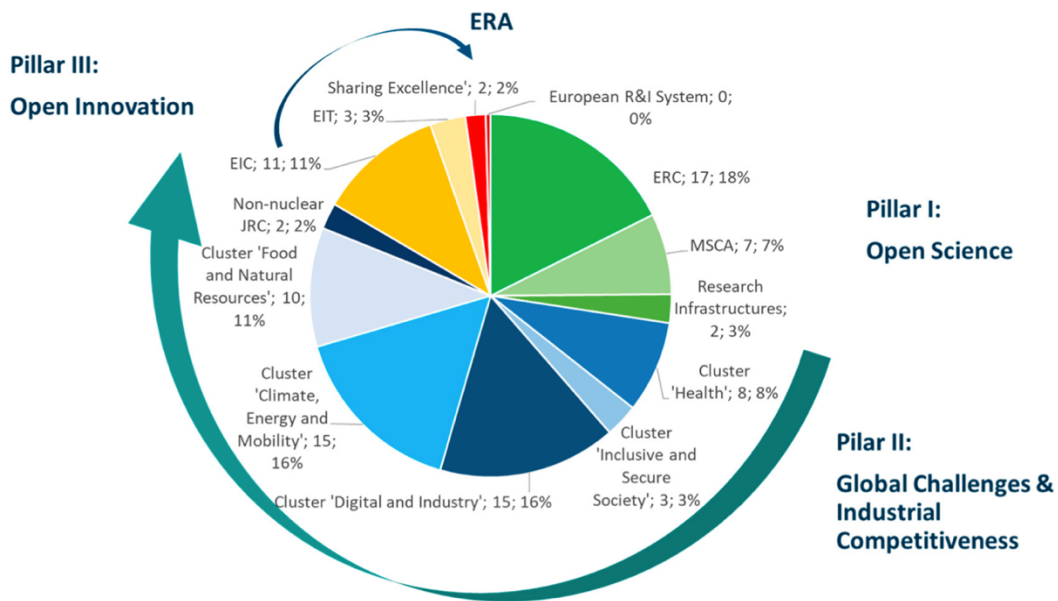
Horizon 2020, which is according to the considered article, one of the main projects that contribute to raise awareness of RRI and its impacts on society and the environment. In regard to Responsible Research and Innovation, also some doubts are present in the literary discourse. The fact is that this concept is strictly related to Horizon 2020, and therefore nowadays that Horizon 2020 is over and has given the way to Horizon Europe, questions arise on the future of RRI and how it will be sustained and implemented in the upcoming future. Even though Horizon Europe should dedicate a considerable part of its funds to responsible innovation and stakeholder engagement in innovation processes, the concept is not stated in a clear way (Albertson et al., 2021). In the work of Albertson et al. (2021), the current economic situation of secular stagnation is taken into consideration in the analysis of RRI alongside the different concepts of relational innovation and well-up innovation. The outcome is that to achieve responsible innovation Horizon Europe should focus on a comprehensive approach to responsible innovation, acknowledging the complexity of the context in which innovation develops and the interdependence of elements (Albertson et al., 2021). The analysis performed by Florin (2019), other than the RRI focus, tries to identify the role of risk governance and the linkages between the latter and the RRI promoted by Horizon 2020. Risk governance is defined as the monitoring, evaluation, and management of risk in the situation taken into consideration. The main benefit of risk governance is that it allows gathering the benefits of changes, in this case, the ones related to innovation, and at the same time, it reduces the negative impacts that risk can imply. It goes without saying that newness brought by innovation imply also new risks. The conclusions drawn by Florin M. (2019) show that risk governance and RRI should go hand in hand and “it is important, both for effective risk governance and for successful innovation that technological and institutional design of innovation reflects an awareness of the needs for fairness and responsibility” (Florin, 2022, p. 988).

González Fernández et al. (2019) keep the attention mainly on the innovation ecosystem present in the European landscape, with the intention to focus mainly on Horizon Europe. Given for granted that innovation is one of the upcoming priorities for the EU and an important element of progress and sustainable development, the innovation policies contributed to the creation of the European innovation ecosystems. In particular, the analysis of the authors is focused on Horizon Europe and among the actors identified as crucial, it is possible to find:

- “Government
- Academia
- Industry
- Society
- Natural Environment” (González Fernández et al., 2019, p. 11-15)

In the work, it is possible to find also an overview of the different innovation policies and therefore the regulatory framework concerning innovation in the EU, including the Framework Programs for research and innovation and the main bodies of the EU involved in such processes. After the examination of the three pillars of Horizon Europe, also the budget structure distributed among the pillars was considered (González Fernández et al., 2019).

Figure 3: Horizon Europe Budget Disposal. It is possible to see the allocation of funds among the three pillars of Horizon Europe.



Source: González Fernández et al., 2019.

The results obtained by González Fernández et al. (2019) identify some important hints that should guide not only Horizon Europe but all future EU innovation programs. First of all, innovation policies should be simple and try to pursue as much as possible the principle of continuity. Besides them, the focus on societal aspects should not be forgotten, given the relationship between innovation and society. What is also interesting is the fact that the EU, which its policies, facilitates the creation of an innovation cluster that without its presence would not have been created, considering the different Member States. Lastly, as already mentioned by other authors, an effective monitoring and benchmarking system should be at the top to analyze the progress, limitations, and room for improvement (González Fernández et al., 2019).

It must be acknowledged that Horizon Europe also encompasses some risks. More to the point, science and technology are needed to pursue sustainable growth, but at the same time, they might cause also pain (Bernstein et al., 2023). This point of view, brought to light by Bernstein et al. (2023), highlights also the critical aspects of the EU innovation policy. Even though the objectives of Horizon Europe are aligned with sustainability and are predicted to have positive impacts on the environment, it is now necessary to also show that research and innovation do not harm the environment. Dealing with the DNSH principle for the authors requires different approaches, which is the reason why they formulate three different invitations: (i) diversification of risk and harm, (ii) understanding that ambiguity is not a negative element, and (iii) coexisting with harm.

Among the relevant policies, besides the EGD, Horizon 2020, and Horizon Europe, also the Common Agricultural Policy must be mentioned. Given that the agri-food sector is an important topic of discussion in the previous paragraph of this work, it marks the importance of pursuing sustainability and innovation also in this sector. Research and innovation for more sustainable agricultural practices is a notion present in Horizon Europe, which has a part of its funds

planned to support not just the agri-food sector but also the development of European rural areas. All by promoting sustainable growth. In order to boost productivity and keep European competitiveness, innovations are needed, especially in a sector that is still based on old and traditional practices (Pokrivčák et al., 2019). An important contribution of the authors is also confronting the treatments between EU-15, the first fifteen member States, and the Central Eastern Countries. What emerges is a split among the different Member States. The technological gap, production gap, resources gap, and research gap between these two groups in the agricultural sector is a matter of fact. The different structure positioned the Central Europe Countries in a position of disadvantage compared to the European neighbors.

4.3. Future perspectives

Crucial for the ongoing sustainable transition is the transfer of knowledge, which should and must be transferred to younger generations of innovators, in order to avoid discontinuities and to pursue the green transition that the EGD strives to achieve (Lankauskienė et al., 2022). In this discourse particularly Martinidis et al. (2022, p. 13) state that “lifelong learning, skills training, and entrepreneurial skills are specific areas that have to be reinforced”. The same authors state that for future perspectives entrepreneurial activities must be supported more, from also a bureaucratic point of view, remarking also the importance of intellectual capital for the achievement of sustainable growth. Long and Blok (2021) with their work give two main recommendations, concerning future perspectives, and the first one is on avoiding information asymmetries, therefore connected also to knowledge sharing. To achieve the objectives of the EGD, in fact, all the actors involved need to have the same knowledge, the recommendation is therefore to overcome this information obstacle. The second recommendation is related to the financing side. Acknowledging that the EGD is supporting the funds’ side of the strategy by giving specific amounts of funds and creating ad hoc initiatives, the suggestion of the authors is to consider the contribution of investment banks in the whole process of the sustainable transition and their role for co-investments. Especially in the sector considered by their analysis, the agri-food one, the hope is in this way to foster partnerships (Long & Blok, 2021).

Considering the urgency of the European sustainable transition, one of the key points for the achievement of sustainable practices is the role of governments and institutions. Among the hints and recommendations, Bernstein et al. (2023) after the analysis made about the risk of harming, suggest that administrative roles and practices should be highlighted in the policy, such as advisory boards and systems of assessment of intellectual properties. Even though the paradox of leaving no one behind and the difficulties faced in the formulation of policies (Sarkki et al., 2022), governments have the power to encourage initiatives that will lead to sustainable models and in this way, considering also that an effective institutional structure could have an amplifying effect in promoting sustainable practices (Popa et al., 2022). In addition, the sentence “as the role of government is to safeguard the public interest, it is in the EU’s interest to use the power of legislation [...] to ensure sustainable prosperity for Europeans today and tomorrow “ (Hedberg & Šipka, 2022, p. 86) further remarks the concept just mentioned and highlights how the role of institutions could shape the future developments. Hedberg and Šipka identified the main recommendations to shape the ongoing and future transitions,

affirming that these elements must be present to transform goals into practices. These are clear and decisive governance, alignment between the goals set and the actions to make them possible, creation of the right context in which companies can operate, do not forget the social side of this transition, and lastly, acting as a leader and showing worldwide the European actions. Regarding this concept, another recommendation for the future perspectives of the EU from a policy and governmental point of view is the formulation of policies and strategies always less inequitable, identifying first the most vulnerable players and, in doing so, creating the different intervention areas based on their needs (Sarkki et al., 2022). Given the paradox of leaving no one behind, the authors suggest that not only the implementation of policies is fundamental, but also the formulation and the first steps are determinant.

In order to smooth out some gaps between different the different Member States, speaking about the agricultural sector but it is a disclosure applicable to other fields, and foster sustainable research and innovation, there is a proposal to specifically allocate a certain amount of funds to the less developed areas of the EU, which in this case are the Central Europe Countries, in order to unlock these areas potential and promote inclusive growth (Pokri-včák et al., 2019).

Relevant is also the study promoted by Hennemann et al. (2021), where the focus of the analysis is trying to explain why some sustainable initiatives fail in the end, and therefore the authors provide hints for their future success. Considering the great scope of the EGD, the authors' aim is to share some recommendations to make green policies and initiatives more strong and more resilient. The work is based on a school real case study, which involves four different classes of stakeholders taken into consideration, and on the educational concept that the school system can be beneficial for sustainable initiatives. The work highlighted the importance that education has and could have in the achievement of sustainable objectives. It is therefore insightful to think about education as a key pillar in the achievement of sustainable initiatives, given the fact that "with that, the authors express their deep wish that "multiple green businesses and sustainable development school initiatives will sparkle around the world to accompany generations that are needed to solve the most pressing challenges of our time" (Hennemann et al., 2021, p.13).

Regarding the trends of sustainable innovations, some pieces of advice for the future are present as well. For the transportation system, acknowledging that EU policies support and still support research and innovation, however, there is still potential for actions that might hasten the market adoption of new fuel alternatives, notwithstanding the considerable expenditures on transportation-related research and innovation. It is possible to affirm then that renewable sources of energy are among the alternatives for a more sustainable future for transportation (Tsakalidis et al., 2020). Concerning the discourses about smart specialization and responsible innovation held in the previous paragraphs, the outcome of Albertson et al. (2021) is that, besides the focus on a comprehensive approach to responsible innovation, Horizon Europe should focus on regional areas which have great perspectives of growth. In regard to future perspectives and innovation research, Colombo et al. (2019) have two main recommendations. In particular, in the eco-innovation framework, the authors suggest circular economy models and practices, especially in developing areas where there is really the opportunity to

pursue sustainable growth. The second one, always related to circularity, clears that also collaboration and decision-making should fit the sustainable model, therefore these processes must suit and be adapted (Colombo et al., 2019). Also, Di Maria et al. (2022) as future perspectives encourage to think about the sustainable opportunities that circular economy could bring, especially in the metallurgic industry, and that toward further development of the technologies, it will be possible to overcome the actual limitations and going into more sustainable and effective models. Being the circular economy one of the key points of the EGD strategy, these literature disclosures open the path of a dominant circular economy presence in the future of European growth.

An important consideration for the future of the sustainability field comes from Lankauskienė et al. (2022), which in a broad framework not only underlines the complexity of the European background in terms of sustainability but also that there are always new challenges that arise. This makes the sustainable transition even more complex, given the fact that always more aspects and challenges have to be taken into consideration. Future perspectives are therefore more difficult to forecast and identify given the constant evolution of the context in which they are developed.

4.4. Descriptives

The below tables are a summary of the content analyzed and the main findings. It is possible to see that the majority of the literature used is included in the time frame 2022-2020. Concerning the content, the large majority of the articles, but with some exceptions, are empirical papers. The tables will support to develop also the discussion, that will follow in the next chapter.

Table 2: Summary of Sustainable Innovation Status Results.

SUSTAINABLE INNOVATION STATUS		
CONTRIBUTION	AUTHORS	YEAR
SMART SPECIALIZATION	Lankauskienė R., Simonaitytė V., Gedminaitė-Raudonė Ž., Johnson J.	2022
	Martinidis G., Dyjakon A., Minta S., Ramut R.	2022
	Meyer C.	2022
CIRCULAR SOLUTIONS	Di María A., Merchán M., Marchand M., Eguizabal D., De Cortázar M.G., Van Acker K.	2022
	Popa A.F., Burcă V., Sahlian D.N., Trașcă D.L.	2022
	Silvestri R., Ingraio C., Fiore M., Carloni E.	2022
DIGITALIZATION	Šimberová I., Korauš A., Schüller D., Smolíkova L., Straková J., Váchal J.	2022
	Zamiri, M., Ferreira, J., Sarraipa, J., Sassanelli, C., Gusmeroli, S., & Jardim-Goncalves, R.	2021
	Fernandez-Aller C., De Velasco A.F., Manjarres A., Pastor-Escuredo D., Pickin S., Criado J.S., Ausin T.	2021
	Kowalska A., Bieniek M.	2022
AGRI-FOOD SECTOR FOCUS	Silvestri R., Ingraio C., Fiore M., Carloni E.	2022
	Chiffolleau Y., Dourian T.	2020
	Florin M.-V.	2022
RRI	Cozzoni E., Passavanti C., Ponsiglione C., Primario S., Rippa P.	2021
	Nazarko L.	2019
	Ligardo-Herrera, I., Gómez-Navarro, T., Inigo, E., & Blok, V.	2018
	Colombo L.A., Pansera M., Owen R.	2019
ECO-INNOVATION	Costantini V., Crespi F., Marin G., Paglialunga E.	2017
	Stosic B., Milutinovic R., Zakic N., Zivkovic N.	2016
	Kralisch D., Ott D., Lapkin A.A., Yaseneva P., De Soete W., Jones M., Minkov N., Finkbeiner M.	2016
BUSINESS MODELS	Hernández-Chea, R., Jain, A., Bocken, N. M. P., & Gurttoo, A.	2021
TRANSPORTATION AND MOBILITY	Tsakalidis A., van Balen M., Gkoumas K., Pekar F.	2020

Source: Own elaboration based on results retrieved

Table 3: Summary of Overview of EU Policies Results

OVERVIEW OF EU POLICIES		
CONTRIBUTION	AUTHORS	YEAR
EUROPEAN GREEN DEAL	Hedberg A., Šipka S.	2022
	Popa A.F., Burcă V., Sahlian D.N., Trașcă D.L.	2022
	Sarkki S., Ludvig A., Nijnik M., Kopy S.	2022
	Šimberová I., Korauš A., Schüller D., Smolíkova L., Straková J., Váchal J.	2022
	Long T.B., Blok V.	2021
HORIZON 2020	Florin M.-V.	2022
	Albertson K., de Saille S., Pandey P., Amanatidou E., Arthur K.N.A., Van Oudheusden M., Medvecký F.	2021
	Cozzoni E., Passavanti C., Ponsiglione C., Primario S., Rippa P.	2021
	Pollex J., Lenschow A.	2018
HORIZON EUROPE	Bernstein M.J., Franssen T., Smith R.D.J., de Wilde M.	2022
	Albertson K., de Saille S., Pandey P., Amanatidou E., Arthur K.N.A., Van Oudheusden M., Medvecký F.	2021
	Fernández S.G., Kubus R., Pérez-Iñigo J.M.	2019
COMMON AGRICULTURAL POLICY	Pokrivčák J., Ciaian P., Drabik D.	2019

Source: Own elaboration based on results retrieved

Table 4: Summary of Future Perspectives Results

FUTURE PERSPECTIVES		
CONTRIBUTION	AUTHORS	YEAR
ROLE OF KNOWLDE AND SHARE INFORMATION	Lankauskienė R., Simonaitytė V., Gedminaitė-Raudonė Ž., Johnson J.	2022
	Long T.B., Blok V.	2021
ROLE OF GOVRNEMNET AND INSTITUTIONS	Bernstein M.J., Franssen T., Smith R.D.J., de Wilde M.	2022
	Hedberg A., Šipka S.	2022
	Popa A.F., Burcă V., Sahlian D.N., Trașcă D.L.	2022
	Sarkki S., Ludvig A., Nijnik M., Kopy S.	2022
SPECIAL FUNDS ALLOCATION	Pokrivčák J., Ciaian P., Drabik D.	2019
EDUCATION	Hennemann J.N., Draser B., Stofkova K.R.	2021
RENEWABLE AND CIRCULAR ENERGY SOURCES	Di Maria A., Merchán M., Marchand M., Eguizabal D., De Cortázar M.G., Van Acker K.	2022
	Albertson K., de Saille S., Pandey P., Amanatidou E., Arthur K.N.A., Van Oudheusden M., Medvecký F.	2021
	Colombo L.A., Pansera M., Owen R.	2019

Source: Own elaboration based on results retrieved

5. Discussion

The current section of this work is entitled to analyze the results and findings of the articles selected for the Systematical Literature Review in combination with the notions presented in the conceptual background chapter.

The evidence gathered, summing the conceptual background and the results, suggests that sustainable innovation is a key component in relation to the EGD, Horizon 2020, and Horizon Europe. The academic discourse that links sustainable innovation and EGD, Horizon 2020, and Horizon Europe is strong in affirming that sustainable innovation is not just an element of the three policies, but it will enhance them. Almost all the findings of sustainable innovation were linked in the discussion with one of the three policies taken into consideration, also thanks to the research string created. Going into detail, there are different trends and concepts regarding sustainable innovation identified throughout the reading and analysis of the 31 articles included in the Systematic Literature Review.

The first one is Smart Specialization. According to the papers taken into consideration dealing with this topic, smart specialization is one of the trends that has the potential to strengthen the different areas of the EU and, above all, has the possibility to suit sustainability (Lankauskienė et al., 2022; Martinidis et al., 2022). Smart Specialization is based on the concept that the adjective specialized does not mean diversified (Lankauskienė et al., 2022). It is a concept based on the understating of the different drivers of regional areas, allowing these regions to base their growth on these drivers (Szerb et al., 2020). More precisely, smart specialization is a “strategic approach to an innovation-based policy for regional economic development” (Asheim, 2019, p. 9). The same author identified smart specialization as an attempt by the EU to enhance European growth also through specialization based on local competencies. In the perspective of leaving no one behind, smart specialization could be one of the keys to overcome the differences and asymmetries among the Member States, focusing and investing in the local differences as an occasion to, to some extent, exploit the difference to build specialized competencies and advantages. Relevant to this discussion is the work of Nakicenovic et al. (2021), which looked at connections between EGD and Smart Specialization, trying to find in this way how the regional innovation strategy can fit and support the EGD. The outcome is the fact that, with sustainability, there should be a new generation of Smart Specialization, where the focus will not just be regional innovation but regional sustainable innovation to achieve the sustainable transition. It is also true that taking into consideration the differences among the different Member States and the principle of leaving no one behind, the next step of Smart Specialisation should not just be a place-based sustainable innovation, but also a supportive one. Thus, both sustainability and solidarity are necessary. This prompts solidarity as a crucial task to be accomplished through Smart Specialization as well (Nakicenovic et al., 2021).

Figure 3: The Future of Smart Specialisation. The image shows the evolution that Smart Specialization should have in order to support sustainably



Source: Own representation from Nakicenovic et al., 2021.

It is important to underline two aspects, the first one is the limit identified in Smart Specialization, thus it will not enhance radical innovation (Martinidis et al., 2022), which however should be a characteristic, highlighted also in the conceptual background, of innovations to achieve sustainable transitions (Boons et al., 2013). The second one is that the articles presented in the result chapter about Smart Specialization were mainly focused on different geographic areas. The examples are the EU Baltic Regions (Lankauskienė et al., 2022) and Eastern Europe areas such as Macedonia and Greece (Martinidis et al., 2022). It comes to think that Smart Specialization might be, therefore, particularly significant for the less developed areas within the EU (Wibisono, 2022). Wibisono (2022) in his article identified also the critical aspect to focus on for Smart Specialisation in less developed regions: regional financing system, local administration, and local cooperation.

The second main result that arise in the sustainable innovation section was digitalization. Even though it is not cited among the eight EGD main elements, digitalization is considered a fundamental complement to the sustainable transition (European Commission, 2019). As stated by Šimberová et al. (2022) results, digitalization must be analyzed from different perspectives, especially for SMEs and large firms. This consideration brings out the hint on how it's important to distinguish between different types of firms in terms of digitalization. Furthermore, the role of emerging and new digital technologies could be the turning point for the EGD sustainable transition (Sharma et al., 2022; Šimberová et al. 2022). An example in this sense are Industry 4.0, which aim is the digitalization of the industry sector, and Society 5.0. More in particular, digitalization “will play an essential and catalytic role” (Bertoncelj, 2022, p. 5). In view of digitalization as a generic term, when speaking about digitalization it is possible to group the different types of digitalization into four macro groups: communication technologies, machine learning, processing technologies, and big data (Aceto et al., 2018). Sharma et al. (2022) identify Industry 4.0 and the consequent digitalization encompassed as a positive element for the European sustainability challenges. In the table below it is possible to see the main findings of their study, where the different targets of the EGD are associated with the relative enabling technologies:

Table 5: Role of digital technology in the EGD. It shows the technologies potentially related to each EGD main element.

Policy-level goals of the European Green Deal (EGD)	Enabling technologies
Increasing the EU's climate ambition for 2030 and 2050 Supplying clean, affordable and secure energy	Big data analytics and Internet of things Artificial intelligence, Big data analytics and Internet of things
Mobilizing industry for a clean and circular economy Building and renovating in an energy and resource-efficient way	Artificial intelligence and big data analytics Big data analytics and Internet of things
Accelerating the shift to sustainable and smart mobility From "Farm to Fork": designing a fair, healthy and environmentally friendly food system	Big data analytics and Internet of things Big data analytics and Internet of things
Preserving and restoring ecosystems and biodiversity	Artificial intelligence, big data analytics and cloud computing
A zero-pollution ambition for a toxic-free environment	Artificial intelligence, big data analytics and Internet of Things

Source: Sharma et al., 2022, p. 275

Following the same topic and considering the above figure, Digital Innovation Hubs, and Artificial Intelligence were also one of the findings present in SLR, where it was associated with sustainability and the fact that its utilization must consider and be respectful of the social component of sustainability (Fernandez-Aller et al., 2021). This highlights the presence of different technologies and digital innovations that are not born with the intention of being used merely for a sustainable scope, but rather can contribute to the sustainability cause.

Another interesting finding is the presence of agricultural and food sectors in the EU scenario. An important part of sustainable innovation results was dedicated to this sector. Nevertheless, the food sector is one of the eight action areas of the EGD. From Farm to Fork, also mentioned in the conceptual background section, is the strategy identified in the EGD to achieve sustainability and growth in the European food system, including all the relevant phases, which means from production to consumption and waste management (European Commission, 2019). What comes out from the results gathered is that both sectors, agricultural and food, are incisive for environmental and climate issues (Chiffolleau & Dourian, 2022; Silvestri et al., 2022). Constructive are also the solutions identified to achieve the EGD sustainable targets in this sector. An example is the combination of the agri-food sector and digitalization. Despite the fact that digitalization has been identified as a major trend in sustainable innovation, this implies its flexibility and the fact that it can suit and support different sectors. The other findings alongside digitalization are Short Supply Chains, which are still potential solutions that could be exploited further (Chiffolleau & Dourian, 2022). In general, in this discourse also CAP should be considered, on the ground that it regulates European agri-food principles (Wrzaszcz & Prandecki, 2020). To further confirm it, alongside EGD, Horizon 2020, and Horizon Europe, CAP was present in the results (Pokrivčák et al., 2019). It will be therefore crucial to understand how the EU CAP policy will evolve and develop to mutually coexist and support the EGD targets.

Even though the mobility and transportation sector has been identified among the main elements of the EGD (European Commission, 2019), the results gained show a minor presence

of it in the literature discussion, even though the expectation was a higher presence of the mobility, transportation, and energy sector. One surprising finding as well is the low presence of circularity in the results of the SLR, considering that the circular economy is a topic that different authors stated as primary importance for the achievement of sustainable objectives (European Commission, 2019, Munta, 2020; Brudermüller et al., 2021). The circular economy was mainly related to energy and resources efficiency (Di Maria et al., 2022; Popa et al., 2022), which clearly states that despite the low number of results, circularity could contribute in relevant fields for the EGD objectives. Furthermore, the circular economy was matched also with the eco-innovation discourse (Colombo et al., 2019).

The eco-innovation discourse was relevant as well in the results. Given that the European policies more related to eco-innovation are Horizon 2020 and Horizon Europe, the overall result is positive for the contribution of eco-innovation in sustainability. Among the main contributions, as just mentioned, there is the fact that eco-innovation could find in the circular economy an opportunity to pursue sustainable growth (Colombo et al., 2019) and to reach a low-carbon economy, alongside the benefits of national and international collaboration, given the examples of spillovers and innovation networks (Costantini et al., 2017). These results confirm what is present also in the conceptual background chapter, which means that the circular economy element of EGD will support sustainable innovation and also the fact that cooperation and collaboration are needed in order to pursue the green transition.

Concerning the findings regarding the EU policies, it is possible to classify them per specific policy. Starting from the European Green Deal, there is the confirmation of the overall , thus its impact in the EU scenario. Different authors in fact recognize the EGD as an ambitious and eager policy (Hedberg & Šipka, 2022; Popa et al, 2021)

Interesting is also the result about the role of SMEs. In particular, linking digitalization with SMEs and EGD, it comes out that not only that SMEs can be a decisive driver for digitalization, already highlighted, but also that SMEs often perceive the green transition encompassed by the EGD as an opportunity (Šimberová et al. 2022). This means that the EU should particularly consider SMEs and point to them for the achievement of sustainable targets. In this regard, the role of SMEs in promoting the digital and sustainable transition could be a starting point for future research. In the EGD framework, the role of start-ups and niche markets is relevant as well. As hinted in the conceptual background, niches are always more cases of study concerning sustainable innovation and transition because of the fact that disruptive and radical innovations find in the niche a good environment to develop and then, eventually, spread through the main markets (Long & Blok, 2022). Niche markets could be a springboard for sustainable innovation and hereby come to the conclusion to particularly monitor these markets. Furthermore, Hedberg & Šipka (2022), highlighted the fact that the EGD is empowering a radical and systemic change to achieve a sustainable transition. This binds to Boons et al. (2013), when the authors marked that the attributes of systemness and radicalness are present when speaking about the sustainable transition, facts also supported by Brudermüller et al. (2021). Additionally, Hedberg & Šipka (2022) underline one of the crucial aspects in the EGD discourse, which is cohesion. One of the main criticalities consists in the fact that Member States might act and take decisions for personal interest or that simply bring short-term benefits. Given the magnitude of the EGD sustainable transition, these actions might undermine the long-term

goals. Another critical aspect, according to Sarraki et al. (2022) is the leaving no one behind component of EGD, arguing that this is a paradox given the diversity of Member States, despite the ad hoc JTF, which is considered by the authors not enough. Nevertheless, the findings in sustainable innovation show how it is possible to build strengths and competitive advantages from diversities among the different areas within the EU, e.g Smart Specialization (Lankauskienė et al., 2022), which should be a positive reinforcement of the fact that, although recognizing the potential paradox, the solutions to overcome it are possible to find. In this regard, the suggestions and future perspectives in this sense are trying to draft a strategy less inequitable as possible (Sarraki et al., 2022), the allocation of specific funds to the less EU-developed regions (Pokrivčák et al., 2019), and follow a comprehensive approach without bias in the identifications of areas with greater growth expectations (Albertson et al., 2021)

For Horizon 2020, it is crucial to understand the past EU innovation program to figure the present and future of innovation out. The main evidence found it's the connection with RRI (Florin, 2019). Responsible Research and Innovation is a concept largely present in the results section, which means that it is one key component of the relationship between the three considered policies and sustainable innovation. RRI means that innovation processes do not harm sustainability, but rather reconcile the two of them. In this way, it is possible to achieve the necessity of innovating and at the same time being respectful of the environment and society (Burget et al., 2017). The RRI disclosure was generally positive, highlighting the positive impact it has on environmental sustainability (Ligardo-Herrera et al., 2018) and the benefits from the firms' perspective (Nazarko, 2019). Concerning Horizon 2020 outcomes, it is possible to affirm that, being the innovation promoted by it risky, risk governance is, therefore, an aspect to consider in the discussion of EU innovation programs (Florin, 2022), alongside understanding that for sustainable growth GDP is not sufficient, but beyond-GDP growth is a better indicator to measure it (Pollex & Lenschow, 2018). This leads to the fact that this discourse might be extended also to the EGD and Horizon Europe, being them promoting as well growth and prosperity. One of the main weaknesses identified in recent years in Horizon 2020 and more in general in the European framework was the presence of dissimilarities among the different Member States, with different starting points in the innovation process. This concept is not new, considering the leaving no one behind objective of the EGD (Sakkari et al., 2022). Always according to Veugelers et al. (2015), there is also a connection between the EU's industrial structure and the innovation deficit identified in the comparison with other international realities. In particular, considering the high-tech industries and their fast spread, new enterprises fall shorts of contributing significantly to the innovation dynamics of the European industry framework. This is demonstrated by their inability to enter the market in a significant way and by the failure of the most innovative and effective newcomers to gain global leadership. And here finds more confirmation of what has been previously marked, thus the role of start-ups and their ability to bring disruptive innovations. In this framework, Colombo et al. (2019), although confirming the still present weaknesses in the sustainability and eco-innovation disclosure, affirms that new perspectives in the sustainability field are taking the stage and, if well exploited, will unlock the European potential. Circular economy for example is one of these elements (Di Maria et al., 2022), thus a remark on what has been said about circularity.

Also for Horizon Europe, the concept of RRI is always present. One of the main findings and points of reflection is the shift from Horizon 2020 to Horizon Europe and the impact that it might have on RRI (Cozzoni et al., 2021). What emerges here is the uncertainty about the future and how Horizon Europe will support and update RRI. Recalling the contribution of Clodoveo et al. (2021) in the conceptual background section, this outcome confirms the fact innovation processes, in this particular case RRI processes, are complex, uncertain, and dynamic. A contribution in this sense is given also by Lankauskienė et al. (2022), wherein the final recommendation is to consider that design of policy and strategy should consider the complexity of the context. Therefore it is possible to state that understanding the differences and the bare spots, if any, between the two Horizon programs should be addressed as a priority in order to have a policy and strategy set that can support EGD achievement and not hinder it. Horizon Europe was also analyzed from the stakeholders' and innovation ecosystem's points of view (González Fernández et al., 2019). Although confirming that there must be a clear identification of the main stakeholders in the sustainability context, which are governments, industrial actors, and societal ones, González Fernández et al. (2019) highlight the fact that the three pillars of Horizon Europe are not equally comparable, considering that the second one has the majority of funds allocated, as shown in Figure 3, therefore it is possible to expect a major focus on industrial competitiveness in the future EU-sustained innovation projects. At the same time, the main limitation and warning concerning this policy come from the fact that science and innovation might also cause harm, as in the past with the linear economy (Bernstein et al., 2023). It is noteworthy to mention that recent data, updated in February 2022, shows positive signs of sustainable innovation in the European context related to Horizon Europe. According to the European Investment Bank, the EU is one of the global leaders in terms of climate change-related innovations (Delanote & Rueckert, 2022). The EIB highlighted also the potential of start-ups in terms of sustainable innovation and the comparison of the number of patents and other instruments of legal protection stored between established companies and start-ups shows that start-ups have a higher number of them. Recalling the two concepts of radicalness and systemness, which according to Boons et al. (2013) characterize sustainable innovation, combined with the recent facts marked by the EIB, and the conclusions of Long and Blok (2021) about start-ups and niche markets, it is possible to further sustain the hypothesis that startups would have a crucial role in the achievement of the European sustainable transition. Another consideration relevant to the discussion is that Horizon Europe was the policy with the smallest number of results gathered.

Finally, the future perspective section highlighted some hints that can be used in the current course of action, as well as starting points for future research, where some of them have already been mentioned in the current discussion. The role of government and political figures in particular is an aspect to be improved, given the impact that it could and should have (Hedberg & Šipka, 2022; Popa et al, 2021). This marks the fact that is not just the EU or the European Institutions, but also governments and institutions at the national and local levels. The other main conclusion arises from the fact that the knowledge generated within the different Member States and the consequent innovation should be shared (Lankauskienė et al., 2022; Martinidis et al., 2022). Leaving no one behind and the concept of solidarity (Nakicenovic et al., 2021) can find in the knowledge transfer a perfect example, alongside the creation of innovation networks and the overcome of the information barriers (Long & Blok, 2021) that might

hinder the success of the sustainable transition. It finds here confirmation that the EU should act and behave compactly, and in doing so create connections and cooperation not just among the different Member States but also through different areas, without forgetting the impact that a sustainable-driven education could have for the current and future generations (Hennemann et al., 2021).

6. Conclusion

The main purpose of this work was to understand and analyze the academic discourse that links sustainable innovation with Horizon Europe, Horizon 2020, and EGD. In doing so, the goal was also to understand the drivers and obstacles of sustainable innovation in the European context, find potential limitations, and try to understand future perspectives.

The study and analysis of the theory present in the conceptual background chapter in combination with the results got from the execution of the SLR both show a positive academic discourse. Considering the different results and the consequent discussion, it is possible to draft the conclusion that the EGD needs sustainable innovation to accomplish its sustainable targets. The research conducted through the SLR allows identifying the main concepts related to sustainable innovation in relation to EGD, Horizon 2020, and Horizon Europe. Almost all the results confirmed the fact that the EGD, despite being an ambitious strategy, will also transform in a significant way the European reality and that this transformation will be enhanced mainly through innovation (Martinidis et al., 2022; Bruder Müller et al., 2021; European Commission, 2019). It is therefore possible to expect sustainable changes in the European industrial system and society toward a sustainable future. In doing so, Horizon 2020 paved the way for future innovation EU programs in starting to focus on and promote a type of innovation that is sustainable, and for Horizon Europe. Horizon Europe can be defined as the main tool of the EGD in terms of fostering innovation (European Commission & Directorate-General for Research and Innovation, 2021).

In particular, the result section highlighted the main sustainable innovations identified by the literature that could support and contribute to the European sustainable transition. What is intriguing, is the fact that these sustainable innovations take into consideration the current situation and the related limits, to suggest solutions and improvements. For example, the presence of Smart Specialization and digitalization was strong. Smart Specialization acknowledges the differences among and within the different Member States and allows to focus on local and regional capabilities to build different and competitive advantages (Lankauskienė et al., 2022; Szerb et al., 2020). In this way, it has the potential to leverage one of the limitations of the EGD, thus the paradox of leaving no one behind and the fact that the EU, although being a unique entity, is composed of different realities (Sarraki et al., 2022). The same reasoning fits digitalization. Given the fact that it could support almost all the eight main elements of the EGD, it's clear that the emergence of innovation in this field could have a big impact on EGD goals (Šimberová et al., 2022). Even though not supported by numerous pieces of literature, also the circular economy has been identified as a reality that could support the rethinking of the European industrial system (European Commission, 2019), especially in resources and energy management (Di Maria et al., 2022). These are just the main findings of a work that recognizes different results and insights, which count also RRI and eco-innovation among them.

What is also clear is that different limitations and aspects to particularly take into consideration in the path towards a sustainable transition for Europe's future. For example, insufficient investments (Long & Blok, 2022), the type of innovation needed to sustain a green transition and the fact that small and incremental innovations are not enough (De Noni et al., 2021; Boons et

al., 2013), and the passing of the baton between Horizon 2020 and Horizon Europe, in a background where it is important to pursue continuity and not lose the progress started with Horizon 2020. It must be recognized that this work was able also to gather hints for future improvements. Among them stand out the role of SMEs and start-ups, governments, and political figures alongside the concepts of knowledge sharing. In particular, SMEs and start-ups have been highlighted for their role and capability to introduce innovations (Long & Blok, 2022; Šimberová et al., 2022). Furthermore, recalling cooperation and continuity concepts, governments should be among the first supporter of the sustainable transition and, consequently, place it before self-interest and short time results. Finally, another remark, which is linked to different topics treated, is the knowledge sharing and the importance of the network concept (Silvestri et al., 2022), in a complex and continuously evolving context (Lankauskienė et al., 2022).

Considering the different results and the consequent discussion, it must be considered that this work presents some limitations. Scopus and Google Scholar are the two databases used to perform the SLR, but ideally, the use of an additional database would have brought more pieces of evidence. Secondly, the findings and discoveries are related to the articles obtained from the string, and the related keywords, used for the SLR. Therefore, it is possible that with a slightly different string or a variation of the keywords used, there would have been a different pool of articles retrieved. Furthermore, there is also the possibility that inclusion and exclusion criteria might have excluded some relevant evidence, despite the fact that the phase of inclusion and exclusion of the relevant work was carefully performed. Finally, another limitation to mention is the fact that a part of the literature was focused on a specific and delimited geographic area, therefore not all the results can be universally used.

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Appendix

i. Appendix with Data Used

Results of search string after limitations and exclusion criteria

Authors	Title	Year	DOI	Author Keywords	Source
Bernstein M.J., Franssen T., Smith R.D.J., de Wilde M.	The European Commission's Green Deal is an opportunity to rethink harmful practices of research and innovation policy	2023	10.1007/s13280-022-01802-3	Do no significant harm; European Green Deal; Feminist science policy; Research policy; Situated ethics; Sustainability	Scopus
Sarkki S., Ludvig A., Nijhik M., Kopy S.	Embracing policy paradoxes: EU's Just Transition Fund and the aim "to leave no one behind"	2022	10.1007/s10784-022-09594-5	Affirmative action; Climate policies; European green deal; Governance innovation; Just Transition; Policy document analysis; Sustainability; Territorial cohesion	Scopus
Lankauskienė R., Simonaitytė V., Gedminaitė-Raudonė Ž., Johnson J.	Addressing the European Green Deal with Smart Specialization Strategies in the Baltic Sea Region	2022	10.3390/su14191912	Baltic Sea region; DPSIR analysis; European Green Deal; green transformation; policy recommendations; smart specialization; sustainability	Scopus
Kowalska A., Bieniek M.	Meeting the European green deal objective of expanding organic farming	2022	10.24136/eq.2022.021	European Green Deal; green growth; green public procurement; organic farming; sustainable food system	Scopus
Martinidis G., Dyjakon A., Mintis S., Ramut R.	Intellectual Capital and Sustainable S3 in the Regions of Central Macedonia and Western Macedonia, Greece	2022	10.3390/su141610325	human capital; intellectual capital; regional development; smart specialisation strategies; social capital; sustainable development	Scopus
Di Maria A., Merchán M., Marchand M., Eguizabal D., De Cortázar M.G., Van Acker K.	Evaluating energy and resource efficiency for recovery of metallurgical residues using environmental and economic analysis	2022	10.1016/j.jclepro.2022.131790	Environmental and Economic Evaluation; Life Cycle Assessment; Life Cycle Costing; Metallurgical residues valorisation	Scopus
Meyer C.	Social Innovation Governance in Smart Specialisation Policies and Strategies Heading towards Sustainability: A Pathway to RIS4?	2022	10.3390/socsci11040150	regional development; regional innovation; RIS3; RIS4; smart specialisation; social innovation; sustainability; systematic literature review	Scopus
Šimberová I., Koraus A., Schüller D., Smolková L., Straková J., Váchal J.	Threats and Opportunities in Digital Transformation in SMEs from the Perspective of Sustainability: A Case Study in the Czech Republic	2022	10.3390/su14063628	digital transformation; digitalisation; opportunities; SMEs; sustainability; threats	Scopus
Hedberg A., Šipka S.	The role of European Union policies in accelerating the green transition	2022			Scopus
Popa A.F., Burcă V., Sahlian D.N., Trașcă D.L.	The Interaction between Renewable Energy Consumption and the Institutional Framework from the Circular Economy-based Perspective	2022	10.24818/EA/2022/61648	Circular economy; energy efficiency; Fully Modified Ordinary Least Squares; generalized method of moments; regulatory indicators for sustainable energy; renewable energy	Scopus
Silvestri R., Ingrao C., Fiore M., Carloni E.	Digital innovation through networking among agro-food SMEs: the role of R&D projects	2022	10.1108/IBF-J-12-2021-1339	Innovation; Project; SMEs	Scopus
Florin M.-V.	Risk governance and 'responsible research and innovation' can be mutually supportive	2022	10.1080/13669877.2019.1646311	responsible research and innovation; Risk governance; RRI	Scopus
Hernández-Chea, R., Jain, A., Bocken, N. M. P., & Gurfo, A.	The Business Model in Sustainability Transition: A Conceptualization	2021	10.3390/su13115763	Responsible Research and Innovation (RRI), responsibility, European Union, innovation, technology management, technology assessment.	Google Scholar
Long T.B., Blok V.	Niche level investment challenges for European Green Deal financing in Europe: lessons from and for the agri-food climate transition	2021	10.1057/s41599-021-00945-0		Scopus
Cozzoni E., Passavanti C., Ponsiglione C., Primario S., Rippe P.	Interorganizational collaboration in innovation networks: An agent-based model for responsible research and innovation in additive manufacturing	2021	10.3390/su13137460	Additive manufacturing; Agent-based modelling; Complexity; Innovation value chains; Interorganizational collaboration; Relational dynamics; Responsible research and innovation	Scopus
Fernandez-Aller C., De Valasco A.F., Manjarres A., Pastor-Escuredo D., Pickin S., Criado J.S., Austin T.	An Inclusive and Sustainable Artificial Intelligence Strategy for Europe Based on Human Rights	2021	10.1109/MTS.2021.3056283		Scopus
Hennemann J.N., Draser B., Stefkova K.R.	The green business and sustainable development school—a case study for an innovative educational concept to prevent big ideas from failure	2021	10.3390/su13041943	Design thinking; Educational concept; Green business school; Green failure; Interdisciplinary capacity and movement building; Prevent big ideas from failure; Science and action-based research; Theory U; Young generation collaboration network; "European green deal"; "New green deal"	Scopus

Authors	Title	Year	DOI	Author Keywords	Source
Albertson K., de Saille S., Pandey P., Amanatidou E., Arthur K.N.A., Van Oudheusden M., Medvecky F.	An RRI for the present moment: relational and 'well-up' innovation	2021	10.1080/23299460.2021.1961066	ethics of care; relational innovation; Responsible research and innovation; responsible stagnation; well-up economics	Scopus
Zamiri, M., Ferreira, J., Saraipa, J., Sassanelli, C., Gusmeroli, S., & Jardim-Goncalves, R.	Towards A Conceptual Framework for Developing Sustainable Digital Supply Chains: Is strengthening the answer? a literature review for a research and innovation	2021	10.1109/ICE/ITMC52061.2021.9570120	Literature review; Local food systems; New indicators of wealth; Short food supply chain; Sustainability	Google Scholar
Chiffolleau Y., Dourian T.	Green Practices for Global Supply Chains in Diverse Industrial, Geographical, and Technological Settings: A Literature Review and Research Agenda	2020	10.3390/su12239831	environmental sustainability; global supply chain; developing economies; developed economies; digital technology; literature review; decision making; industry; cognitive frame; intertwined supply network	Scopus
Giuffrida, M., Mangiaracina, R.	Catalyzing sustainable transport innovation through policy support and monitoring: The case of TRIMIS and the European green deal	2020	10.3390/su122310151	Capacity mapping; Decarbonization; Horizon scanning; Transport policy; Transport research governance; Transport technologies	Google Scholar
Tsakalidis A., van Balen M., Gkountas K., Pekar F.	Innovation ecosystems in the EU: Policy evolution and horizon Europe proposal case study (the Actors' perspective)	2020	10.3390/SU12083171	9th R&D Framework Program; EU innovation policy; Horizon Europe; Innovation; Innovation ecosystems; Innovation helix; Innovation sustainability; Socioecological transformation	Scopus
Fernández S.G., Kubus R., Pérez-Iñigo J.M.	Perspectives of Central and Eastern European Countries on Research and Innovation in the New CAP	2019	10.3390/su11174735		Scopus
Pokrivčák J., Ciaian P., Drabik D.	[Perspectives des pays d'Europe centrale et orientale sur la recherche et l'innovation dans la nouvelle PAC] [Sichtweisen der mittel- und osteuropäischen Länder auf Forschung und Innovation in der neuen GAP]	2019	10.1111/1746-692X.12220		Scopus
Colombo L.A., Pansera M., Owen R.	The discourse of eco-innovation in the European Union: An analysis of the Eco-Innovation Action Plan and Horizon 2020	2019	10.1016/j.jclepro.2018.12.150	Eco-efficiency; Eco-innovation; European Union policy; Horizon 2020	Scopus
Nazarlo L.	Responsible research and innovation – A conceptual contribution to theory and practice of technology management	2019	10.3846/btp.2019.32	European Union; Innovation; Responsibility; Responsible research and innovation (RRI); Technology assessment; Technology management	Scopus
Ligardo-Herrera, I., Gómez-Navarro, T., Inigo, E., & Blok, V.	Responsible research and innovation: Recommendations for its Operationalization	2018	10.3390/su10062012	responsible research and innovation; climate change; sustainable innovation; corporate social responsibility	Google Scholar
Pollex J., Lenschow A.	Surrendering to growth? The European Union's goals for research and technology in the Horizon 2020 framework	2018	10.1016/j.jclepro.2016.10.195	Degrowth and policy; European Union; Horizon 2020; Information and communication technology; Research policy; Sustainability	Scopus
Costantini V., Crespi F., Marin G., Paglialunga E.	Eco-innovation, sustainable supply chains and environmental performance in European industries We gratefully acknowledge the support by the European Union's Horizon 2020 research and innovation programme under grant agreement No. 649186 – ISiGrowth. The comments and suggestions by three anonymous referees are also acknowledged. The usual disclaimer applies.	2017	10.1016/j.jclepro.2016.09.038	Eco-innovation; Environmental performance; Governance systems; Inter-sectoral linkages; International spillovers; Sustainable production; Value chain	Scopus
Kralisch D., Ott D., Lapkin A.A., Yaseneva P., De Soete W., Jones M., Minkov N., Finkbeiner M.	The need for innovation management and decision guidance in sustainable process design	2016	10.1016/j.jclepro.2017.11.173	Decision guidance; Horizon 2020; Innovation management; Process design; Stage-and-gate; Sustainability assessment	Scopus
Stosic B., Miliutinovic R., Zakić N., Zivkovic N.	Selected indicators for evaluation of eco-innovation projects	2016	10.1080/13511610.2016.1157682	AHP; eco-innovation projects; innovation; model; prioritization; recycling	Scopus

ii. Declaration of Originality

Erklärung*

Hiermit erkläre ich,

Name, Vorname Eleonora Crivellaro

Matrikelnummer 933407

dass ich bei der vorliegenden

- Bachelor-Arbeit Master-Thesis/Master-Arbeit
 Seminararbeit Diplomarbeit

die Regeln guter wissenschaftlicher Praxis eingehalten habe. Ich habe diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt und die wörtlich oder inhaltlich übernommenen Stellen als solche kenntlich gemacht.

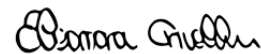
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Stuttgart, 25/02/2022



* Diese Erklärung ist der eigenständig erstellten Arbeit als Anhang beizufügen. Arbeiten ohne diese Erklärung werden nicht angenommen.