Politecnico di Torino

POLITECNICO DI TORINO

Master's Degree in Management Engineering
Graduation Session of March/April 2023

Cleantech Firms and Green Policies

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Academic Year 2022/2023

Abstract

Over the past few years, there has been a growing recognition of global climate change as a significant challenge for humanity. Climate change is leading to a range of environmental and social impacts, including rising sea levels, an increased frequency and severity of natural disasters,and shifts in the distribution of plants and animal species. Mitigating the effects of climate change is a global challenge that requires international cooperation and actions.

Throughout the years, the European Union has taken a leading role in addressing the challenge of climate change. By adopting progressively more ambitious targets, plans, and strategies, the EU has promoted a sustainable mindset in all its member states.

To wit, my research work is mainly focused on "The European Green Deal" which aims to shift the EU's economy into a more sustainable one while ensuring that the transition is fair for all parties involved. The Green Deal is a far-reaching plan that involves a range of policy initiatives and measures aimed at reaching the EU's most ambitious objective: achieving climate neutrality by 2050. Among all the Green Deal areas, the core of my research is the Circular Economy chapter and more specifically the Circular Economy Package which includes updated proposals on how to manage wastes. This transition is expected to enhance the competitiveness of the region on a global scale, thus encouraging economic growth that is sustainable, and creating new job opportunities.

The goal of this work is to examine the key directives within the Circular Economy Package, and how these directives have been enforced by member states at the national level. Specifically, from a methodological point of view, the primary objective is to build a comprehensive list of policies and regulations implemented at both European and national level, and categorize them based on relevant criteria such as environmental stringency and market-based or non-market policies. This dataset will serve as the initial step of a broader analysis, which will investigate the factors that enables the growth of clean technology companies in Europe.

Keywords: European Union, Green Deal, Environmental Policies, Circular Economy, Waste, Plastic

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Chapter 1

Climate policies and instruments to address the problem of climate change

1.1 Introduction

Throughout history, the Earth's climate has undergone changes that have become increasingly extreme, resulting in unpredictable and changeable ecosystems. This has led to the emergence of frequent extreme weather and violent natural phenomena in the past decade, making climate change the most critical issue facing humanity. Urgent action is required to address its negative impacts on human health.

International institutions need to take the lead in addressing the challenges posed by climate change by implementing different measures to shift towards a net zero emissions world. It is essential that all countries cooperate and work together to move toward a low-carbon economy and accelerate the sustainable transition by improving the development of green technologies and innovations. To achieve this goal, several Global Climate Agreements have been submitted at the international level to pave the way for formulating a common climate-resilient pathway. One of the most significant global climate agreements is the Paris Agreement, which requires countries to set substantial emissions-reduction pledge. Undoubtedly, the Paris Agreement represents an important milestone in international climate policy as it acknowledges the significance of national policies in addressing climate change. It enables countries to determine their level of ambition in mitigating climate change and sets up a framework that allows them to voluntarily declare their commitments.

EU strongly supports the Paris Agreement's goal by aiming to be the first continent with a net-zero greenhouse gas emissions economy by 2050. The vision for a climate-neutral EU is at the heart of other important European strategies, such as the Europe 2020 Strategy, which is implemented to move towards a more smart, sustainable, and inclusive growth and the 2030 Climate Target Plan is also enforced to increase the European Union's targets for achieving climate neutrality by 2050.

1.2 Effectiveness of environmental policies and instruments

To truly comply with the Paris Agreement, the efforts made by European member states must be supported by a legislative body that is capable of directing the economy towards more sustainable choices. This support should lead to the development of policies that promote green growth and generate climate-related investment and technological development opportunities for cleantech firms.

The academic literature has mainly investigated the correlation between climate policies and the cleantech sector, with a specific emphasis on exploring how the climate policy framework can affect the rate and direction of environmental innovation while also reducing the impact of climate change.

Before diving into the analysis of the impacts of green policies, it is important to understand what types of environmental instruments have been established to induce the development of environmental technologies. An initial differentiation can be made between market-based and non-market-based instruments.

The following Table 1.1 provide a schematic overview on the climate instruments classification.

Environmental Policy Instruments	
Market-based instruments	**Non-market based instruments**
Taxes	Command-and-control regulations
Emissions Trading System (ETS)	Reporting Requirements
Removal of perverse incentives	Active (green) technology support policies
Deposit refund scheme	Removal of green-tech financial barriers
Liability rules	Information and voluntary approaches

Table 1.1: Environmental Policy Instruments

1.2.1 Market-based instruments

Market-based instruments are a type of regulatory tool that affect how people behave by changing their financial incentives. Usually, the costs associated with environmental problems like greenhouse gas emissions are not factored into business or consumer decisions, even though they can harm other people or the environment. To address this problem, market-based policies work by attaching a cost to environmentally damaging activities, encouraging the people responsible to reduce their impact.[1]

Taxes

Governments might use tax revenue to repair environmental damage or invest directly in R&D, which can enhance a technology's efficiency [2]. The first case involves taxing

the pollutants directly or the products that generate them. Such a strategy can motivate individuals and businesses across different sectors to reduce their reliance on these harmful substances. However, while taxes can be a useful tool, they do not have a direct influence on the actual quantity of pollutants emitted. Moreover, aiming to reduce emissions to meet environmental goals may not always align with economic incentives, as lower emissions can lead to a decrease in tax revenue.

Emissions Trading System (ETS)

The Emission Trading System goal is to encourage a reduction in emissions by creating a limit or "cap" that companies are allowed to emit, which incentives them to decrease their emissions to stay within the limit. It offers a major advantage by simplifying the process of reducing greenhouse gas emissions and catering to the unique needs of various firms. By participating in the ETS, companies that cannot afford to transform their operations can still contribute to emission reductions by buying allowances and credits from those who have managed to reduce their emissions in a cost-efficient way. Permits are regarded as a more effective economic and environmental policy in comparison to taxes and subsidies owing to their ability to provide assurance about overall emission levels and their capacity to forestall inefficient utilization of resources . However, permits may fail to account for the potential relocation of companies or the provision of financial incentives to polluting firms by local governments, which runs counter to the fundamental principles of the permit trading system.[2]

Removal of perverse incentives

The removal of perverse incentives is a market-based instrument which aims to to get rid of subsidies that sustain activities and products that harm the environment. Some examples of such subsidies are those that support fossil fuel extraction or production, exemptions from energy taxes, and subsidies that artificially reduce the cost of fossil fuels. Additionally, it aims to eliminate other incentives that encourage damaging activities, such as getting rid of liability exemptions. [1]

Deposit refund scheme

Several national governments use the deposit refund scheme as a market-based tool to raise consumer awareness about recycling glass and plastic bottles. This scheme involves adding a deposit fee to the purchase price, which can be refunded to the buyer if they return the bottle through a dedicated system. However, to be effective this instrument requires the development of a good infrastructure which includes includes organizing and locating collection points, as well as monitoring the reimbursement process.

Liability rules

Liability rules are a market-based tool that involves assigning responsibility for damage caused to the environment directly to the producer, with the aim of inducing them to reduce their environmental impact.

1.2.2 Non-market based instruments

Non-market instruments are a type of regulatory tool that aims to move people's behavior to more environmentally friendly choices without involving monetary or financial compensation, as opposed to the market-based instruments.

Command-and-control regulations

Governments use command-and-control regulations as a means to set mandatory standards through the promulgation of laws and regulations, with a focus on improving energy efficiency and decreasing greenhouse gas emissions. These standards are legally enforced, making this an efficient approach to achieving environmental objectives. Specifically, this instrument comprises three application frameworks:

- Performance standards are designed to achieve a particular environmental objective without specifying which technology should be utilized.[3]
- Technology standards either ban or eliminate technologies that are harmful to the environment, or establish minimum requirements. [3]
- Framework standards include technological requirements

Despite their limitations, command-and-control methods can have a significant impact on fostering innovation and advancing technology. One way to achieve this is by providing support and investment for currently unprofitable technologies, thereby expanding the range of available options for reducing environmental damage and bringing these technologies to market. When used in combination with pricing mechanisms, command-and-control measures can help create a market for new technologies.[4]

Reporting Requirements

Both European and national institutions use reporting requirements to impose reporting obligations. Along with market-based measures,the EU places strong emphasis on providing recommendations to guide Member States in monitoring their progress. It is crucial not only to set objectives for each Member State but also to monitor their progress through official reports that are accessible to everyone. By doing so, this approach promotes transparency and impartiality while also raising public awareness. The EU Climate Monitoring Mechanism Regulation is an example of reporting regulations on greenhouse gas emissions that comply with global requirements and reporting obligations outlined in the 2009 climate and energy package. It assists in monitoring progress towards meeting the Member States' emission targets for 2013-2020 and, as a result, supports the development of the EU's climate policy mix. [3]

Active (green) technology support policies

The active (green) technology support policies are non-marked based instrument designed by the public institutions to encourage the development of sustainable innovation through

incentives and research promotion. These policies are commonly implemented in public procurement to boost demand for sustainable products and services, promote eco-friendly practices throughout the supply chain, and foster innovation in green technologies. The NER 300 programme is an instance of this type of policy that was created to support the research and development of new technologies in both renewable energy and Carbon Capture and Storage.

Removal of green-tech financial barriers

Financial barriers associated with green technologies include economic incentives such as tax breaks or subsidized loans to encourage and support sustainable innovation from the demand side. However, these instruments are not classified as market-based measures because they do not directly affect the market by changing prices, fro example.

Information and voluntary approaches

The information and voluntary approaches are often used in conjunction with market-based instruments as complementary measures. Their main goal is to raise consumers' awareness of recycling and reuse, and to encourage the use of more sustainable products. Examples of these types of instruments include product labelling, which aims to display environmental information on the product's packaging to guide consumers towards eco-friendly choices in their purchasing decisions.

1.2.3 Hybrid Instruments

Each type of climate policy instrument exhibits advantages and disadvantages with respect to their ability to effectively safeguard the environment. According to the scholars Johnstone and Kalamova, market-based instruments are more effective at encouraging innovation than direct regulations such as technology-based standards since as companies stand to gain a larger share of the advantages associated with technological advancements and uptake. [5] However, market-based instrument may be vulnerable to market fluctuations and can result in volatile prices for emissions permits or credits. Furthermore, in certain instances, these tools may not be adequate to address alone climate challenges, particularly when direct involvement is necessary, such as the banning of certain pollutants. The non-market instruments can be challenging to measure in terms of their effectiveness in achieving environmental goals, especially when voluntary actions are involved. Moreover, if applied alone a non-market tool may need to become more invasive to deal with potential rebound effects that may arise.[4]

Considering these factors, a hybrid policy approach can mitigate the limitations of each individual instrument by leveraging their complementary characteristics [4]. Combining market-based instruments with command-and-control measures should result in a more effective impact on environmental innovation development.

1.2.4 Environmental policy stringency

To evaluate the impact of climate policies on promoting green innovation, it is crucial to examine not only the policy types but also the level of policy stringency. According to the OECD definition, *"stringency is defined as the degree to which environmental policies put an explicit or implicit price on polluting or environmentally harmful behaviour"*[6].

There is very little empirical evidence about the role of environmental stringency towards environmentally friendly technological innovation. According to scholars such as Porter [7] and Porter and van der Linde [8], it is crucial in promoting innovation, efficiency improvements, and company reorganization. Their study found out that proper development of restrictive environmental policies by governments could boost firms' competitiveness and stimulate their innovation. This hypothesis is confirmed by the study conducted by Martínez-Zarzoso, Bengochea-Morancho and Morales-Lage whose findings indicate that in the long term more stringent environmental policies lead to either an increase in innovative activity (in the form of research and development or patents) or an improvement in economic efficiency (reflected in total factor productivity). [9]. Moreover, the scholars Johnstone and Kalamova suggested that the stringency measures of these policies can offer incentives for innovation, while stable norms and standards can reduce uncertainty in investment decisions.[5]

Regarding this topic, another important gap in the literature pertains to the lack of indicators which enable the comparison of OECD countries' environmental policy stringency. To fill this gap, the scholars Botta and Koźluk have developed new indicators which measure at the country level on an annual basis how strict environmental policies are on a scale of 0 to 6, where higher values indicate more stringent regulations. [10]. The OECD has updated Botta and Koźluk's indicators to cover 40 countries until 2020 and has included 13 policy instruments, creating an essential tool for cross-country policy analysis. Other similar index have been proposed in the literature, however in this work, the research phase involves the OECD indicators due to their contemporary nature, extensive coverage of countries and time periods, and, notably, their division of policy instruments into market and non-market categories.

Furthermore, studies conducted by OECD researchers reveal that over the last 20 years, non-market policy instruments have experienced the most significant absolute increase in intensity on average across the OECD index, followed by technology support policies and market-based policies. Specifically, technology support policies have experienced a decreasing trend, probably due to the adoption of more effective technology support policies, such as the transition from feed-in tariffs to renewable auctions. This trend highlights the urgent need for governments to implement further measures to support the development of eco-friendly technology. [11]

Chapter 2

Green Deal

The impact of climate change on the Earth's ecosystem has resulted in a rise in environmental threats that endanger human populations, which is an unacceptable situation that requires the attention of governments worldwide.

Among the several measures adopted by international organizations to tackle climate challenges, European Green Deal has played a fundamental role in Europe long-term strategy. It outlines a plan for creating a sustainable economy in the EU by transforming environmental and climate challenges into opportunities in all policy areas, while ensuring that the transition is fair and inclusive for everyone.[12] To reach these, European Commission outlined the importance of putting people first by providing all appropriate measures to face the challenges in the most appropriate way. In line with that, Green Deal should be read from a social point of view since aims to lead people to a society just and socially balanced. A new pact is needed to bring together citizens in all their diversity, with national, regional, local authorities, civil society and industry working closely with the EU's institutions and consultative bodies. [13]

With the implementation of the Green Deal, European Union confirms its central role in the global tackling climate change with the aim to become the global leader on climate and environmental measures. The EU will continue to promote and implement ambitious environmental, climate and energy policies across the world. [13]

The Green Deal has been thought to cover all economic sectors in order to provide proper measures and tools to lay the groundwork for the green transition. In particular, the Green Deal covers 8 areas as illustrated on the Figure 2.1

2.1 Increasing the EU's climate ambition for 2030 and 2050

In the Green Deal first chapter, European Commission focused on the strategies and plans already implemented by Europe and member states taking more attention to how these measures should be improve to set more ambitious goals. Thus, throughout the years Europe has clearly defined its vision for a climate-neutral EU supporting by a large number of initiatives such as:

Figure 2.1: The European Green Deal

- European climate Law:

  "We are very happy with the provisional deal reached today. The European climate law is "the law of laws" that sets the frame for the EU's climate-related legislation for the 30 years to come. The EU is strongly committed to becoming climate neutral by 2050 and today we can be proud to have set in stone an ambitious climate goal that can get everyone's support. With this agreement we send a strong signal to the world - right ahead of the Leader's Climate Summit on 22 April - and pave the way for the Commission to propose its "fit-for-55" climate package in June." (João Pedro Matos Fernandes, Minister of Environment and Climate Action)[14]

  The European climate law was entered into force on 29 July 2021 with the aim to turn into law the goal of reaching climate neutrality. According to that, the EU and its member states are bound to reducing net greenhouse gas emissions by at least 55% by 2030[15]. Furthermore, it includes measures to monitor the progress made by each member state and additional steps to reach the 2050 target.

- Just Transition Mechanism:

  "We must show solidarity with the most affected regions in Europe, such as coal mining regions and others, to make sure the Green Deal gets everyone's full support and has a chance to become a reality." (Frans Timmermans, Executive Vice-President of the European Commission)[16]

  The Just Transition Mechanism aims to ensure that the transition happens in a fair way, taking into account all stakeholders who are experiencing the climate challenges such as EU citizens, firms, local governments, etc,. In such way, all actors who are most exposed to the transition will be protect by providing financial and technical support.

- Fit for 55 :

  The Fit for 55 package is a set of proposals thought to align the EU policies with the climate targets set out by the European Commission. [15] Specifically, the package includes thirteen proposals which cover several economic areas such as energy, transport and emission trading system that are illustrated in the Figure 2.2

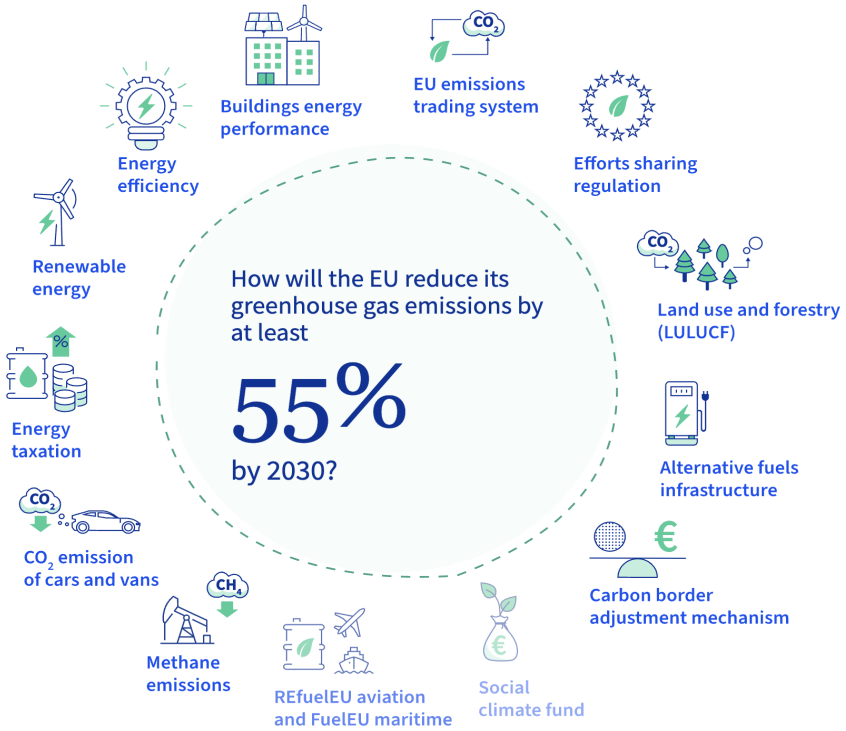

Figure 2.2: Fit for 55

It's clear that these measures by themselves aren't enough to meet the ambitious goals that have been established. They need to be regularly revised to ensure they align with the current social and economic circumstances, and they should be backed by a well-rounded policy framework designed specifically for the purpose.

2.2 Supplying clean, affordable and secure energy

The main aim of the Green Deal is to achieve climate neutrality, which requires the European Commission to tackle the major challenge of transforming energy production and use that presently contribute to 75% of the EU's greenhouse gas emissions. Adopting clean energy is critical to reaching the target of climate neutrality by 2050 and also presents a promising opportunity for economic advancement. [17].

Decarbonizing the energy sector is a significant milestone in this transition, as it is regarded as a crucial step towards achieving a Europe that emits net-zero greenhouse gases. Decarbonization, from a technical perspective, aims to minimize and ultimately eradicate

carbon emissions by transitioning to alternative low-carbon energy sources instead of fossil fuels. The strategy adopted by each member state is influenced by their unique geographical factors, which can provide the basis for cleaner energy production. For example, northern European countries can leverage up to 60% more onshore wind hours compared to southern countries, while southern countries could benefit from receiving more than 1,000 additional hours of sunlight each year. [18]

In addition to the appropriate use of the geographical features, EU member states are required to prepare energy plans at national level to determinate and keep on track the measures set out to meet the Europe climate and energy goals. The national energy and climate plans should cover the following targets (illustrated in the Figure 2.3):

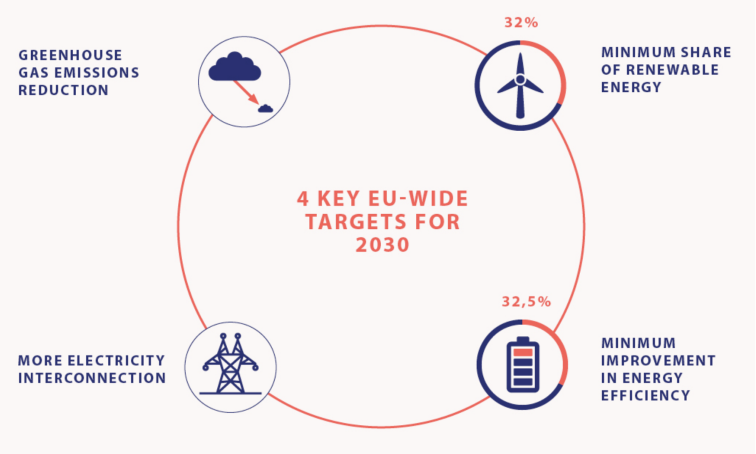

Figure 2.3: National energy and climate plans

- reducing greenhouse gas emission:

  National GHG reduction targets are governed by the Effort Sharing legislation. The national targets cover sectors, such as transport, buildings, non-ETS industry, agriculture and waste. [19] Currently, the sectors mentioned produce 60% of the total greenhouse gas (GHG) emissions in the EU, as shown in Figure 2.4. According to the latest EU regulations, these emissions must be reduced by 40% by 2030.

  The Effort Sharing Regulation establishes yearly emission targets for every Member State, ensuring that each country contributes to EU climate action in a fair and equitable way. [20]

  To achieve their goals, the European Union offers various flexible options, such as allowing member states to bank unused emissions allocations if their yearly emissions are lower than the limit, or borrow additional allocations if their yearly emissions exceed the limit. Additionally, countries can trade their excess allocations with one another. [21].

  The Effort Sharing Regulation is closely linked with the EU emissions trading system included in the Fit for 55 package. It is the world's first major carbon market as monitoring the trade of emissions produced throughout Europe. The Emission

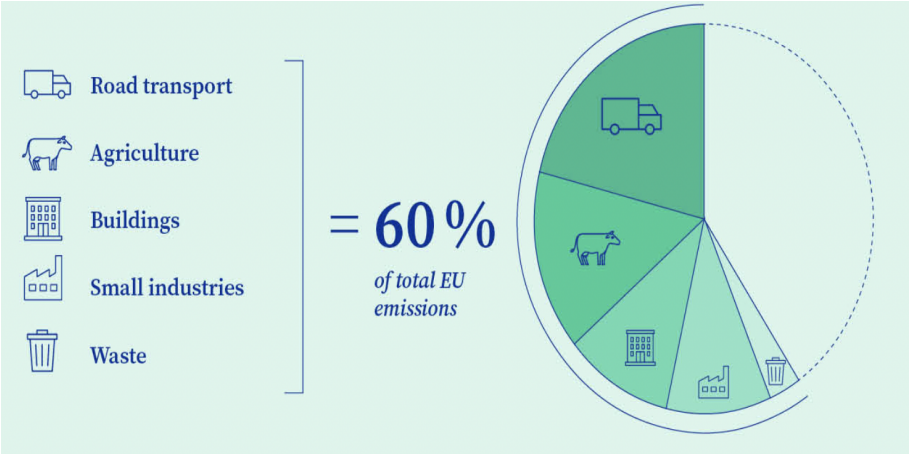

Figure 2.4: GHG emissions produced by ESR sectors

Trading System (ETS) goal is to encourage a reduction in emissions by creating a limit or "cap" that companies are allowed to emit, which incentives them to decrease their emissions to stay within the limit. It offers a major advantage by simplifying the process of reducing greenhouse gas emissions and catering to the unique needs of various firms. By participating in the ETS, companies that cannot afford to transform their operations can still contribute to emission reductions by buying allowances and credits from those who have managed to reduce their emissions in a cost-efficient way.

The EU's Emissions Trading System is complemented by the Carbon Border Adjustment Mechanism (CBAM), which is specifically designed to work in conjunction with the ETS to reduce global greenhouse gas emissions. The CBAM aims to prevent carbon leakage, which occurs when companies relocate their production outside of Europe to countries with less stringent climate policies.

"The agreement in the Council on the Carbon Border Adjustment Mechanism (CBAM) is a victory for European climate policy. It will give us a tool to speed up the decarbonisation of our industry, while protecting it from companies from countries with less ambitious climate goals. It will also incentivize other countries to become more sustainable and emit less. Finally, this mechanism responds to our European ambitious strategy that is to accelerate Europe's energy independence." (Bruno Le Maire, French Minister for Economic Affairs, Finance and Recovery) [22]

- encouraging the use of cleaner energy sources and renewable energy :

  The EU's approach to renewable energy is set out in the Renewable Energy Directive (2009/28/EC), which obligates all member states to make significant progress in increasing the use of renewables in transportation, heating, and cooling. Although the original target for EU renewable energy consumption was 20% by 2020, it has been revised several times to set more ambitious goals. The most recent revision, the Renewable Energy Directive 2018/2001/EU, sets a target of at least 32% renewable energy by 2030. This target will be evaluated and potentially strengthened to ensure

that at least 40% of all energy consumed in the EU comes from renewable sources by 2030.

- prioritising energy efficiency

  To achieve the ambitious climate neutrality objective set by the European Green Deal, prioritizing energy efficiency is crucial. Energy efficiency is a fundamental principle of the Union's energy policy and should be implemented across all sectors, beyond the energy system, at all levels, including the financial sector. Planning and investment decisions should consider energy efficiency solutions as the primary option, and new rules for the supply side and other policy areas should also incorporate energy efficiency.[23]

  From there, as first step European Council has proposed an overall revision of the existing Directive on Energy Efficiency 2012/27 (amended by Directive 2018/2002) to set higher energy efficiency targets. Indeed, the current EU-level target for energy efficiency from 32.5% to 36% for final, and 39% for primary energy consumption [15] as illustrated in the Figure 2.5

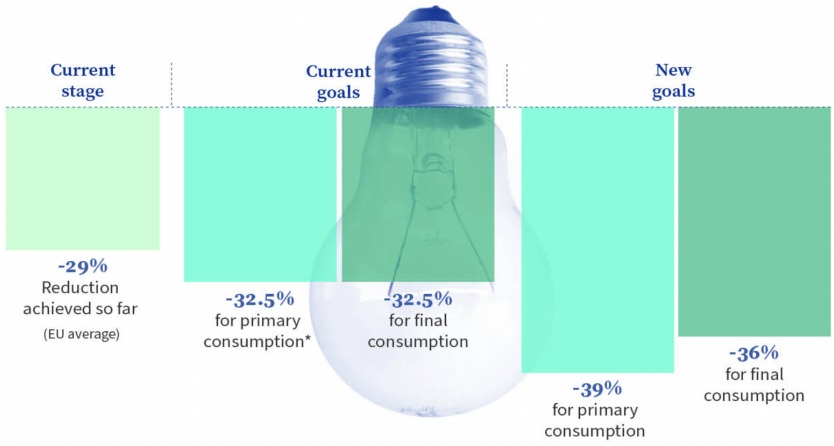

Figure 2.5: Increased efficiency target

The target is binding at EU level, so this means that all members states have to enforce such directive defining in the national plans their indicative targets. Under the new rules, EU countries will have to reach end-use annual energy savings at least 1,5% of final energy consumption.

- ensuring a fully interconnected and integrated energy system throughout Europe (electricity interconnection):

  The EU's goal is to become carbon-neutral by 2050, which involves moving away from fossil fuels and towards renewable energy sources. To achieve this and continue to lead in renewable energy production, Europe must modernize its energy market design by creating a unified and interconnected market. The Clean energy for all European package includes some legal measures such as The Directive on common rules for the internal market for electricity (EU) 2019/944 and Regulation on the

internal market for electricity (EU) 2019/943 which will help EU to improve cross-border electricity interconnections setting a new target of at least 15% by 2030.

2.3 Mobilising industry for a clean and circular economy

"The Circular Economy is a blueprint for a new sustainable economy, one that has innovation and efficiency at its heart and addresses the business challenges presented by continued economic unpredictability, exponential population growth and our escalating demand for the world's natural resources." (Cisco Chris Dedicoat, President, EMEA). [24]

The concept of circular economy is one of the most important pillar of the European Green Deal and it is considered essential to meet EU target to be climate-neutral by 2050.

The current approach, commonly known as 'take-make-dispose', involves businesses gathering raw materials, expending energy to create a finished product, selling it to the end user, who discards it once it is no longer needed. Consequently, the linear production method results in unnecessary resource wastage [24]. Not only does it have adverse impacts on the natural environment, but the linear approach also poses economic issues, such as scarcity of materials, unstable raw material prices, and a surge in demand. Therefore, it is essential to move away from a linear model and adopt a circular economy to reduce the impact of human activities on the environment and relieve pressure on natural resources. In a circular economy, the worth of resources and materials is maintained for as long as feasible, used as frequently as possible, and waste generation is kept to a minimum.

To make Europe cleaner and more competitive, European Commission has tried to accelerate the transition to a circular economy by adopting the circular economy action plan. It presents a set of initiatives that regulate the entire life-cycle of products. In particular, the measures introduced are concerned to:

- Sustainable product policy framework:

  The European Commission has taken various actions to align products with a circular economy as part of the Circular Economy Action Plan. These measures set the stage for developing a sustainable product policy that will gradually establish sustainability principles for products as the norm. One of the key goals is to extend the Ecodesign Directive beyond energy-related items so that it covers the broadest range of products possible and facilitates circularity. [25]

  Another crucial component of the sustainable product policy framework is increasing consumer awareness of recycling and reuse, as well as encouraging the use of more sustainable products. Product labeling is an example of how this can be achieved, as it provides environmental information on the packaging, helping consumers make environmentally friendly choices when buying products.

- Sustainable raw materials:

To achieve a circular economy, it is essential for the European Union to prioritize the sustainable supply of critical raw materials, as they are economically significant and pose a high risk of supply disruption. The EU's raw materials strategy includes a list of critical raw materials (CRMs) and a methodology for assessing their criticality. This list plays a key role in shaping EU policies related to research, innovation, industrial policy, trade, and development.

- Ensuring less waste:

  The large reduction of waste is a key component of the circular economy idea and one that the European Union should stress on. The EU supports a number of initiatives to improve waste management and foster innovation in recycling in order to increase support for waste avoidance and circularity.

  The EU is particularly focused on promoting various proposals to establish a common framework for the separation of waste collection systems. The primary objective is to explore the densities and accessibility of various collection points and determine the most effective combinations of separation models. This is aimed at aiding individuals, organizations, and public authorities in better segregating waste. [25]

- Making circularity work for people, regions and cities:

  The European Green Deal is not solely concerned with moving towards a circular model of production and consumption, but it also plays a crucial role in ensuring a just transition that benefits all. This transition should involve the creation of job opportunities in various sectors such as product design, waste management, repair and refurbishment, and the development of innovative technologies and materials. Moreover, investing in education and training programs can help to build the necessary skills and knowledge to support the circular economy and build a workforce that can meet the demands of a more sustainable future.

- Leading global efforts on circular economy:

  The European Union cannot achieve the goals of the European Green Deal, which aim for a climate-neutral, resource-efficient, and circular economy, without international support. Thus, it is vital for the EU to spearhead the implementation of ambitious energy, climate, and environmental policies across the world. To demonstrate its leadership and influence, the EU is laying the groundwork for global standards for achieving a circular economy through the Circular Economy Action Plan.

2.4 Building and renovating in an energy and resource efficient way

"Stimulating renovation of homes and other buildings supports economic recovery and creates new job opportunities. Moreover, energy renovation leads to lower energy bills and in the end the investment pays for itself. By targeting the obstacles to renovation and providing financial support for the necessary upfront investment, today's proposal on the

energy performance of buildings aims to boost the rate of energy renovation across the EU. Its focus on the worst performing buildings prioritises the most cost-effective renovations and helps fight energy poverty." (Executive Vice-President for the European Green Deal, Frans Timmermans) [26]

Buildings are harmful to the environment due to their production of waste and pollution, as well as their high energy consumption. In fact, the building sector consumes the most energy worldwide, accounting for approximately 30-40% of global consumption. It also contributes to the deterioration of air quality, responsible for over 30% of global greenhouse gas emissions, and is a major user of raw materials, consuming 40-50% of the world's annual material use.[27]

Regardless, the building sector holds a significant potential to reduce environmental risks by adopting sustainable practices that lower energy consumption and emissions. To address the challenge of improving energy efficiency and reducing consumption, the European Commission has put forth the Renovation Wave Strategy which aims to convert all buildings into zero-emission structures by 2050, with a focus on three primary areas:

1. decarbonisation of heating and cooling:

   Reducing carbon emissions from buildings is crucial for achieving carbon neutrality in the energy sector since they account for 25-33% of black carbon emissions. Indeed, in order to achieve carbon neutrality by 2050, The European Commission has developed the EU Heating and Cooling Strategy in 2016, which provides measures and tools to accelerate the adoption of renewable energy in heating and cooling.

2. tackling energy poverty and worst-performing buildings:

   The European Commission has published new regulations for Energy Efficiency Certificates to encourage building renovation. These certificates set minimum energy performance criteria for existing buildings and include energy performance ratings and recommendations for cost-effective improvements. The European Commission emphasizes the improvement of these certificates as a way to provide consumers with easier access to energy information.

   The Renovation strategy does not only focus on enhancing the energy efficiency of buildings, but it also strives for a just transition that ensures access to essential energy services for all.

   To achieve the Energy Union's goal of providing affordable energy, European institutions have addressed the growing problem of energy poverty. A rising number of EU citizens cannot afford their energy bills and live in unhealthy housing conditions. This issue predominantly impacts vulnerable groups such as low-income families and the elderly, whose health and well-being are increasingly compromised.

   To combat energy poverty and safeguard vulnerable consumers, the European Commission has implemented various measures under the Clean Energy for All Europeans package. The objective is to underscore the significance of tackling energy poverty, and member states are mandated to devise targeted solutions in their national energy plans to support those who cannot afford basic energy services.

3. renovation of public buildings:

   Public buildings make up 30% of all non-residential structures in Europe, and their energy consumption is 40% higher than that of residential buildings. [28] Due to this, the European Union is prioritizing the improvement of energy efficiency in public buildings as a vital component of its renovation strategy.

The effective execution of the renovation strategy relies on a strong policy framework that facilitates accessible and targeted funding. The European Commission has pledged to strengthen incentives for private ventures and rehabilitation projects by simplifying the requirements for combining various funding sources.[29].

This should engage all stakeholders of building sector in order to address the barriers to renovation and build together a more sustainable and inclusive construction ecosystem.

2.5 Accelerating the shift to sustainable and smart mobility

Transportation is a crucial aspect of modern society, which, however, has significant negative impacts on the environment and human health. Indeed, to achieve its goal of becoming the first climate-neutral continent, the European Commission has implemented a focused strategy to make the transportation system more sustainable, competitive, and digital.

"As the backbone that connects European citizens and business, transport matters to us all. We have no time to lose in getting it fit for the future. Digital technologies have the potential to revolutionise the way we move, making our mobility smarter, more efficient, and also greener. We need to provide businesses a clear pathway for the green investments they will need to make over the coming decades. Through the implementation of this strategy, we will create an irreversible shift to zero-emission mobility while making our transport system more efficient and resilient." (Commissioner for Transport Adina Vălean) [30]

The European Commission's strategy centers around an ambitious goal of reducing transport emissions by 90% by 2050, which requires regulation and contribution from all areas of transportation to accelerate the sustainable transition.

The strategy consists of 82 initiatives that primarily focus on three key areas:

1. sustainable transport:

   Several actions have be adopted by European Commission as a guide to move towards forms of mobility that are sustainable, energy-efficient and respectful for the environment. These measures are mainly focused to promote the production and consequently use of sustainable alternative transport fuels in the light of accelerating the transition towards low- and zero-emission vehicles. Moving to clean and energy efficiency vehicles is at heart of Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles which lays the foundation to how EU will gradually shift from fossil fuels to alternative fuels and new vehicle propulsion systems capable of delivering long term.

The green transformation engages road transport as well as air and maritime transport. Indeed, green ports and airports have a great potential to drive the transition to carbon neutral aviation, shipping and wider multimodal mobility.

2. smart mobility:

   As central part of Smart Mobility strategy, digitalisation of transport have to be the key driver of shifting to sustainable mobility sector. In line with that, European Commission is committed to a strategic framework for transport with the aim to support implementation of two emerging concepts:

   - Intelligent transport systems (ITS) are crucial tools to accelerate the innovative transport process since offer the possibility for improved management of current resources and infrastructure, through the supply of information to travelers and transportation planning specialists. [31]
   - Cooperative, connected and automated mobility (CCAM) which is expected to significantly improve road safety, traffic efficiency and comfort of driving by coordinating drivers' actions thanks to the information shared between vehicles and transport infrastructure. [32]

3. resilient transportation:

   The Smart Mobility strategy, as stated in the European Green Deal, aims not only to transition to low carbon mobility but also to ensure a fair and equitable transition that makes transportation accessible and affordable for all. In line with this objective, the European Commission has formulated policies that are specifically targeted at rural areas to promote their economic growth and connectivity through well-designed measures.[33]

2.6 From 'Farm to Fork': designing a fair, healthy and environmentally-friendly food system

Improving people's health and quality of life is an important element of the European Green Deal, which also encompasses the food system. The food system, as it stands, is unsustainable, leading to natural resource depletion, biodiversity loss, and increased food waste. To address these issues, the European Commission introduced the Farm to Fork Strategy in 2020, aiming to make food systems more equitable, healthy, and environmentally-friendly. The strategy recognizes the need for a transition to a sustainable food system, which presents an opportunity to improve lifestyles, health, and the environment. [34]

The transition towards a sustainable food system requires significant changes throughout the entire food chain, involving the cooperation of all stakeholders, including farmers, fishers, other operators, and EU citizens. A shift in people's diets, particularly in reducing meat consumption, is necessary for this transition to occur, as the meat industry is a major contributor to global greenhouse gas emissions, environmental pollution, and land-use change. However, it's important to note that reducing meat consumption or becoming

Figure 2.6: Farm to Fork areas

vegan is not the only solution to curbing climate change. Instead, it is crucial to focus on increasing the productivity of animals to improve the sustainability of meat production. [35]

Europe has always been known worldwide for its high-quality and nutritious food, and it is essential to maintain this position by implementing measures that prioritize the promotion of safe and healthy food for everyone in its sustainable food strategy. The Farm to Fork Strategy, adopted by the European Commission, reaffirms its commitment to ensuring food security, nutrition, and public health by significantly reducing the use and risk of chemical pesticides, fertilizers, and antibiotics. To achieve this, farmers and other stakeholders must be encouraged to develop innovative methods for protecting crops from pests and diseases. [36]

The Farm to Fork Strategy aims to protect environment, reduce natural resources depletion and preserve biodiversity covering all stages of food chain as illustrated in the Figure 2.6.

All actors must will play their part trying to move toward more sustainable practises and production method as soon as possible. That requires significant human and financial investment that could be transformed into opportunities thanks an appropriate policy framework. Therefore, The European Commission will submit a legislative proposal for a framework for a sustainable food system by the end of 2023. Incorporating sustainability into all food-related policies and strengthening the resilience of food systems are all benefits of this, which will also enhance policy consistency at the national and EU levels. [36]

The Farm to Fork Strategy should be read also as an implementation of European goal to achieving circular economy. Indeed, putting all stages of food chain on a new path of sustainability represents an important step to move from a linear toward a circular approach. From this point of view, the legislative framework for sustainable food systems set out by European Commission plays a fundamental role in leading member states to take actions at national level to reduce food waste and environmental impact of the food processing.

2.7 Preserving and restoring ecosystems and biodiversity

Over the years, climate change has drastically affected Earth's ecosystem by causing a number of impacts on biodiversity. Flooding, sea-level rise and temperature changes are some of the violent consequences which have led to a serious ecosystem alteration. Climate change will alter not just the borders of ecosystems but also their natural habitats, which will have an impact on species survival. According to a growing corpus of evidence, species extinction rates may sharply rise as a result of climate change. [37]

To tackle these climate challenges, European Commission must have a clear vision of how to halt biodiversity loss. This vision should form the basis for the long-term strategy that the EU will adopt to meet its ambitious climate targets by 2050.[13]

Over the decades, EU has been committed to protection of nature and biodiversity by several laws but it failed to achieve some of its most important environmental objectives set by 2020. Understanding past failures, EU confirmed its key role in the fighting against climate challenges paving the way for a new strengthened set of regulatory and not regulatory measures.

In March 2020, the European Commission made a The Biodiversity Strategy for 2030 outlines a bold strategy to stop biodiversity loss and safeguard and restore protected habitats. Enlarging the EU network of legally protected areas and preserving or enhancing the conservation status of all endangered species and ecosystems included in it are the two key binding objectives. [38]

The Biodiversity Strategy contains several initiatives and actions aim to put Europe's biodiversity on the path of restoration by 2030. Following the past failures as guide, it introduces concrete measures to make transition possible ensuring better implementation and improving financing and investments. On this direction, EU commits all member states to set binding targets with periodic assessments and define thorough plans explained how to reach them.

Key element of the Biodiversity Strategy is the EU's first ever Nature Restoration Law which aims to bring natural habitats and ecosystems to good recovery status. The proposal combines a broad restoration goal for the long-term recovery of nature in land and marine regions of the EU with legally mandated restoration objectives for particular ecosystems and species. By 2030, at least 20% of the land and marine regions of the EU should be covered by these policies, and by 2050, all ecosystems that require restoration should be covered. [39]

In particular, the proposal focuses on the potential role of seas and oceans in regulating climate. The world's greatest heat sink is the ocean. 90% of the extra heat brought on by climate change is absorbed by them. Additionally, the oceans are a particularly effective carbon sink, absorbing 23% of CO2 emissions brought on by humans. [40]

Realizing the importance to put oceans and seas on the path to recover, European Commission proposes several measures in the maritime area lay the groundwork for the so called 'blue economy' which implementation requires a sustainable use of seas and its marine resources. The blue economy or ocean economy contributes to climate change mitigation in several ways:

- developing offshore renewable energy
- decarbonizing maritime transport
- greening port

Blue economy plays an essential role in achieving EU's targets to preserve biodiversity but implementing alone is not enough to make again ecosystems health and resilient; more generally European Commission should focus on nature-based solutions in order to take advantage from natural resources in the most sustainable and environmental-friendly way.

Despite all measures set out to tackle climate challenges, biodiversity is deteriorating worldwide and this decline is projected to worsen with business-as-usual scenarios. The reservation of the degradation of ecosystems is an urgent objective which international organizations must meet as soon as possible. To reap that, world leaders attended the biggest biodiversity conference COP 15 with the aim to adopt a global biodiversity framework and to work together in the fight against climate challenge.

Specifically, the Framework includes four overarching global goals and 23 targets by 2030 and 2050 aiming to protect and restore nature for current and future generations, to achieve a sustainable use of biodiversity and improve financial and technical investments necessary to move toward circular economy.

"The agreement reached at COP15 is a landmark deal to protect nature, restore ecosystems and keep our planet liveable. This is about our very survival: humanity has no future on a dead planet. We need nature and biodiversity for food security, our economy, our wellbeing, and our health. Nature is also our best ally in the fight against the climate crisis. When we restore and protect nature, it can help us adapt and shield us from the worst impacts of climate change." (Frans Timmermans, Executive Vice-President for the European Green Deal - 19/12/2022) [41]

2.8 A zero pollution ambition for a toxic-free environment

As part of EU's green strategy, Green Deal also includes a zero pollution ambition for a toxic-free environment.

Pollution is one of the dangerous problems that humanity has ever faced. It is the biggest cause of environmental degradation affecting negatively biodiversity and ecosystems. Indeed, the release of pollutants into environment can change the normal conditions and processes of ecosystems leading gradually to long-term disruption of natural habitat. This leads to increasingly number of all species pushed at risk of extinction and reducing quality of air, water and soil.

In addition to affecting biodiversity, pollution harms people's health since it is the greatest environmental causes of deaths and diseases. 90% of environmental fatalities in Europe are caused by non-communicable illnesses such cancer, heart disease, stroke, chronic obstructive pulmonary disease, mental, behavioral, and neurological problems, diabetes, renal disease, and asthma. [42]

In Figure 2.7 is illustrated is shown the top 10 non-communicable diseases causing deaths attributable to the environment.

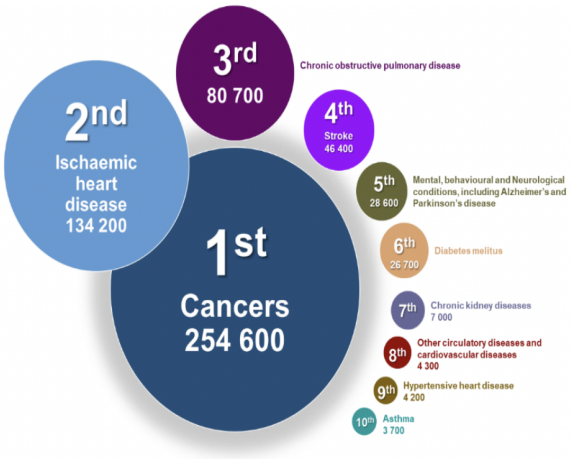

Figure 2.7: Top 10 non-communicable diseases causing deaths attributable to the environment

Today people are exposed to multiple environmental stressors at any one time, which combine and in some cases act synergistically, causing impacts on health. [42]. High level of air pollution, noise and high temperatures are gradually reducing the qualify of life affecting especially the most vulnerable groups such as children, people with certain medical conditions and the elderly.

To protect people's health, European Commission has been committed to deliver its long-term strategy aiming an improvement of the quality of the environment. In line with this strategy, EU adopted "The zero pollution action plan" which paves the way to a new policy framework for environment. This action plan's primary goal is to lower air, water, and soil pollution levels to those that are no longer considered hazardous to health and natural ecosystems and that respect the limits our planet can handle, thereby establishing a toxic-free world. [43]

This objective is translated into key targets by 2030 which are mainly concerned to:

- air pollution:

  Air pollution is the principal environmental risk which harms people's health by causing serious diseases such as asthma, cardiovascular problems and lung cancer. The quality of air is getting worse and worse because of the emissions of pollutants in the air produced especially human activities. These activities are notably linked to industry, energy production, domestic heating, agriculture and transport.

  The EU's aim of improving air quality is based on the implementation of three pillars:

  1. ambient air quality standards:

     European Commission has proposed to review The Ambient Air Quality Directives in order to put the air quality standards in the same line of targets

proposed by the World Health Organization. The proposals also introduces measures with the aim to help member states to achieve cleaner air by strengthening air quality monitoring, modelling, and air quality plans.

2. reducing air pollution emissions:

   The main regulatory measures are adopted in NEC Directive (Directive (EU) 2016/2284) which establishes the commitments to member states to reduce air pollutant emissions. Furthermore, each member state should define national air pollution control programmes to specify how they will meet the air targets set and the tools used to monitor the progress.

3. emissions standards for key sources of pollution:

   To achieve zero pollution for air, European Commission has introduced limits on emissions of air pollutants typical of sectors such as energy, transport, agriculture and industry.

- water pollution:

  Over the years, human activities have negatively affected the quality of water by contaminating water with toxic substances which harm human health. People can be exposed to water pollution in several ways: directly by drinking pollutant water as well as indirectly by eating fish containing pollutants. In particular, there are concerns in relation of the rise quantity of pollutant substance groups in the surface water that may enter food chains. This is supported by the concerning condition of Europe's surface water bodies, of which only 40% were judged to have acceptable ecological state and 38% to have good chemical status. [42] Thus, protecting the water resources and ecosystems must be one of the cornerstones of environmental strategy in Europe.

  To achieve zero pollution for water, European Commission has proposed a number of key directives that focus on the protection and enhancement of water quality in Europe such as:

  - Water Framework Directive (EU, 2000): aims to set concrete action to prevent pollution from water in order to contribute to restoration of biodiversity and nature.
  - Drinking Water Directive (EU, 1998) : assures that water meant for human consumption may be drunk safely on a lifetime basis, and thus constitutes a high degree of health protection. [44]
  - Urban Wastewater Treatment Directive(EU, 1991): establishes requirements with respect to the collection, the treatment, and the discharge of urban waste-water and the treatment and discharge of waste-water from certain industrial sectors by combining quality objectives and emission limit values.
  - Bathing Water Directive (EU, 2006a): aims to ensure higher quality of bathing water by improving management tools for member states to monitor bathing waters every year especially at the end of season.

- soil pollution:

  As air and water, human activities has led to soil pollution directly and indirectly. Due to the presence of soil contaminants, the ecological balance is greatly disturbed, and the health of the organisms is at danger. [45]

  Soil pollutants have as main effect the reduction of soil productivity by limiting ecosystems to provide their essential services such as supplying health foods.

  To achieve zero pollution for soil, European Commission has defined EU Soil Strategy for 2030 which sets out concrete measures to put soils on a path of recovery. Health soils are essential to reach protecting biodiversity and ecosystems targets. In line with that, European Commission has proposed the Soil Health Law which establishes new actions to achieve health soils by 2030 and more generally ensure a high level of environmental protection.

  To combat climate change, ensuring our forests are healthy, our water is pure, and our land is rich, productive, and resilient, it is imperative that we achieve our goal of making all soils healthy by 2050. We are acting forcefully to safeguard and preserve this irreplaceable natural treasure, which we must not lose. [46]

Chapter 3

Research Methodology

From a methodological point of view, the main objective of this "Research Phase" is the adaption from me and my research fellow colleagues of an uniform classification approach in order to create a coherent dataset of policies and regulatory initiatives at EU-level and country-level. Indeed, this stage resulted in a collection of policies that has been implemented at EU level and in each EU country in the past years, grouped along a number of relevant dimensions.

3.1 Identification of Green Deal area

As first step, I started to analyze the existing literature focusing, in particular, on the document "European Green Deal", which is a set of proposals adopted by the European Commission to make Europe climate-neutral by 2050. This first reading of the Green Deal played a fundamental role also to determinate the area of Green Deal that I preferred to focus on. Indeed, after a preliminary analysis, I decided to choose the chapter "Mobilizing industry for a green and circular economy" because I'm particularly interested in studying the measures set out by the European Union (EU) to transform and modernize its industrial sectors and all the value chains with the aim to make EU economy more sustainable. In that way, the transition to a circular economy represents a fundamental opportunity to preserve the value of the resources and materials as long as possible, to reuse them as often as possible and, ideally, to generate no or as little as possible waste.

3.2 Definition of keywords

The next step was the definition of keywords that best relate to and summarize the selected Green Deal's chapter. In this case, my approach was a first read of the overall document to understand the context, then a careful read of each sub-part, underlying all the key sentences or words I would find. At first, the keywords identified were generic and so, following my academic supervisors' suggestion, me and my fellow research colleagues created a list of "transversal" key words in order to fully understand the overlapping areas of the Green Deal. This process helped us to identify concepts that we thought would

apply to all the topic of the green deal and remove them from each Green Deal chapter list. The list of transversal keywords is:

- Climate neutrality
  - Greenhouse gas emissions reduction
  - Renewable sources
  - Clean energy transition
- Modernization and transformation of the economy
  - Digital transformation
  - Digital technologies
  - Energy efficiency
  - Energy performance
  - Energy flexibility
  - Performance monitoring
- Taxation aligned with climate objectives
- Citizen awareness and education

Individually, we re-organized hierarchically the remaining keywords to cluster them into macro-categories by focusing on similarities between them. At the end, my list of keywords is:

- EU industrial strategy
  - Energy-intensive industry
    - Decarbonization
    - Zero-carbon steel
- Resource-intensive industry
  - Textiles
  - Electronics
  - Plastics
    - Biodegradable and bio-based plastics
    - Single-use plastics
- Sustainable product policy
  - Right to repair
    - Planned obsolescence

    - Common charger
    - Ecolabel
  - Waste
    - End-of-life vehicles
    - Over-packaging

3.3 Research Phase

Keeping in mind the keywords of my Green Deal area, I started the research phase according to the following steps:

1. Identification of the European directives according to the keywords identified
2. The transposition of EU law into national law in each member state
3. In-depth analysis of each national transposition in order to categorize it

More specifically, in the first step, I became familiar with some existing policy databases to understand how they are structured and make the search clear and straightforward. I looked at the IEA policies database (included in the links provided to us by academic supervisors), but I immediately realized that it is mainly focused on the energy topic and so despite I used the keywords previous identified, it was hard for me to find policies related to my Green Deal area.

Being aware that it was not the right approach, I decided to continue in the simplest way: searching directly the keywords (such as circular economy) on the European Union official website.

By doing so I ended up with the "Circular Economy Action Plan", a comprehensive body of legislative and non-legislative measures that aims to accelerate and scale up actions to support the circular economy. The Circular Economy Action Plan can be considered the Europe's new agenda for sustainable growth since including legislative actions and supportive measures that should be applied as guidelines by each member state to implement Circular Economy concepts. From an overall read, I caught on that CEAP is structed by several policy areas (Chemicals, Circular economy, Circular economy at the global level, Industry, Plastics, Sustainable development, Waste and recycling) each of which may be related to a strategy set out by Europe.

Analyzing each policy area, I realized that considering the importance of plastic as material in our economy and daily life, the plastics area is one of the most implemented. The EU had to set a series of measures to limit and regulate the way plastics are currently produced, used and discarded that harm the environment. To address the urgent need to a more sustainable plastics economy, the EU delineated a specific Plastic Strategy with the aim to transform the way plastic products are designed, produced, used and recycled. As Plastic Strategy implementation, I found the first directive 2019/904 (EU) in the official website of European Union Law (EUR-Lex). By enacting a variety of measures specifically suited to the products covered by the directive, it seeks to prevent and reduce

the environmental impact of specific plastic products and to promote the transition to a circular economy across the European Union (EU). It does this by making sure that single-use plastic (SUP) products, for which more affordable and sustainable alternatives are available, cannot be sold.[47]

After I identified that directive, the next step was to categorize it a following the classification file provided by the academic supervisors. The codebook includes several fields that which univocally define each policy such as the name, the reference, the category and so on and contains also multiple quantitative indicators on the stringency of government environmental policies based upon Botta and Koźluk (2014) and the OECD database. To fully understand each classification field, I have studied the documents shared to us by the Professors and discussed with my fellow research colleagues to clarify any doubts and uniform the classification method to adopt.

As result of that discussion, the following decisions have been taken about the most equivocal fields:

- policy level: we identify which administrative levels are subject to policy coverage: European Union (EU), national (CO), and regional (RE)
- mechanism: we categorize policies and regulations as either market-based or non-market-based. Non-market-based tools use specific requirements or non-financial incentives to influence behavior, whereas market-based tools indirectly regulate economic incentives to drive changes in behavior
- last amended: we report the date when the amended law was enacted, rather than the date it came into effect
- indicator: If it exists, we identify a performance indicator that forms the basis of the incentive system.
- stringency: referring to the OECD classification, we use the OECD PSI Index which provides a concise summary of the development of environmental policy frameworks in 40 countries in the period from 1990 to 2020

At that point, I started research how each of the member state enforced such directives in their national territory by using the National Transposition section in the EUR-Lex website. In this phase, the main problems come up were principally correlated to the language differences between MSs. Some East- Europe countries such as Hungary or Romania may not have official government website in English thus making impossible the comprehension. In this case, a possible approach is translating the keywords in the different languages and trying to find visual and mathematical figures to compare the information.

Once I classified all national transpositions of the first directive, I realized that another important mainstay of the Plastic Strategy is played by packaging and waste packaging management. As part of a shift in EU policy towards a circular economy, the European Commission made four legislative proposals called “Circular Economy Package” introducing new waste-management targets regarding reuse, recycling and landfilling. Furthermore,

on the waste prevention field in the Circular Economy Package, I started my analysis from the original Directive 94/62/EC that should have covered all types of packaging placed on the market and all packaging waste. It was amended by several European directives regarding different aspects of the main topic packaging waste. I focused on Directive (EU) 2015/720 EC on reducing the consumption of lightweight plastic carrier bags,Directive (EU) 2018/852 on packaging and packaging waste and Directive (EU) 2018/851 on waste and analyzed all of them in parallel in order to understand how effective European package works together and in which measure they are contributing to achieve European targets.

Chapter 4

Impact analysis on how member states have implemented the directives of the Circular Economy Package into their national laws

In line with the working outline, as output of the Research Phase, I obtained a dateset of the main directives and their national transpositions related to my European Green Deal area with specially regard to the Circular Economy Package. This dataset is crucial to my analysis, which focuses on how member states have implemented the following directives into their national laws: Directive (EU) 2018/904, Directive (EU) 2018/852, Directive (EU) 2015/720, and Directive (EU) 2018/851. To conduct this analysis, I utilized a comparative approach to examine the outcomes of the implementation of specific policies and regulations that were adopted by the Member States.

4.1 Directive (EU) 2018/904

The Directive (EU) 2018/904 aims "to prevent and reduce the impact of certain plastic products on the environment, in particular the aquatic environment, and on human health, as well as to promote the transition to a circular economy with innovative and sustainable business models, products and materials." [48] To reduce the use of single-use plastics products, it introduces a number of different measures which include specifically:

- Prohibition on placing on the market: some SUPs and any items containing oxodegradable plastic are banned from the market;[49]
- Consumption reduction obligations: member States are obligated to secure a reduction in the use of certain SUPs by adopting national reduction targets, making replacement items available at the point of sale, or making sure that single-use plastic products cannot be given away for free;

- Product and design requirements: SUPs with plastic lids and caps may only be sold if the lids and caps remain on the containers throughout the intended usage stage of the product;
- Marking and labelling requirements: certain products need to have universally clear labels that indicate if they include plastic, what harm littering causes, and how to properly dispose of the product's trash;
- Extended producer responsibility: extended producer responsibility schemes, which Member States have required, force select SUP manufacturers to pay for waste management, cleaning, and public awareness campaigns;
- Separate collection: by 2025, Member States must adopt deposit-refund programs or distinct collection targets for producers to collect 77% of specific SUPs independently. The target is set at 90% by 2029; [49]
- Awareness-raising measures: member States must inform customers about the repercussions of throwing away specific SUPs and fishing gear, as well as the recycling and waste management solutions available for these items.

According to the official transposition deadline, member states should have brought into force all the regulatory and not regulatory measures necessary to meet the Directive targets by 3 July 2021.

Nowadays, the majority of states in the European Union have implemented laws and regulations at national level to comply with the directive. Anyway, as expected, the transposition process was not taking place uniformly and consistently across Europe since some countries missed the EU deadline imposed or did not well transport the EU requirements into national legislation. How each of the member states implemented the SUP directive for in their national territory is well summarized by the following Figure 4.1 [50] exhibited in the recent report "Single Use Plastics Directive Implementation Assessment Report" published in September 2022.

Poland

Poland is still in the very early stages of its transposition process probably because of legislative slowness and inefficiency. [50] Among the few measures taken, the polish government has planned to introduce a new tax for the placing single-use plastic packaging on the market. Since the draft act is still being worked on, the appropriate charge rates have not yet been decided, although they now call for a maximum fee rate of about EUR 0.01 for each product that is put on the market. Additionally, owners of retail and catering businesses who sell items in single-use plastic packaging or single-use plastic packaging will need to pay a surcharge to each package that is up to a maximum of about EUR 0.22.

Czech Republic

Czech Republic failed to meet the EU deadline. In deed, the two laws adopted by Czechoslovakian government, "Zákon, kterým se mění některé zákony v souvislosti s

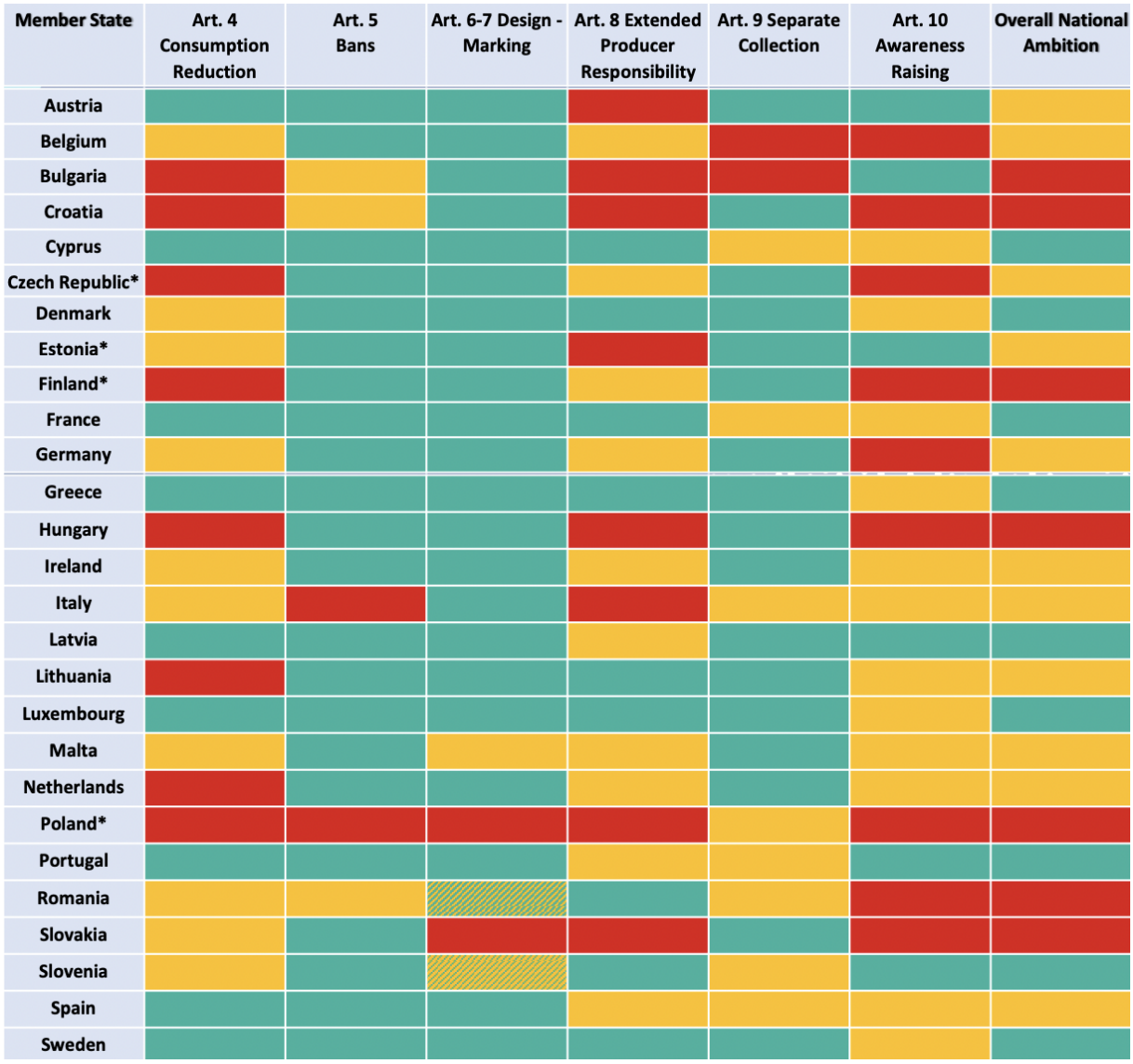

Figure 4.1: Implementation status per measure.[50]

přijetím zákona o omezení dopadu vybraných plastových výrobků na životní prostředí" and "Zákon č. 243/2022 Sb., o omezení dopadu vybraných plastových výrobků na životní prostředí" both entered into force in October 2022 and just the minimum targets are implemented. In the same line, also in Romania, Hungary, Croatia, Bulgaria and Slovakia, the directive has been implemented with little intention and without taking certain important steps. [50]

Romania

In **Romania**, the overall national ambition is below the European expectations, presenting important gap especially in the implementation of Art.5 "Bans" and Art 10 "Awareness Raising" of the reference directive. About the first, Romanian government has made some

changes in the list of plastics which should have been banned according to the European directive. Romania introduced exceptions when defining the single-use plastic sticks and drink stirrers that were subject to the bans, excluding drink stirrers used for medical purposes or by a health professional for medical purposes as well as disposable plastic chopsticks used by a forensic service provider or for scientific purposes.[50]. About the second, Romania has missed European targets on "Awareness Raising" and " Extended Producer Responsibility", placing the responsibility for taking such steps on plastic manufacturers rather than national authorities. The same approach has been also adopted in **Slovakia** and **Hungary** which results in the awareness-raising activities remaining limited to anti-littering campaigns.

More than one year after the end of the transposition period, it is clear that the national transposition process is still ongoing and in countries such as those mentioned above, it is moving in the wrong direction since they still haven't taken all the necessary action, or have gone against the Directive and taken harmful actions or exemptions. On the other hand, some countries such as **Portugal**, **France**, **Greece**, **Luxembourg** have gone further than the directive setting ambitions targets to tackle the problem of plastic pollution. Going beyond the EU minimum requirements enables member states to take a significant step in the shifting away from the single-use plastics and promotion of alternative products. These Member States used the opportunity provided by their obligation to implement the SUP Directive to replace the manner they had tackled plastic pollution and establish (new or additional) market restrictions on all or certain single-use plastic.

France

France, by taking advantage of the potential offered by the SUP Directive, over the last years, has clearly set a path to transition away from single-use plastics confirming as one of the main European leader on climate and environmental measures.[50]

France has demonstrated its high ambition by implementing a comprehensive package of policies as part of its national circular economy plan for reducing, reusing, refilling, and recycling single-use plastic package. In particular, french government has put in place a number of measures regarding both the use of single-use plastics products in public services and events as well as for food services. The use of plastic bottles at cultural and sporting events is prohibited beginning in 2021, and their use is also prohibited in government buildings and at events beginning in 2022. Restaurants and bars are also required to install water fountains and provide free access to drinking water by the end of that year. By 2025, a ban on plastic containers for cooking, reheating, and serving will have been implemented in school catering and paediatric, obstetric, and maternity wards.

France was the first member state to set up national reduction targets:

- a 20% reduction target for plastic packaging of which at least 50% is achieved through reuse and the progressive elimination of single-use plastic packaging.
- a 100% reduction target for unnecessary single-use plastic packaging, defined as that which does not have an essential technical function, such as protection, health and

product integrity, transport, or regulatory information support, by 31 December 2025. [50]

- a 50% reduction target for plastic bottles placed on the market by 2030.

Furthermore, enforcing the Law for a Circular Economy, France approved a decree in order to set a minimum market share for reusable packaging. The minimum annual requirement are been set according to the following timetable from 2022 to 2027:

- 1,5% in 20220
- 5% in 2023
- 6% in 2024
- 7% in 2025
- 8% in 2026
- 10% in 2027

On the Extended Producer Responsibility, France has fully transposed the EPR requirements into their national laws. In particular, in France, the Extended Producer Responsibility is based on the "pay-or-play principle" according to which manufacturers or distributors take financial and organisational responsibility for the disposal or recycling of products they produce or sell. It has mostly been utilized up to this point for the collecting of waste from domestic packaging, obsolete batteries and accumulators, paper, and electrical and electronic equipment (EEE) but as of 1 January 2022, the EPR principle is gradually extended to new categories of products to form "new EPR schemes" (e.g. textile products, toys, sports and leisure items, DIY and gardening items, cars, chewing gums, etc.). The development and implementation of a five-year preventative and eco-design plan is now required of producers affected by EPR programmes, maybe through the eco-organisation. [51]

In addition to the quantity targets set, french government has adopted a number of national and local initiatives to promote reuses. The main objective is to encourage people to move forward to culture of sustainability through the promotion of recycling and reuse so that empower consumers to make knowledgeable choices and take an active part in the ecological transition.

Luxembourg

In the same line of the France, **Luxembourg** has fully transposed the SUP directive and has been able to set a clear national strategy to phase out single-use plastics and become plastic free by 2050.

Government of Luxembourg has been gone beyond the requirements of the SUP directive by adding 2 additional bans:

- on the use of single-use plastic packaging for fresh fruits and vegetables which entered into effect on January 1, 2023 (but only for produce weighing less than 1.5 kilograms).
- on the use of SUP at public events that goes into effect on January 1, 2023 and targets mini-picks, bottles, and other beverage containers. By the first of January 2025, single-use beverage cans and cartons will also be subject to this restriction.

In addition to these two additional bans, Luxembourg has also implemented a thorough reduction strategy as part of its national zero waste goal. It includes the following measures:

- By 1 January 2023, restaurants have to serve food and drinks consumed on the premises with reusable cups, mugs, glasses, plates, containers, cutlery. [50]
- By 1 January 2025, containers, trays, plates and cutlery used in the context of takeaway or delivery meals must be reusable. [50]
- By 1 January 2025, beverage containers, food containers and bags cannot be provided free of charge at the point of sale of goods or products. [50]

Furthermore, Luxembourg adopted the national strategy 'Null Offall Lëtzebuerg' with the aim to significantly reduce the amount of waste produced nationwide. With this strategy, Luxembourg set the objective of manage resources more responsibly and sustainably while relying on principles of the circular economy. It is also included several measures and initiatives developed to raise awareness among citizens.

Portugal

Among all member states, **Portugal** is one of the few countries which was able to fully explored the potential offered by the SUP Directive to phase out single-use plastics. [50]

Regarding the single-use plastics, the main portugal legislative framework is Decreto-Lei n.º 78/2021 which foresees the main aspects concerning several activities including the transport, elimination and recovery of packaging and plastics.[50] With this law, Portugal has adopted very high reduction targets aiming at for 80% by 2026 and 90% by 2030 (of the number of units placed on the market, compared to 2022 data), in particular the government has set the goal of a 30% decrease in consumption of single-use plastic cups and food containers until the end of 2026 and a 50% reduction in the number of units sold until the end of 2030. Moreover, obligations to provide reusable packaging have been introduced. Indeed, by 2024 By January 2024, restaurants must provide their clients reusable packaging (in exchange for a deposit that must be returned after use) for takeout or delivery of food and beverages. Reusable packaging should not be more expensive or less beneficial than single-use packaging. Additionally, restaurants are required to offer reusable utensils for customers to use when eating or drinking on-site at their locations.

To reduce plastic consumption and thereby encourage the wise use of natural resources, Portugal has implemented tax policies which apply the user-pays principle. This means that the costs of environmental services and damages are directly incorporated in the prices of goods, services, and activities that are the source of those costs. Especially regarding

the single-use plastics, the State Budget Law for 2021 created a contribution, of € 0.30 per package, on single-use packaging made of plastic or aluminium purchased in ready-to-eat meals. The amount of the contribution must be detailed on the invoice, throughout the entire commercial chain, up to the final consumer.

Spain

Following Portugal's steps, **Spain** has completed the adoption of transposition laws at the national level, although being formally informed by the European Commission in January 2022 that it had failed to transfer the SUP Directive.

To prevent and reduce the impact of certain plastic products on the environment, Spain has gone further than the EU SUP directive by adding additional measures which pave the way for formulating an ambitious national plastic strategy.

On consumption reduction, Spain set as national targets for single-use plastic cups and food containers 50% reduction in weight by 2026 and 70% by 2030. To meet these objectives, starting on 1 January 2023, SUP cups and food containers are taxed according to the quantity of plastic (€ 0.45 per kg of plastic) and the price which must be visible to consumers on their receipts.

On bans, in addition to the measures from the EU directive, Spain has adopted an additional ban on plastic packaging for fruit and vegetables weighing less than 1.5kg. This national objective is strengthened by several regional measures which are already aiming higher: Canary Islands and Balearic Islands have already banned the use of SUP at public events and bottled water in public services, and Catalonia intends to outlaw SUP food packaging as of January 1, 2024. Other single-use items like food trays, candy sticks, and single-serve food packaging as well as other SUP in the catering sector have also been outlawed. [50]

To get more effective results, the Spanish government complemented the consumption reduction and ban of single-use plastic products with several initiatives concerning the awareness raising. Interestingly, Spain has chosen young people as specific target of its initiatives with the aim to to shift them towards sustainable behaviour.

Italy

As for **Italy**, the national transposition process has been completed although numerous delays in implementing. The Italian government merely adopted the minimum requirements of the directive, confirming its low ambition in setting targets.

To comply with the EU directive, Italy set out a single decree "DECRETO LEGISLATIVO 8 novembre 2021, n. 196" which should encompass all the measures needed to put the country on a more sustainable path in term of single-use plastics reduction. However, the Italian Decree departs significantly from the SUP in several important ways, including by providing a more flexible definition of plastic, delaying the enforcement of the prohibition on some SUPs, and exempting certain biodegradable and compostable materials from such prohibition.

On the other hand, Italy are working on a national strategy tailored specifically toward combating plastic pollution with steps to encourage responsible purchasing and give

customers comprehensive information on the effects of single-use plastics on the environment. As part of its ambition to raise awareness, Italy has put strong emphasis on increasing reusable packaging and plastic items through several initiatives both at national and local level. In addition, to contribute to promote reuse and achieve single-use plastic consumption reduction, Italian government is planning to introduce a national plastic tax on packaging which should be fixed at 0.45 cents per kilogram of single-use plastic products sold.

From the analysis performed, it can be seen that one year after the end of the transposition period, a great majority of EU Member States, as illustrated in the Figure 4.2 [50], are currently on schedule to implement the Single-Use Plastic Directive across all of its varied provisions.

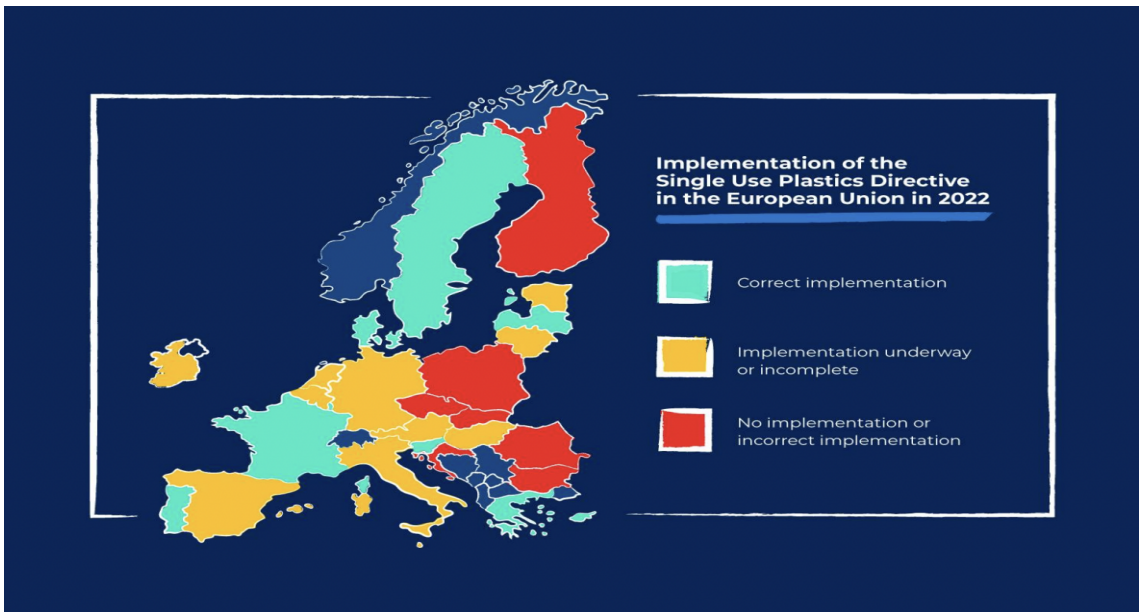

Figure 4.2: Map highlighting implementation of the Single Use Plastics Directive across all Member States in the EU as of September 2022. [50]

Apart a few exceptions, such as **Poland**or **Slovakia**, member states have shown themselves ready to embrace and accelerate the challenge against single-use plastics contributing to make Europe more sustainable. Although many measures have already been taken, there is still a long way to go to reach the ambitious goals set by the Europe and several improvements are needed. Setting up national goals or measures to reduce usage of cups and food containers by 2026 needs more attention. Plans for national awareness-building include extensive EPR programs based on eco-modulated fees and paying all cleanup expenses, as well as the coordination and scaling up of successful local awareness initiatives. Supporting reusable alternatives to single-use plastics should take precedence over substituting them with other single-use materials when implementing the Directive.[50]

4.2 Circular economy package: Four legislative proposals on waste

The EU has long set the agenda for resource use and waste policy for constituent Member States and the launch of the EU's Circular Economy Package first seems to mark a significant change in the direction in which EU policy is taking. It includes a wide range of policy instruments with the main aim to improve waste management and to promote eco-innovation and resource efficiency.

Essentially, the Circular Economy Package consisted in four legislative proposals:

- amending Directive 2008/98/EC on waste
- amending Directive 1999/31/EC on the landfill of waste
- amending Directive 94/62/EC on packaging and packaging waste
- amending Directives 2000/53/EC on end-of-life vehicles, 2006/66/EC on batteries and accumulators and waste batteries and accumulators, and 2012/19/EU on waste electrical and electronic equipment

These proposals are planned to introduce new waste-management targets regarding reuse, recycling and landfilling and also strengthen provisions on waste prevention and extended producer responsibility, and streamline definitions, reporting obligations and calculation methods for targets. [52]

Specifically, in my research work, I focused on the implementation and recently revisions of Directive 94/62/EC on packaging and packaging waste which aims to harmonize the various national approaches to managing packaging and packaging waste and ensuring a high degree of environmental protection.

The 1994 original directive, and the amended version from 2004, set targets with regard to recovery and recycling of packaging waste and required member states to set more strictly recovery and recycling goals. In particular, the targets established in 2004 for completion by 2008 include minimum recycling rates for a number of products, including glass, paper and board, metals, plastics, and wood, as well as total recovery and recycling rates of 60%, 55–80%, and 60%, respectively. [52].

The directive has undergone a number of amendments and the following are the most notable:

4.2.1 Directive(EU) 2018/852

With the directive 2018/852, the EU strives for reducing new raw materials. This directive intends to utilize processed and reused recyclates from the recycling of used packaging as the raw material for new packaging instead of utilizing any new raw materials for packaging with a short life and usage phase. To reap that, more stringent goals for recycling packaging waste were established for EU Member States to meet by 2025 and 2030. By the end of 2025, at least 65% of all packaging waste must be recycled and more specifically, according to the raw material:

- plastic: 50%
- wood: 25%
- ferrous metals: 70%
- glass: 70%
- aluminium: 50%
- paper and cardboard: 75%

By the end of 2030, at least 70% of all packaging waste must be recycled and more specifically, according to the raw material:

- plastic: 55%
- wood: 30%
- ferrous metals: 80%
- glass: 75%
- aluminium: 60%
- paper and cardboard: 85%

According to the EU transposition deadline, Member States were required to have implemented the legislation in their national legal framework by the beginning of July 2020 also in order to pave the way for formulating national plans which make achieving the targets easier. Unfortunately, several Member States are still lagging behind and only a few countries had fully explored the potential offered by the Packaging Waste directive to effectively prevent waste production.

Portugal

Portugal has made slow but steady progress over the past decade on stepping up its recycling rate and diverting municipal waste from landfilling. However, it was identified as one of the Member States that missed the 2020 municipal waste recycling target of 50% in the Commission's "Early Warning report".

For this reason, much effort will be needed to meet the new post-2020 recycling targets, with a clear focus on prevention and diverting waste from incineration to reuse and recycling.

To tackle these objectives, Portugal has been actively developing several measures aiming at aligning the national legislation with European objectives in waste management. It has reviewed the landfill tax (and a similar incineration tax) in its National Budget Law for 2020, with a gradual increase in the years after 2020. Furthermore, the State Budget Law for 2021 created a contribution of € 0.30 per package, on single-use packaging made of plastic or aluminium purchased in ready-to-eat meals. This is positive, although the

charges are too low to change people's behaviour. Portugal government should strengthen its economic instrument to make reuse and recycling more economically attractive by for instance, increasing landfill and incineration charges or raising the charge on municipalities for failing to meet recycling targets). [53]

Concerning Directive (EU) 2018/852, the Decreto-Lei n.º 152/2017 foresaw the possibility of reusable package systems, and established some of its rules [54]. However, the use of reusable packaging was further specified in the DECREE LAW No. 102-D/2020 which transposes European packaging recycling targets, by type of material, and provides for the adoption of targets concerning the placing on the market of beverages in reusable packaging. The decree enacts a new general framework for waste management and with more reference to packaging it establishes new rules on package marking and regulates the procedures and duties of economic industries and sectors with a special focus on reusable packaging.

Greece

As illustrated in the Figure 4.3, **Greece** is among the member states that missed the the target of 50% municipal waste recycling by 2020. Therefore, the Commission has released a "Early Warning Report" for Greece that outlines particular priorities for closing the implementation gap.

The measures that have been taken so far have been ineffective and have not led to the desired results. Greece passed a law imposing a landfill fee in 2012, but it came into effect by 2019. In the meanwhile, the existing low landfill gate price and the affordable illegal dumps do not promote recycling over waste disposal. The present programs are unsuccessful and the economic tools available are insufficient.

Thus, Greece will have to work harder to divert waste away from land filling and toward recycling in light of the newly approved post-2020 recycling objectives for municipal waste (55% by 2025, 60% by 2030, and 65% by 2035).[55]

To align the national legislation with European objectives in packaging and packaging waste management, Greece adopted the "Law 4819/2021" which incorporates the Directives 2018/851 and 2018/852 of European Union. In addition to the measures already taken in the Packaging and Packaging Waste Regulation (e.g. it requires that all packaging placed on the Greek market be labeled with information about its composition and recyclability,...), this law introduced a number of measures needed to meet the target of recycling 60% of its packaging waste by 2025, in line with EU requirements. Specifically, these measures includes the promotion of source separation and the establishment of recycling facilities. The Greek government has also introduced a recycling duty of 8 cents per piece the packaging of which contains polyvinyl chloride (PVC) and a number of incentives to encourage companies to reduce the environmental impact of their packaging, such as subsidies for the use of recyclable materials.

Furthermore, in favour of an integrated municipal waste management plan, Article 37 of Law 4819/2021 has implemented the pay-as-you-throw (PAYT) program to decrease waste in landfills and encourage consumers to divide their rubbish for separate collection. The Pay-As-You-Throw (PAYT) is a waste management pricing strategy that charges households based on the amount of waste they generate.In particular, the Article 37 laid

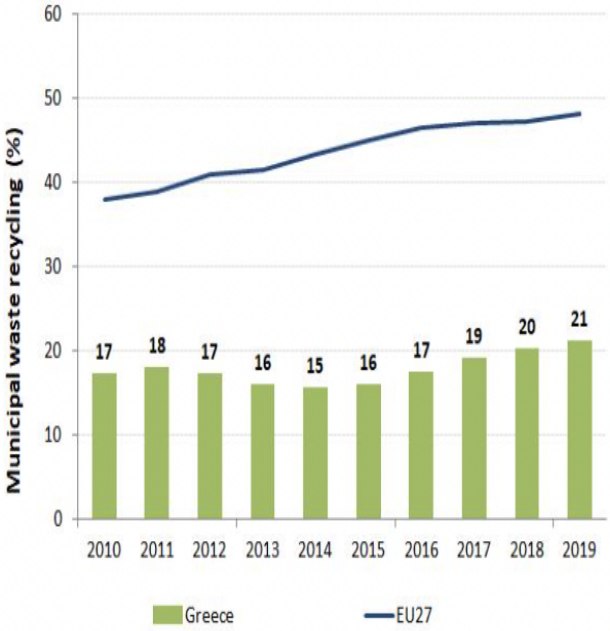

Figure 4.3: Recycling rate of municipal waste in Greece in 2010- 2019

out that the PAYT will become the staple pricing model for municipal waste: from 1st January 2023 and onwards, municipalities of a population between 20,000 and 100,000 should apply PAYT for biodegradable waste from food establishments; municipalities of a population of 10,000 should apply PAYT from hotels; municipalities of more than 100,000 should apply PAYT schemes; and, finally, from 1st January 2028, municipalities of a population between 20,000 and 100,000 should apply PAYT schemes. [56]

France

Among all member states, **France** confirmed its leadership in waste management by formulating by formulating a clear national strategy and action plan that could be an inspiration to other countries.

The "LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire" is the national legislation that translates Directive 2018/852 into action for the Circular Economy Package. The law contains rules for managing packaging and its waste. Its main goal is to:

- Encourage the design of more sustainable products and packaging
- Strengthen the rules on waste management and disposal
- Support the development of new recycling and recovery activities
- Encourage the development of new circular business models such as product-as-a-service, lease, and repair, with the goal of increasing their market share by 2030.

- Reduction of food waste by setting a target to reduce food waste by 50% by 2025 compared to 2015 levels

With the Circular Economy law, France has not adopted the minimum requirements to comply with the directive, however it goes further by establishing the target of:

- 5% of reused packaging put on the market in 2023
- 10% of reused packaging put on the market in 2027

One of the key provisions of the law is the extended producer responsibility (EPR), which mandates that producers pay for waste management and the end-of-life care of their products. As a result, Producers, importers or exporters must prove that the waste generated by their products is capable of being managed under certain conditions. By 1 January 2030 at the latest, those who place on the market greater than 10,000 product units per year and declaring a turnover greater than EUR 10m will have to prove that their waste is likely to enter a recycling scheme.

To date, there is no tax on packaging. However, from 1 January 2022, a system of incentives and penalties based on environmental performance criteria, including the integration of recycled material, is used to modify the eco-contribution payable by manufacturers to their eco-organisation in the framework of an EPR scheme.

Estonia

According to the EU Environmental Implementation Review, **Estonia** missed to meet 2020 waste targets, with a low municipal recycling rate of 28% and a move away from landfilling (19%) in favor of incineration (42%). [54].

Since 2017, there have been a few encouraging developments that are expected to improve the situation. One of these is the possibility of reducing the number of municipalities, which would help streamline services and improve efficiency. Additionally, the statistics on packaging placed on the market have already been positively corrected as a result of mandated audits of companies placing packaging on the market. This leads to higher monetary contributions to the system and increases the pressure on manufacturers to reach their package recycling goals.

To comply with the Directive (EU) 2018/852, Estonia has a number of laws and regulations in place to manage packaging waste and reduce its impact on the environment that need to be strengthened and updated to meet the post 2020 targets.

In detail, the main national transposition is the last amendment of the "Packaging Act" which can be considered as the main Estonian legal framework on the packaging waste management. The "Packaging Act" requires companies that produce or import packaged products to take responsibility for managing the waste generated by their packaging. This entails taking steps to reduce the environmental effect of the packaging they manufacture or import and to participate in packaging trash recovery and recycling initiatives. To reinforce the EPR system, Estonia, with the last amendment, introduces the obligation to submit annual reports on the packaging they have placed on the market. The "Packaging Act" also sets a system for packaging deposits, under which businesses are obligated to

make a deposit on particular forms of packaging, such beverage containers, at the point of sale. When the package is returned to a designated collection location, the consumer will receive their deposit back. By 2021, the deposit system has been extended to new types of packaging and it is established a new deposit rate for certain types of packaging.

Italy

Waste management in Italy is regulated by a complex legal framework, including national, regional, and local legislation. The central government is responsible for providing the overall guidelines for waste management and for adopting the EU waste management directives into national law. The local and regional authorities are responsible for enforcing the law, providing waste treatment and collection services, and ensuring that the waste management system is functioning as it should.

However, wast management continues to be a major problem for **Italy**. Despite considerable improvements in municipal waste management in recent years, particularly with a constant and continuous growth in recycling and composting as illustrated in the Figure 4.4 , the waste industry still has serious deficiencies, as evidenced by various infringement processes against Italy. These include the "Campania case" and the "landfill case," which have been punishable by fines imposed by the Court of Justice of the European Union (CJEU). Thus, To make sure that waste disposal in Italy complies with EU rules, the Italian government is committed, with the recovery and resilience plan (RRP) to introduce significant reforms that are intended to enhance the execution of environmental standards on the ground. This includes the formulation of a specific national circular economy strategy, a national waste management plan , and landmark recycling initiatives. [57]

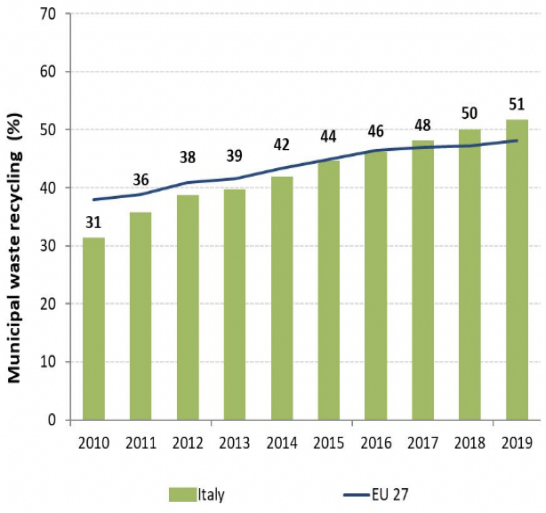

Figure 4.4: Recycling rate of municipal waste in Italy in 2010- 2019

The Waste Management National Plan, also known as "Piano Nazionale di Gestione dei Rifiuti" (PNGR) in Italian, is a strategic document that lays out the policies, strategies,

and steps the Italian government will take to manage the nation's waste over a number of years.

To ensure that it accurately reflects changes in national and international legislation and best practices in the area of waste management, the plan is updated on a regular basis. The most current revision of the plan, which covers the years 2017 through 2022, was enacted in 2017.

The National Plan for Waste Management's primary goals are to reduce waste production in Italy, enhance waste recycling and recovery, and support the sustainable management of waste. To accomplish these goals, the plan describes a variety of particular policies and measures that will be taken such as:

- Reducing the amount of waste produced through the development of policies and incentives that encourage waste reduction and prevention at the source
- Improving waste collection, sorting, and treatment infrastructure to increase the amount of waste that is recycled and recovered
- Promoting the use of sustainable waste management practices by businesses and households, including the adoption of more sustainable products and packaging
- Reducing the environmental and health risks associated with waste management activities

Indeed, The Waste National Plan (Piano Nazionale di Gestione dei Rifiuti) also includes specific targets and measures for the management of packaging waste which are further strengthened by the approval of the Decreto Legislativo116/2020 (dlgs 116/2020). This Decree is the Italian national transposition of the Directive(EU) 2018/852 and it establishes a framework for managing packaging waste, including prevention, reuse, recycling, and recovery. In detail, it sets the targets for the preparation for reuse and recycling of urban waste in Italy with the aim to achieve a percentage of 55% by weight of urban waste prepared for reuse and recycling by 2025, 60% by 2030, and 65% by 2035. To reach these targets, the following key action have been implemented by the involved stakeholders:

- Separate collection: the responsibility of setting up separate waste collection systems for various packaging materials like paper, plastic, and glass lies with the municipalities
- Deposit and return systems:certain regions in Italy have introduced deposit and return schemes for certain types of packaging, such as beverage containers
- Eco-design: the Italian government encourages the use of sustainable materials and the reduction of packaging waste is encouraged to promote eco-design of packaging
- Awareness-raising and education: the Italian government promotes awareness-raising and education campaigns to encourage consumers to reduce, reuse, and recycle packaging waste.

Moreover, the Italian government has introduced a "CONAI Environmental Contribution" on packaging that distributes between producers and users the cost for collection charges. This tax is differentiated according to the total volume, weight and type of packaging materials sold on the domestic market. As January 2023, this contributor has been increased for certain materials such as Plastic, however the general progress made by Italy on the priorities to introduce new policy and economic instruments to promote waste prevention, product re-use and increasing recycling rates are really limited.

4.2.2 Directive (EU) 2015/720

By amending Directive 94/62/EC on packaging and packaging waste, Directive (EU) 2015/720 seeks to reduce the use of lightweight plastic carrier bags throughout the European Union. The directive sets a binding target for EU Member States to reduce the consumption of lightweight plastic carrier bags with a thickness below 50 microns and entails the following objectives:

- As 2019: reduction of single use plastic bags consumption up to 90 pieces/capita per year
- As 2025: reduction of consumption up to 40 pieces/capita per year

It further specifies that plastic bags will not be provided free of charge at the point of sale of goods or products after December, 2015. [50] Thus, on the one hand, it aims to reduce the consumption of lightweight plastic carrier bags so that the amount of litter caused by these carrier bags is reduced, and on the other hand to encourage waste prevention and achieve a more efficient use of raw materials.

The directive requires Member States to take appropriate actions to ensure that plastic carrier bags are marked with the appropriate labeling to inform consumers about their environmental impact and proper disposal.

The transposition of the directive into national law varies by member state and each country has the flexibility to adopt its own methods to meet the targets set. **Luxembourg**adopted policy measures in stages that have contributed to the decline in plastic bag usage. **France**, **Germany**, and **Slovakia**, have introduced feed for plastic bags in supermarkets and hypermarket. Some countries and regions, including **Austria**, the **Netherlands**, and **Portugal** are just beginning to enforce Directive 2015/720 by prohibiting the distribution of free plastic bags or implementing taxes.[58].

France

As mentioned in the section Directive (EU) 2018/904, **France** has clearly set a strategy to transition away from single-use plastics confirming as one of the main European leader on implementing measures against the use of plastics.

Also part of this strategy is the implementation of the Directive (EU) 2015/720 which aims to reduce the consumption of lightweight plastic carrier bags. It was transposed into national law by the "LOI no 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte" which was adopted on August 17, 2015. In accordance with this

law, the French government began charging for thin plastic bags by July 1, 2016, in an effort to cut down on their use. Starting on January 1, 2017, the charge was increased from € 0.05 per bag to € 0.10 per bag. Independently they are produced, all lightweight plastic carrying bags must pay this levy, and the funds collected are used to support environmental activities. As of July 2016, the law also banned the distribution of lightweight plastic bags in large retailers and supermarkets, with some exceptions for bags that meet specific environmental standards. In addition, the law mandated that all plastic bags, including biodegradable ones, must meet certain environmental requirements and labeling guidelines.

The EU directive is also transposed by the "Décret n° 2016-379 du 30 mars 2016 relatif aux modalités de mise en œuvre de la limitation des sacs en matières plastiques à usage unique" which objective is to reduce the ecological consequences of plastic waste by limiting the distribution of disposable plastic bags and encouraging the use of materials that are bio-sourced for their production. In detail, the Decree establishes that all single-use plastic bags provided in France, even those that are compostable or biodegradable, contain a minimum of 40% bio-sourced components as January 2018. The decree also specifies requirements for single-use plastic bag labeling, including disclosure of information on the bags' make-up and environmental effects. Retailers are required to educate customers about the restrictions on the distribution of single-use plastic bags and encourage the use of reusable bags. Specifically, to support these requirements a fine for non-compliance with the regulations has been introduced: €75 to €150 for individuals and €375 to €750 for legal entities, depending on the severity and frequency of the offense.

Due to the EU directive's transpositions, France has experienced a substantial decline in the use of lightweight plastic carrier bags. According to the French Ministry for the Ecological Transition, the number of these bags consumed in France dropped by approximately 90% between 2015 and 2019, from an estimated 17 billion to about 1 billion.

Denmark

For some time now, **Denmark** has been tackling the issue of plastic pollution by adopting several measures at aiming to reduce plastic consumption and promote reuse.

Specifically, with the "Emballageafgiftsloven" Denmark implemented a tax to the state on all carrier bags that have a handle and a volume of at least 5 liters, which resulted in a decrease in plastic bag consumption from 19,000 in 1993 tonnes to approximately 9,000 tonnes in 2015. The law was first introduced in 1993 and has been updated several times since then, most recently in 2020. In the last amendment, the Danish Parliament has implemented a ban on free plastic bags in stores, as well as on thin plastic carrier bags that cannot be recycled or used more than once or twice. Moreover, it is introduced a tax of at least DKK 4 (€0.54) for each bag sold at retail, which includes paper bags with handles. However, very thin plastic bags for fruits and vegetables are still allowed, as they are necessary for food waste control and hygiene. The Danish Environmental Protection Agency is responsible for enforcing the law related to packaging waste, including monitoring compliance and collecting tax revenue.The agency collaborates with businesses and local authorities to promote sustainable packaging practices and supports recycling initiatives.

Portugal

Portugal has anticipated the Directive (EU) 2015/720 by introducing a tax on lightweight plastic bags in the "Reforma da Fiscalidade Verde" published in December 2014. [58] This tax has been increased to €0.10 per bag (including value added tax) by the "Decreto-Lei n.º 152-D/2017" to discourage the use of single-use bags and encourage consumers to use their own reusable bags. The tax applies to all types of bags, including biodegradable and compostable ones, with certain exemptions for bags used for loose food products or hygiene reasons, as well as bags provided on public transport.

In addition to the tax, other key provisions of the Decree include a prohibition of free distribution of plastic carrier bags by retailers and enforcement by the Portuguese Environmental Agency (APA), which is responsible for conducting inspections, imposing sanctions, and ensuring compliance with the legislation.

In Portugal, the tax on lightweight plastic bags has been effective in reducing their consumption. However, there was a slight increase in the consumption of garbage bags, which may have partially offset the benefits of the tax. To ensure the success of the tax, retailers play an important role in providing alternatives to single-use plastic bags and distributing reusable bags. Along with this, education and awareness campaigns are needed to promote more sustainable behaviors among consumers to fully address the environmental impact of plastic waste.

Italy

In **Italy**, the national transposition process has been completed although numerous delays in implementing. Indeed, the Directive (EU) 2015/720 has been transposed into national legislation by "DECRETO-LEGGE 20 giugno 2017, n. 91 Disposizioni urgenti per la crescita economica nel Mezzogiorno" adopted in July, 2017. The Decree, also known as the Mezzogiorno Decree, introduces specific measures to reduce plastic bag consumption in Italy. In particular, it establishes:

- the distribution of only ultralight bags that are biodegradable, compostable, and made up of at least 40% renewable material. This percentage is increased to 50% by 2020, and to 60% by 2021
- the distribution of plastic bags with a thickness greater than 50 microns is prohibited starting from January 1, 2019
- manufactures are required to inform consumers about the new regulations and the types of plastic bags allowed

The Decree also allows for some exceptions to the use of biodegradable and compostable plastic bags, provided that they meet certain environmental sustainability standards. These bags must be distributed for a fee, with the total cost borne by the consumer, who will see the cost of the bags on their shopping receipt. Retailers are required to follow the new regulations, as serious penalties is imposed on those who try to avoid compliance with the law starting from January 1st. Anyone who sells bags that do not meet the specified standards will face administrative fines that can range from €2,500 to €25,000.

Italy has planned to introduce a plastic tax of € 0.45 per kilogram of new plastic contained, and failure to pay this tax will result in significant penalties. If the tax is not paid, the taxpayer will face penalties of two to five times the unpaid amount, with a minimum penalty of € 250. Additionally, late payments will result in an administrative fee of 25% of the amount owed, with a minimum fee of € 150. Although the original implementation of the plastic tax was scheduled for 2020, Italy has postponed its introduction several times, and it is currently uncertain when the rules will finally come into effect.

Spain

As for Italy, **Spain** has completed the adoption of transposition laws at the national level, although being formally informed by the European Commission that it had failed to transfer the Directive (EU) 2015/720.

Indeed only in May 2019, Spain adopted "Real Decreto 293/2018, de 18 de mayo, sobre reducción del consumo de bolsas de plástico y por el que se crea el Registro de Productores" to implement the European directive on reducing plastic bag consumption. The main objective of the Real Decreto is to decrease the use of plastic bags and minimize their negative impact on the environment. The Decree prohibits the free distribution of plastic bags at points of sale, except for very thin (less than 15 microns) or thick (50 microns or more) bags that are compostable. The decree also requires retailers to charge a minimum fee per bag provided to customers, with a minimum price of 5 cents per bag. Implementation of this legislation is mandatory for all retail establishments,although each autonomous community in Spain is allowed to set its own tariff.This means that the tax may be higher in some regions, depending on the local government's decision. For instance, the Balearic Islands and Catalonia have set tariffs of €10 and €10-15 cents per bag, respectively, depending on the type of bag. It is important to mention that the funds obtained from the plastic bag tax are allocated to regional governments, which can use the revenue to support environmental protection and waste management programs in their regions.

4.2.3 Directive (EU) 2018/851

Still concerning the Circular economy package, I delved into the analysis of the Directive (EU) 2018/851 which made amendments of the Directive Directive 2008/98/EC by reforming significant aspects of the waste management policy. It altered the focus and intent of the Framework Directive incorporating therein the necessity of reducing waste production and the significance of moving toward a circular economy, both of which are crucial for ensuring the competitiveness of the Union in the long run. To reach that, an important step was the establishment of three new targets for municipal waste:

- By 2025, the preparing for re-use and the recycling of municipal waste shall be increase to a minimum of 55% by weight
- By 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60% by weight

- By 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65% by weight

This is a big change since it allows waste management systems to be part of the overall goal of creating a true circular economy. [59] Waste prevention is an integral part of the comprehensive transformation towards a circular economy since it reduces not only the input of natural resources into the economy but also the efforts required to collect and recycle waste.

Member States were required by law to have implemented the legislation in their national legal framework by the beginning of July 2020 also in order to pave the way for formulating national plans which make achieving the targets easier.

However, the transposition process into national legislation has been conducted differently across the member states due to the significant differences between how Member States manage waste. Only a few countries had fully explored the potential offered by the Waste Directives to effectively prevent packaging waste production and stimulate innovation in recycling. The majority of EU countries are still in the process of transposing having still not adopted all the measures needed.

Belgium

Among all member states, **Belgium** has become a leader in Europe in sustainable waste management. Indeed, since 2017 Belgium has already met the 2020 EU waste targets, anyway it is already working to reach the more ambitious objectives set by the Directive 2018/851. Considering the Belgian political system, to fully understand how the transposition process is going, it is important to focus on all measures taken at regional level. Specifically:

- Flanders:

  Since 1995, Flanders has had overall mandatory measures on separate collection and recycling for many waste streams in several laws and implementing act . Over the years, these measures have been modified and strengthened to result "The Flemish Climate Action Plan 2021-2030". It contains, in particular, targets for a reduction in the amount of residual waste sent to incineration, by 25% by 2030, through stepping up the separate collection of recyclable waste streams. Furthermore, for various material streams, Flanders has a number of sectoral policies in place with the aim to seek to increase the most effective actions (such preventing, reusing, and recycling) and lessen the least effective ones (landfilling and incineration). [59]

- Wallonia:

  Wallonia is still in the transposition process, however the requirements of Directive 2018/851 were anticipated in the 'Plan wallon des Déchets-Ressources',adopted on 22 March 2018, which reported expected evolutions of household waste levels between 2013 and 2025.

- Brusseles:

> Among the Belgian regions, Brusseles region is the worst performing in terms of waste management reporting only 37% of their municipal waste is collected separately in contrast to Wallonia and Flanders where this percentage rises to 70%. To keep up with the new targets, Brussels region approved a plan, 'Plan de Gestion des Ressources et des Déchets 2018–2023' which aims to determine the main lines of waste management and prevention policy over several years. It establishes quantifiable goals for cutting waste both within and outside of homes. The goal for homes is to cut trash generation per person by 5% in 2023 and by 20% in 2030. [60]

These data show that, at the regional level, Belgium is well on its way to charting a transition path toward modern and resource-efficient waste management by confirming itself among the most ambitious countries in terms of waste prevention.

Austria

As with Belgium, **Austria** ranks among top EU countries in waste management. Having already met the 2020 EU waste targets for municipal waste, it is already planning its ambitious national strategy with a clear focus on prevention and diverting waste from incineration to reuse and recycling.

Directive (EU) 2018/851 has been transposed by amending the Federal Waste Management Act and related Ordinances. It outlines the key pillars of Austrian waste management, including sustainability, environmental protection, and the preservation of natural resources. A crucial component of the Federal Waste Management Plan is Waste Prevention Programme which aims to decouple economic growth from the environmental effects associated with waste creation.

One of the main sector regulated is the food industry which produces annually of huge quantity of inedible food waste. In particular, to achieve the goal of halving food waste generation along the whole value chain, the Waste Prevention Programme includes a specific chapter on food waste prevention with various detailed measures. Among these 26 measures, the Austrian government has chosen to place strong emphasis on the promotion of national and regional awareness campaigns on the topic of preventing food waste. The objective is to rise individual awareness and empower Austrian citizens to act in a more conscious and sustainable way. Indeed, the programme aims to encourage all stakeholders to participate in the implementation of waste prevention at a local, regional and provincial level. Thus Denmark needs to primarily focus on reducing waste generation and improving its resource productivity.

Denmark

Denmark had taken appropriate steps to improve waste management and is likely going to reach the EU 2020 goal of recycling 50% of municipal waste. However, it produces the most municipal waste per resident among all member states, and its rate of circular (secondary) material utilization is far lower than the EU average.

To comply the Directive (EU) 2018/851, Austria has enacted specifically three national laws with the primary aim to promote waste prevention and make preparing for waste reuse

and recycling more economically attractive. With the Act on Environmental Protection no. 807, Danish government implemented the waste directive's minimum requirements for existing extended producer responsibility schemes, introduction of extended producer responsibility for packaging and modernization of collection and treatment of electronic waste. The Act on Environmental Protection no. 645 of 19th May 2020 made updated to the National Prevention Plan and National Waste Management Plan to be aligned to the new waste targets established by the EU directive.

Finally, Denmark has ended its national transposition process by adopting the "Order on waste No 2512" came into force by January 2022. These three measures lay the groundwork for a clearly national plan which is planned to guide Denmark toward conscious waste management by ensuring less waste and improving better use of natural resources.

France

France adopted targets also set in the new Waste Directives some time ago being a real source of inspiration for those who aim to improve the current waste situation. Indeed, France has already moved toward to an ambitious anti-waste law (LOI n° 2020-105 du 10 février 2020 relative à la lutte contre le gaspillage et à l'économie circulaire) with extended responsibilities for all producers (EPR schemes) on prevention and reuse, with a ban on future disposal of products. [50]

With this law, France drew an ambitious roadmap to transform production and consumption patterns, minimize waste, protect the environment, and preserve natural resources. Specifically,it contains about 50 measures that include:

- new obligations with the creation of new Polluter pays sectors to include new product families in the circular economy (toys, sports and do-it-yourself equipment, building materials, cigarette butts, sanitary textiles) and the requirement of transparency on the environmental and health impacts of products, on waste management. [61]
- new prohibitions on the use of single-use plastics and to combat wastage of both food and non-food unsold products
- new tool to better control and sanction offences against the environment

All of these measures are supported by a series of initiatives aiming at promoting reuse. One of the main action is the introduction, starting 1st January 2021, of reparability index that will allow the consumer to know whether the product is repairable, difficult to repair, or non-repairable. Additionally, a "solidarity reuse funds" will be established to pay the organizations participating in reuse, allowing them to grow reuse, reduce the waste of hundreds of tonnes of items, and support employment growth.

Ireland

Ireland is one the few countries to end its national transposition process by the EU deadline. Indeed, in September 2020, Ireland had already transposed the Directive EU 2018/851 into national legislation by adopting the European Union (Waste Directive) Regulations 2020.

With this regulation, the Irish government has introduced the requirement for households to sort the food waste and has made an effort to increase public participation via several awareness and education measures, including on food waste and separate collection. To strengthen these objectives, Ireland made significant updates to its Waste Prevention Programme which is the Irish's primary initiative with regard to developing the circular economy. The Programme funds innovation and demonstration programs, advocates for waste reduction and disseminates ideas to assist national-level, strategic waste prevention and circular economy programs. More specifically, it placed strong emphasis in the implementation of initiatives aiming to promote and support sustainable behavior. For example, to encourage the reuse of products, it is created a network (Community Resources Network Ireland) for reuse and repair organisations in Ireland, representing them in the national and EU policy developments.[62]

Finland

Finland has worked very hard to increase its recycling rate. Nevertheless, despite this development, the nation was identified as one of the Member States that missed the 2020 municipal waste recycling target of 50% in the Commission's "Early Warning report". Finland has several areas that are quite rural and sparsely populated. Due of the low collection volumes and extensive distances between homes, collecting in these regions has not been a top focus. While the expanded producer responsibility programs have been disjointed, door-to-door recycling pickups in more suburban locations have also not been a focus. Uncertainty and a lack of investment have resulted from this.[63]

To comply with the Directive, Finland had to do more to meet recycling targets after 2020. It adopted several acts (e.g.Landscape Act (2018:83) on application of the national waste act 04/12/2018, Landscape Ordinance (2018:92) on producer responsibility,...) with the aim to:

- Set mandatory recycling targets for municipalities and shift responsibilities back to the municipalities, with measures in case of non-compliance
- introduce mandatory minimum service standards on separate collection
- Reduce fragmentation of responsibilities within the EPR schemes and improve their functioning
- Introduce new policy instruments, including economic instruments, to promote prevention, make reuse and recycling more economically attractive. Thus, Finnish government has amended the "Waste Tax Act" by increasing the landfill tax per tonne of waste from 50 €/t to 70 €/t

Romania

Wast management continues to be a major problem for **Romania**, which was designated by the European Commission as one of the Member States furthest away from achieving the 2030 municipal waste recycling target. Romania has also missed waste targets since

2020 and largely ignored the implementation of the EU's roadmap and the key priority actions laid down in 2018 in the Commission's 'Early Warning Report' and the ones from 2019.[54] Romania is unambitious in implementing EU waste Directives and much effort will be need to align the national legislation with European objectives in waste management in order to contribute to the transition to a circular economy.

However, since 2018, some articles of the Directive (EU) 2918/851 were transposed into national law by the "EMERGENCY ORDINANCE no. 92 of August 19, 2021" which completes the general framework for the waste regime and repeals Law no. 211/2011. With this Ordinance, Romania had adopted the bare minimum requirements to comply with the Directive without introducing more substantial targets. Specifically, the Ordinance set new municipal waste recycling targets that have been increased to a minimum of 55% by 2025, a minimum of 60% by 2030 and a minimum of 65% by 2035.[64] The calculation of recycling targets is based on the weight of municipal waste entering recycling operations. For extended producer responsibility programs, minimum operational standards have been established in an effort to save costs, improve performance, and ensure that all operators—including small and medium-sized businesses—play on an even playing field.[64] Furthermore, as required by the EU Directives, an order of preference for waste management (waste hierarchy) is introduced. That hierarchy will be enforced through landfill disposal fees, payment schemes based on the amount of waste generated, extended producer responsibility schemes, facilitation of food donations, incentives for local authorities or other instruments, and other appropriate measures.[64]

In addition, under pressure of European Union, Romania had to formulate a Waste Prevention and Management Plan for accession of the EU structural funds. Anyway, it is implemented with several years of delay probably because of the lack of reliable data at the national level. The programme should aim to establish a global vision and strategic direction in developing effective measures on waste prevention. It introduced quantitative objectives to reduce waste generation and a number of qualitative measures to increase waste awareness. In particular, several initiatives has been adopted to encourage the reuse of products and the setting up of systems promoting repair and reuse activities.

Chapter 5

Discussions

This work has been developed to build a comprehensive list of policies and regulations implemented at both European and national level with a focus on the Circular Economy as part of the Green Deal. This dataset serves as the starting point for my analysis, with the ultimate goal of investigating to what extent member states have been able to incorporate into national laws the key European directives of the Circular Economy Package.

The results of my analysis show that the majority of states in the European Union have implemented laws and regulations at national level to comply with the directives. Countries such as France, Portugal or Luxembourg have fully taken advantage of the potential offered by the Circular Economy directives and have set clearly national paths to accelerate the transition towards an innovation-intensive Circular Economy.

Anyway, as expected, the process of transposition was not carried out uniformly and consistently throughout Europe, as some countries failed to meet the EU's deadline or did not effectively incorporate the EU's requirements into their national laws. This was particularly evident in some eastern European countries, such as Romania, Poland, and Hungary which have demonstrated a lack of ambition in their implementation.

Furthermore, upon closer examination of the measures taken by each country, it was discovered that the majority of member states have met the European directives by implementing hybrid policies. Specifically, the adopted measures were designed by combining the advantages of non-market instruments with the effectiveness of taxes and incentives. In most cases, governments have prescribed environmental standards through command-and-control regulations which are enforced though monitoring the progress made and sanctioning deviations from the standards. These measures are used in conjunction with the market-based instruments which aim at changing consumers' behaviour by economic incentives. With more attention on market-based policies, it appears that governments are relying more heavily on taxes and charges as their primary instruments and in most countries such as France, Portugal and Spain the funds obtained from these taxes or charges are reallocated in activities to promote the growth of eco-innovation.

Another important finding regards the level of policy stringency. From my analysis, it

was discovered that the environmental OECD stringency index for each country is increased over the last ten years as result of more strict measures adopted by the governments. This result aligns with the research carried out by OECD scholars, who found that non-market policy instruments and technology support policies have had the most substantial absolute increase in intensity on average across the OECD index. [11]

Hence, the implementation of environmental policies and regulations plays a crucial role in enabling the emergence of a new wave of investment and technological innovations concerning climate change. Specifically, it is imperative that governments rely on devising a blend of market-based instruments and command-and-control measures to expedite the development of environmental innovation.

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Appendix A

Appendix I: Part of the dataset of policies and regulations collected

COD	Policy name	Policy reference	Instrument	Policy level	Mechanism
EU_3	DIRECTIVE (EU) 2019/904 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the reduction of the impact of certain plastic products on the environment	Directive (UE) 2019/904	EU Commission's strategy/Targets for all MS:	EU	non-market based
IT_3	DECRETO LEGISLATIVO 8 novembre 2021, n. 196	Dlgs. 196/2021	National Regulation	CO	marked-based
IT_3	STRATEGIA PLASTIC-FREE	DGR 2000/2019	Regional Regulation	RE	non-market based
DE_3	Verordnung über die Beschaffenheit und Kennzeichnung von bestimmten Einwegkunststoffprodukten Regulation on quality and labelling Of certain disposable plastic products	EWKKennzV - Einwegkunststoffkennzeichnungsverordnung	National Regulation	CO	non-market based
PT_3	Verordnung über das Verbot des Inverkehrbringens von bestimmten Einwegkunststoffprodukten und von Produkten aus oxo-abbaubarem Kunststoff "Ordinance on the ban on the placing on the market of certain single-use plastic products and products made from oxo-degradable plastic"	Einwegkunststoffverbotsverordnung - EWKVerbotsV	National Regulation	CO	non-market based
	Transpõe a Diretiva (UE) 2019/904, relativa à redução do impacto de determinados produtos de plástico no ambiente, e que altera as regras relativas aos produtos de plástico nos pontos de venda de pão, frutas e legumes	Decreto-Lei n.º 78/2021	National Regulation	CO	market-based

Type_Botta	Category	Perimeter of application	Technology	Created on	Expired on	Last amended	Indicator	Stringency
Regulatory policy (including banning regulation)		certain single-use plastic products, industry sector	no	2/7/2019			1) a 77% separate collection target for plastic bottles by 2025 – increasing to 90% by 2029 2) incorporating 25% of recycled plastic in PET beverage bottles from 2025, and 30% in all plastic beverage bottles from 2030	
taxes and charges applied on input or output of a production process / deposit rules	Regulatory policy	certain single-use plastic products (Il presente decreto si applica ai prodotti in plastica monouso, di cui all'Allegato, ai prodotti in plastica oxo-degradabile, nonche' agli attrezzi da pesca contenenti plastica.)	no	14/1/2022				
Command-and-control regulations	Regulatory policy		no	11/11/2019				3.75
Command-and-control regulations	Regulatory policy	certain single-use plastic products	no	3/7/2021				
Command-and-control regulations	Banning Regulation	certain single-use plastic products	no	3/7/2021				
subsidy for environmentally - friendly activitie	Banning Regulation	certain single-use plastic products	no	1/11/2021			consumption reduction: 1) 80% by 2026 2) 90% by 2030	

Acknowledgements

Ringrazio di cuore la mia relatrice Prof.ssa Elisa Ughetto la quale, con preziosa dedizione, mi ha guidata durante la stesura di questo elaborato.

Un immenso grazie lo dedico anche alle Prof.sse Laura Toschi e Sara Zanni che, insieme alla mia relatrice, sono state fonti di grande conoscenza e indispensabili consigli.

Ringrazio i miei colleghi Caterina, Gatto, Andrea e Peppo, con cui ho collaborato durante la fase di ricerca di questo lavoro, grazie per aver risposto ai miei innumerevoli dubbi e di aver condiviso la mia ansia.

Lavorare con Voi è stato un'immenso piacere che ha contribuito a rendere il mio percorso universitario una sorprendente avventura.