

Cattedra Managerial decision making

The Waste Industry and Its Future: Circular Economy and sustainability. The CONOU Case

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Introduction

Throughout modern history, the management of environmental policy has assumed an increasingly crucial role on the global agenda. The evolution of environmental awareness has led to the recognition that environmental problems cannot be confined in spatial or temporal terms. This awareness has triggered a moral and practical imperative: the duty to protect the environment for future generations, preserving its beauty and integrity.

In this phase of progress, scientific research has intensified, aiming to enhance the measurement and control capabilities of environmental phenomena. This endeavor has been catalyzed by the need to address issues characterized by considerable uncertainty. The result has been a clearer understanding of the mechanisms governing interactions between humans and the environment, accompanied by the development of new technologies for pollution reduction and sustainable management of natural resources.

Environmental policies have had to adopt a cautious approach, especially in the face of situations where the evolution of environmental problems is difficult to predict. This caution has required the definition of long-term strategies to ensure the effectiveness of environmental policies, resulting in the adoption of preventive measures to avoid irreversible damage to the environment.

The aim of this thesis is to explore and analyze the waste sector. Through an analysis of the context

in which it operates, we will seek to understand the economic, social, and environmental importance of this sector. The dimensions of the waste market, key players involved, growth prospects, and the future of this critical sector will be identified.

The future prospects of the waste disposal sector are influenced by a range of key factors, including technological innovation, government regulation, environmental pressures, and market trends. It will be interesting to explore how these variables interact to shape the financial strategies of companies operating in the sector and the impact this will have on both their economic performance and the surrounding environment.

Through an analysis of best financial practices and investment opportunities in the waste disposal sector, this research aims to provide valuable insights to financial stakeholders, including investors, waste management companies, and policymakers. The ultimate goal is to promote more efficient, sustainable, and economically beneficial waste management, in the common interest of society and the environment.

Chapter 1: Regulatory framework and waste

1.1 Definition and classification of waste

The increase of population and human activities in specific areas has placed the problem of waste at the center of economic and legal discussions. This is because waste management and disposal have become increasingly intricate and crucial operations, especially in densely populated areas where space for waste disposal is limited and environmental and health risks are high.

The concentration of population and human activities in certain areas has a major impact on the environment and waste management. Urbanization, intensive manufacturing, intensive agriculture and increasing consumerism have led to increased waste generation, decreasing the environment's ability to manage it through its natural processes of decomposition and maintenance of ecological balance.

This has made waste management an increasingly complex and crucial challenge, requiring effective and sustainable solutions to reduce its negative impact on the environment and human health. As a result, economic and legal disciplines focus on finding integrated approaches to address the problem in a way that minimizes environmental impacts and protects basic goods as life, while adhering to the principles of sustainability and prevention. In the past, waste was considered simply for disposal, but today it is seen as a valuable resource. They are recycled and turned into raw materials for the production of new goods, helping to reduce environmental impact and use of natural resources. (S. MAGLIA, "Waste Management from A to Z," TuttoAmbiente Editions, 2015.)

To understand the world of waste, it is important to understand what is meant by "waste." A definition was first given in Directive 75/442/EEC,16 which conceived of it as "any substance or object falling within the categories set out in Annex I and which the holder discards or intends or is required to discard". Subsequently, this Directive was amended by Directive 91/156/EEC,18 which, in line with the commitments made by the Council of the European Communities in its resolution of May 7, 199019 not only reaffirms the need to promote the recovery of waste, its reuse as a raw material and the use of materials as energy sources, but also innovates, profoundly, the discipline, creating simplified regulations for the management of recyclable waste. It also establishes, as well, a system separate from that of waste destined for landfill or disposal.

The proper management of waste starts with its classification, a fundamental aspect that directs toward the most suitable path to transform it into usable resources. In Italy, classification is based on the European Waste List, which conforms to the European Union's vision and is codified in Annex D of Legislative Decree No. 152/2006.

This decree categorizes waste into various types and establishes guidelines for their management, recovery, and disposal.

Waste can be classified based on its origin, composition, and hazard potential. This classification is fundamental for effective waste management, ensuring that different types of waste are handled appropriately to minimize environmental and health impacts.¹

N°	Туре	Definition
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¹ Municipal waste management in Italy, Antonio Massarutto – University of Udine

1.	Municipal Solid Waste (MSW)	This includes household waste, commercial
		waste, and similar industrial waste. It is
		typically managed by local municipalities and
		is the most visible form of waste to the general
		public.
2	Industrial Waste	Generated by manufacturing and industrial
2.	industrial waste	processes this type of waste can include
		hazardous and non-hazardous materials Proper
		management is crucial to prevent
		environmental contamination and health risks
3	Hazardous Waste	This category includes waste that poses
		significant risks to health or the environment
		due to its toxic, corrosive, flammable, or
		reactive properties. Strict regulations govern
		the handling, treatment, and disposal of
		hazardous waste to mitigate these risks.
4.	Construction and Demolition	4. Arising from construction, renovation, and
	Waste (C&D)	demolition activities, this waste type includes
		materials like concrete, wood, metals, and
		glass. Effective management and recycling of
		C&D waste can significantly reduce landfill
		usage and promote resource recovery.
5.	Organic Waste	Comprising food waste, garden waste, and
		other biodegradable materials, organic waste is
		a significant component of municipal waste.
		Composting and anaerobic digestion are
		common methods for recycling organic waste,

	converting	it	into	valuable	products	like
	compost and biogas.					

In the annex, it is specified that each type of waste is defined through a six-digit code, while the corresponding chapters are identified by four- and two-digit codes. This coding system allows for the precise and unique identification of each type of waste, thus facilitating the management process and enabling accurate monitoring of waste generation and disposal. In essence, the European Waste List is an essential tool for effective waste management, enabling competent authorities to take appropriate measures to address waste management and reduction challenges.

This classification is used to facilitate the management and transportation of waste in accordance with European regulations.

Article 184 of Legislative Decree 152/2006 classifies waste according to its origin into municipal or special and, according to its hazardous characteristics, as hazardous and non- hazardous. Previously, there was an intermediate category of special waste that could be assimilated with municipal waste. However, as of January 1, 2021, the category of special waste assimilated to municipal waste was eliminated.

"Municipal wastes" are those wastes that, even if bulky, originate from dwellings; "household wastes"; wastes of any nature or origin lying on public or private roads, on maritime or lacunar beaches or on the banks of watercourses; vegetable wastes from exhumations and extumulations; and other wastes from cemetery activities.²

The "SaveMare" Law47, in force since June 25, 2022, added to the above list of urban waste "waste accidentally fished or voluntarily collected, including through cleaning campaigns, at sea, in lakes, rivers and lagoons. "48 In addition, the same law places the aforementioned incidentally fished or voluntarily collected waste on the same level as waste from ships, pursuant to Directive 2019/883/EU49 (implemented by Legislative Decree 197/2021).

Wastes classified as "special" derive from a wide range of specific activities, such as agriculture, agro-industry, forestry, fishing, construction and demolition, industrial, handicraft, commercial and service processing, waste recovery and disposal, water purification and treatment, sanitary activities,

² The municipal waste management sector in Europe: shifting boundaries between public service and the market by Barbara Antonioli and Antonio Massarutto. University of Udine, italy-2012

as well as deteriorated and obsolete machinery and equipment, discarded motor vehicles, trailers and similar vehicles and their parts. These wastes are distinguished from municipal waste by their characteristics and management methods that require specific procedures.

The difference between hazardous and non-hazardous wastes is based primarily on the presence or absence of substances harmful to the environment or human health. Hazardous waste presents an immediate or long-term risk to human, animal, and plant health and includes toxic, harmful, irritating, flammable, corrosive, carcinogenic, or explosive substances, mainly of industrial origin.

The classification of hazardous waste is divided into municipal hazardous waste and special hazardous waste. The former include civilian-use wastes with a high concentration of hazardous substances, such as expired medicines and batteries, while the latter derive from production activities with a significant presence of pollutants, such as petroleum refining, chemical processes and solvents, and waste oils. It is essential to take measures to neutralize or treat these wastes to reduce their level of hazardousness.

As of June 1, 2015, EU Regulation 1357/2014 came into force, establishing new rules for classifying waste as hazardous. This regulation, which is primary in nature, is binding on all EU member states, including Italy, and defines the hazardous properties of waste and how to identify them. This aims to ensure safety for human health and the environment throughout the European Union by requiring hazardous waste to be identified according to the properties specified in the regulation.³

1.2. Global economic and environmental importance of the waste sector

Waste management is a global issue that affects all countries in the world. Waste generation rates are increasing rapidly due to population growth and increasing consumption. One of the most most important for their management is the adoption of a systems approach that considers all aspects of the waste life cycle, from generation to management final. This includes the prevention of waste generation through reduction, recycling and reuse, as well as the management of residual waste through methods sustainable methods such as controlled incineration or landfilling.

The circular economy is an increasingly popular global perspective for waste management, which aims to transform waste into resources and create an economic system in which there is no end-oflife for materials. Also important is the promotion of environmental sustainability, international

³ The municipal waste management sector in Europe: shifting boundaries between public service and the market by Barbara Antonioli and Antonio Massarutto. University of Udine, italy-2012

cooperation and active citizen participation to achieve sustainable waste management goals. In general, important progress is being made but there is still much work to be done to improve its management practices and reduce its negative environmental impact. In response to environmental needs, it was drafted by UNEP (United Nations Environment Program) and the International Waste Management Association (IWMA) following the Rio+20 summit, a reference document for the analysis of the current situation of waste management globally: the Global Waste Management Outlook (GWMO)⁴.

The document has been developed with the aim of providing an assessment scientific and comprehensive view of the state of waste management. It represents a call to action for the international community to address the global challenges related to their management and to promote a more sustainable society. The GWMO was developed to provide an overview of waste management around the the world, how it has evolved over time, what is the current state and what will be the future one. The GWMO considers waste management essential to ensure public health and environmental protection once it has been generated and, in a context broader context of "waste and resource management," recognizes the importance of assessing the entire life cycle of materials and products in order to prevent and reduce the waste generation.

The Outlook aims to provide the rationale and tools for taking a holistic approach toward their management and to recognize waste and resource management as a significant contribution to sustainable development and mitigation of climate change.

Among the general objectives, some specific objectives have been defined that deserve special attention.

One of the main objectives is to position waste management as a critical area requiring urgent action. It is critical that policy makers be urged to take immediate actions and decisions to address waste management challenges.

Furthermore, it is important to expand the traditional concept of "waste management" toward a more integrated "waste and resource management" approach. This new approach not only includes waste prevention and minimization, but also aspects of resource efficiency and sustainable consumption and production (SCP) practices.⁵

⁴ www.unep.org, Il Global Waste Management Outlook.

⁵ www.unep.it, Il Global Waste Management Outlook

Another crucial objective is to demonstrate the link between waste and resource management and other global challenges, such as sustainable development, balance and security of water and energy resources, safe management of chemicals, climate change, food security, resource scarcity, and poverty alleviation. These linkages are essential to understanding the importance of integrated waste management in the context of major global challenges.

Establishing linkages to broader health and environmental policy challenges is another important goal. Recognizing how waste management affects and is affected by these sectors is critical to developing effective and holistic policies.

It is essential to conduct a comprehensive analysis of the costs and revenues associated with waste management. This includes not only operational and maintenance costs, but also potential revenues from material recovery and recycling. In addition, it is crucial to consider the costs of inaction, that is, the future expenses and environmental damage that would result from inadequate waste management. In parallel, the indirect benefits of environmentally sustainable waste management, such as improving public health, conserving natural resources, and reducing greenhouse gas emissions, should be evaluated.

Explore methods to generate sufficient revenue to cover the net costs of service provision and finance necessary investments.

Various strategies need to be examined and implemented to ensure that waste management is financially sustainable. This could include introducing fees for waste management services, adopting payment systems based on the amount of waste generated, accessing government subsidies, and attracting private investment through public-private partnerships. In addition, incentive policies that can stimulate virtuous behavior among citizens and businesses, such as discounts for those who recycle or for those who reduce the amount of waste generated, should be evaluated. These approaches aim to cover the operational and capital costs required for efficient and sustainable waste management.

Finally, it assembles a set of standardized performance indicators on waste management that enable benchmarking exercises and facilitate better analysis of the state of waste management around the world while also providing a standardized means of monitoring progress.

Diffuse experience around the world has shown that solving society's waste management challenges requires both technical (the physical infrastructure) as well as governance and financial aspects.

The 2030 Agenda⁶ for Sustainable Development is a global program of action signed in September

⁶ www.unric.org, Goals for sustainable development

2015 by the governments of the 193 member countries of the UN220. It consists of 17 Sustainable Development Goals (SDGs) and 169 associated targets, which are interconnected and indivisible. The countries that have joined have committed to achieving, by 2030, very challenging common goals on the many issues that are relevant to the pursuit of development conceived in a new way, by virtue of the inclusion of issues such as fighting poverty, eliminating hunger, combating climate change, and reducing inequality among countries. The 2030 Agenda represents a global commitment, and individual countries have an obligation to define their own sustainable development strategy for achieving the SDGs. Countries have voluntarily submitted to the monitoring process carried out by the United Nations with respect to the status of implementation of the SDGs, and the High Level Political Forum (HLPF)⁷meets annually under the auspices of the UN Economic and Social Committee (ECOSOC)⁸ to monitor it. Every four years, the meeting is also held under the supervision of the General Assembly (GA).

The 2030 Agenda aims to lead the world towards a sustainable path, without discrimination between developed, emerging and developing countries, and to ensure that no one is excluded or left behind in the process to achieve these goals. The main goal of this Agenda is to eradicate poverty in all its forms by promoting the well-being of people, the planet and prosperity, leading the world on the path to sustainability and resilience.

The 17 Sustainable Development Goals and the 169 associated targets that have been set demonstrate the scope and ambition of this new Universal Agenda, which builds on the successes and limitations of the Millennium Development Goals⁹. The goal is to fully guarantee the human rights of all, promote gender equality and the empowerment of women, and foster sustainable and equitable growth that takes into account the three dimensions of sustainable development: economic, social and environmental.

⁷ The High Level Political Forum (HLPF) is an intergovernmental body of the United Nations (UN) that is responsible for reviewing and monitoring the 2030 Agenda for Sustainable Development. The HLPF was established in 2012 by the United Nations Conference on Sustainable Development (Rio+20) as the body responsible for the periodic review of the implementation of the Agenda 2030. The HLPF meets annually at the UN headquarters in New York. During the session, the HLPF reviews the status of the implementation of the 2030 Agenda and the 17 related Sustainable Development Goals (SDGs). Specifically, the HLPF assesses progress made, challenges encountered, and actions needed to achieve the SDGs by 2030. The HLPF also plays a role in coordinating and facilitating collaboration among the various actors involved in the implementation of the 2030 Agenda. It also promotes the sharing of best practices, knowledge and experiences among countries and organizations.

⁸ The European Economic and Social Committee (EESC), also known as the Economic and Social Committee (ECOSOC) internationally, is a consultative body of the European Union (EU) representing civil society organizations, trade unions and entrepreneurs, and serves as a bridge between European citizens and EU institutions.

⁹ The Millennium Development Goals (MDGs) are eight global goals established by the United Nations in 2000 with the aim of addressing the challenges of the developing world. They were agreed upon by all member countries of the United Nations and represent a road map for addressing the most pressing social, economic and environmental problems.

This is a momentous and far-sighted strategic choice that demonstrates a step change in the role of institutions, national and supranational, but which will inevitably have to be subjected to scrutiny of the results achieved in the set deadlines.

The new Agenda for Sustainable Development was created following the basic principles of the United Nations Charter¹⁰ and respecting international law. It was based on the Universal Declaration of Human Rights¹¹, international human rights treaties, the Millennium Declaration, and the outcomes of the 2005 World Summit¹². In addition, it is based on other international instruments, such as the Declaration of the Right to Development.

The Sustainable Development Goals and targets are global in nature and universally applicable, but take into account different national realities, capacities and levels of development while taking into account the specific policies and priorities of each state. Each government has the freedom to determine its own national goals, taking into account the global level of ambition, but also considering the specific circumstances of its own country. Each government may, in addition, decide how these goals should be incorporated into national planning processes, policies and strategies. ¹³

Within the SDGs of the 2030 Agenda, the one of most interest here to examine is Goal 12, which aims to "Ensure sustainable consumption and production patterns." This is a commitment that UN member states have made in order to promote environmental sustainability, reduce waste and improve resource efficiency. In a world where the world's population continues to grow and pressure on the environment increases, achieving this goal is of paramount importance. Member states should implement policies and concrete measures to promote sustainable consumption and production, sustainable waste management, reduction of food waste, and adoption of environmentally sound production and consumption practices.

¹⁰ The Charter of the United Nations is the fundamental document of the United Nations (UN) that establishes the international organization and defines its purpose, principles and operation. The Charter of the United Nations was adopted on June 26, 1945 at the United Nations Conference on International Organization, held in San Francisco, and subsequently ratified by the countries members of the United Nations.

¹¹ The Universal Declaration of Human Rights (UDHR) is an important text adopted by the United Nations United Nations that affirms the essential rights and fundamental freedoms of every individual, without discrimination based on race, color, gender, language, religion, political opinion or other similar criteria. The Declaration was adopted by the United Nations General Assembly on December 10, 1948.

¹² The 2005 World Summit refers to the United Nations Summit held in New York from September 14 to September 16, 2005, also known as "World Summit 2005" or "Millennium +5 Summit." The summit was held on the occasion of the 60th anniversary of the United Nations and brought together world leaders to discuss on how to strengthen the United Nations system and advance progress toward achieving the Millennium Development Goals (MDGs).

¹³ Resolution adopted by the General Assembly on September 25, 2015. [without reference to a Main Commission (A/70/L.I)]

1.3 Legal and regulatory framework in Italy and Europe

Waste, often referred to as rubbish, trash, or garbage, encompasses materials that are discarded or no longer considered useful. The concept of waste is crucial in environmental management, particularly concerning the principles of sustainability and circular economy. This detailed overview delves into the definition and classification of waste, emphasizing regulatory frameworks and their implications. The definition of waste varies across different legal frameworks and contexts. Generally, waste is any substance or object that its holder discards, intends to discard, or is required to discard. This broad definition is essential for understanding how waste management policies are crafted and implemented.

The European Union (EU) provides a comprehensive definition of waste under the Waste Framework Directive 2008/98/EC. According to this directive, waste is "any substance or object which the holder discards or intends or is required to discard". This definition is crucial for harmonizing waste management practices across EU member states and ensuring a unified approach to environmental protection.

Understanding the definition and classification of waste is fundamental for effective waste management and environmental protection. By adhering to regulatory frameworks and promoting sustainable practices, societies can mitigate the negative impacts of waste, conserve resources, and move towards a more sustainable future. This comprehensive approach ensures that waste management contributes positively to economic, environmental, and social well-being.

The waste sector holds significant economic and environmental importance, increasingly recognized within the framework of sustainable development and the circular economy.

This comprehensive analysis highlights the waste sector's multiple roles in promoting economic growth, creating jobs, conserving resources and protecting the environment, gaining insights from the report "Recycling in Italy 2023".

The economic impact of the waste sector is profound, particularly through resource recovery and recycling processes. By transforming waste materials into valuable resources, recycling reduces the need for virgin materials, which in turn lowers production costs and mitigates the environmental impact of resource extraction. For instance, recycling metals like aluminium and steel is highly energy-efficient; recycling aluminium saves up to 95% of the energy required to produce it from raw

bauxite, while recycling steel conserves up to 60% of energy compared to new production. Similarly, paper recycling reduces the demand for virgin wood pulp, conserving forests and reducing the environmental impacts associated with deforestation and wood processing, while also consuming significantly less water and energy than producing new paper from wood pulp.¹⁴

The waste management and recycling sector is also a substantial source of employment, encompassing activities such as collection, sorting, processing, and manufacturing recycled products. These activities generate jobs at various skill levels, supporting local economies and providing livelihoods. For example, according to the "Recycling in Italy 2023" report, the recycling industry employs thousands of individuals across Italy. Recycling facilities that process construction and demolition waste typically employ more workers per plant than traditional quarry operations. The sector contributes significantly to the national economy, with the recycling and recovery of packaging waste alone generating economic benefits exceeding 3 billion euros in 2022. The value of recovered materials and energy from waste substantially offsets the costs associated with waste management.¹⁵ Market competitiveness and innovation are also driven by the waste sector, which fosters advancements in recycling technologies and materials recovery processes. As industries and governments push for higher recycling rates and more efficient waste management systems, the sector continues to evolve, offering new business opportunities and technological advancements. Innovations in recycling technologies, such as chemical recycling of plastics, are essential for achieving higher recycling rates and meeting future targets. Italy's commitment to a circular economy is evident in its national strategies and regulations, aiming to close the loop by keeping materials in use for as long as possible. This approach not only conserves resources but also stimulates economic growth by creating new markets for recycled products and materials.

Environmentally, effective waste management and recycling significantly reduce pollution by minimizing the amount of waste sent to landfills and incinerators, preventing hazardous substances from contaminating soil, water, and air. This protects ecosystems and human health. Recycling and waste recovery divert substantial amounts of waste from landfills, reducing methane emissions—a potent greenhouse gas generated from decomposing organic waste in landfills. This diversion is crucial for mitigating climate change and achieving national and international environmental targets. Recycling efforts, particularly for plastics, are vital in combating marine pollution by ensuring that

¹⁴ Sustainable Development Foundation. "Recycling in Italy 2023" Report.

¹⁵ Municipal waste management in Italy, Antonio Massarutto – University of Udine

plastic waste is collected and recycled, thus preventing plastics from entering oceans and harming marine life.

Recycling conserves natural resources by reducing the need for virgin materials, which is crucial for non-renewable resources, often involving environmentally damaging extraction processes. In 2022, recycling efforts in Italy saved approximately 11.8 million tons of virgin materials, significantly reducing the environmental footprint associated with resource extraction and processing. This conservation helps preserve natural habitats and reduce the ecological impact of industrial activities. Moreover, recycling processes generally consume less energy than producing new products from raw materials, translating into lower greenhouse gas emissions and reduced reliance on fossil fuels. The recycling of materials in Italy in 2022 resulted in substantial greenhouse gas emission reductions, valued at around 609 million euros in avoided emissions costs, highlighting the environmental and economic benefits of a robust recycling system. Waste-to-energy processes contribute to the generation of renewable energy, further reducing dependence on fossil fuels and enhancing energy security, aligning with broader sustainability objectives and supporting the transition to a low-carbon economy.¹⁶

The importance of the waste sector is further emphasized by the comprehensive policy and regulatory framework governing waste management in Italy. National strategies, such as the National Strategy for the Circular Economy and the National Waste Management Program, prioritize waste reduction, resource recovery, and environmental protection. Italy's legislative framework supports the waste sector through various policies and incentives aimed at promoting recycling and reducing waste generation, including economic instruments, regulatory measures, and initiatives to foster technological innovation and market development for recycled products. Compliance with European Union directives, such as the Waste Framework Directive and the Circular Economy Package, ensures that Italy aligns its waste management practices with broader EU sustainability goals, setting ambitious targets for recycling rates and waste reduction, driving continuous improvement in the sector.

The waste sector's economic and environmental importance cannot be overstated. It plays a critical role in resource conservation, pollution reduction, and climate change mitigation, while simultaneously driving economic growth and job creation. Italy's commitment to a circular economy, supported by robust policies and innovative technologies, exemplifies the potential of the waste sector to contribute to sustainable development. By continuing to invest in and prioritize effective waste

¹⁶ Sustainable Development Foundation. "Recycling in Italy 2023" Report.

management and recycling practices, Italy can achieve significant economic and environmental benefits, paving the way for a more sustainable future.¹⁷

The regulatory and legislative framework surrounding the waste sector in Italy is both comprehensive and dynamic, reflecting the country's commitment to addressing waste management challenges in alignment with European Union directives. This framework aims to enhance sustainability, promote recycling, and ensure environmentally responsible waste handling practices.

At the core of Italy's waste regulatory environment is the adoption and implementation of the Circular Economy Package, which was transposed into national law through Legislative Decree No. 116/2020. This decree significantly updated the waste management landscape by setting stringent targets and requirements for waste separation, recycling, and recovery. One of the key provisions mandates that biodegradable waste must be separately collected and sent for industrial composting, anaerobic digestion, or home composting by December 31, 2021. This initiative underscores the importance of segregating organic waste to facilitate its efficient processing and recycling.

Further strengthening the legislative framework, the decree stipulates that from 2027 onwards, only organic waste derived from separate collection can be included in recycling calculations. This move is intended to enhance the purity and quality of recyclable organic waste streams, thereby improving the overall efficiency and effectiveness of recycling processes. Moreover, Italy has set ambitious targets for municipal solid waste recycling: a 55% recycling rate by 2025, 60% by 2030, and a 65% rate by 2035.¹⁸ Achieving these targets requires a substantial overhaul of waste management practices, focusing not only on maximizing separate collection rates but also on improving the quality of collected materials and the performance of treatment facilities.

Italy's regulatory framework also addresses the issue of non-biodegradable and non-compostable plastics, which pose significant challenges to organic waste recycling. The presence of traditional plastics in organic waste streams is estimated to be around 128,000 tons per year, and efforts are being made to reduce this contamination to enhance recycling outcomes.

In addition to these measures, the Italian government has leveraged European Union funds allocated for post-pandemic recovery to support the development of waste management infrastructure. The National Waste Management Program (PNGR), approved in June 2022, is a key initiative funded by the National Recovery and Resilience Plan (PNRR). This program aims to modernize and expand

¹⁷ Municipal waste management in Italy, Antonio Massarutto – University of Udine

¹⁸ Sustainable Development Foundation. "Recycling in Italy 2023" Report.

waste treatment facilities, thereby supporting the country's transition towards a circular economy. The regulatory landscape for construction and demolition (C&D) waste is another critical area. C&D waste is the largest stream of special waste in Italy, accounting for a significant portion of the total waste generated. The European Union's Waste Framework Directive 2008/98 and its subsequent amendments set a 70% target for the preparation for reuse, recycling, and other recovery operations for C&D waste by 2020. This directive emphasizes the importance of recycling and reusing materials to reduce the environmental impact of construction activities.¹⁹

The regulatory framework for packaging waste is equally rigorous. The European Commission's proposal to make all packaging recyclable by 2030 is a significant step towards reducing the environmental footprint of packaging materials. This proposal includes measures to harmonize recycling information, reduce the use of primary natural resources, and increase the use of recycled plastics in packaging. Additionally, there are specific targets for recycled content in plastic packaging, and the proposal seeks to ban certain single-use packaging items to further drive sustainability in the sector.

Cross-border waste shipments are also tightly regulated to prevent environmental degradation and ensure that waste exports do not circumvent EU environmental standards. Proposed amendments to existing regulations aim to facilitate the shipment of waste for reuse and recycling within the EU while cracking down on illegal waste shipments and ensuring that waste management practices outside the EU adhere to strict environmental standards.

The regulatory framework also extends to end-of-waste criteria, which determine when certain waste materials cease to be considered waste and can be reclassified as secondary raw materials. This is crucial for fostering a market for recycled materials and supporting the circular economy. The Italian government has been proactive in establishing national end-of-waste criteria for various waste streams, in line with European guidelines.

Thus, the regulatory and legislative framework governing the waste sector in Italy is robust and multifaceted, encompassing a wide range of measures aimed at promoting recycling, reducing waste generation, and ensuring environmentally sound waste management practices. These regulations are designed to align with broader European Union objectives and are supported by significant investments in infrastructure and innovation to drive the transition towards a more sustainable and circular economy.

¹⁹ The municipal waste management sector in Europe: shifting boundaries between public service and the market by Barbara Antonioli and Antonio Massarutto. University of Udine, italy-2012

The "Recycling in Italy 2023" report underscores the importance of a well-defined and effectively managed waste sector. Proper classification of waste, coupled with robust economic and environmental policies, is essential for achieving sustainability goals. The regulatory framework, supported by national and European legislation, plays a pivotal role in promoting recycling, reducing environmental impacts, and driving economic growth. Addressing implementation challenges and enhancing technological and market capabilities are critical for the continued success and improvement of Italy's waste management sector.²⁰

Chapter 2: Analysis of the waste market in Italy

2.1 Market size and growth trends

The analysis of the waste market in Italy is essential for understanding the dynamics that regulate one of the key sectors for the country's environmental sustainability and economic development. This market reflects the complexity of the challenges associated with urban and industrial waste management, highlighting the need for innovative and sustainable solutions. In recent years, the sector has seen significant changes, influenced by economic, regulatory and social factors. Separate collection and reduced reliance on landfills have become primary goals, supported by national and European policies and programs. However, structural critical issues, such as the plant deficit in some

²⁰ Sustainable Development Foundation. "Recycling in Italy 2023" Report.

regions, remain, requiring targeted interventions to improve the efficiency and effectiveness of the waste management system. The National Recovery and Resilience Plan (PNRR) offers new opportunities to invest in infrastructure and advanced technologies, promoting a circular approach to waste management. This analysis aims to provide a general overview of the waste market in Italy, identifying the main trends, challenges and opportunities for the future.²¹

The crisis triggered by the COVID-19 pandemic has had a significant impact on municipal waste generation in Italy, with a decline of about 1 million tons in 2020 compared to 2019. However, data from Ispra's Urban Waste Report 2022 indicate that the return of commuting and tourism in 2021 triggered a new increase in municipal waste generation. However, this growth was lower than the increase in GDP and household consumption over the same period.

Separate waste collection also continued to grow, reaching a national average of 64 percent in 2021. Despite progress over the past decade, which has seen a 52 percent reduction in the use of landfill, there is an urgent need to further halve this form of disposal. Currently, nearly 5.6 million tons of municipal waste, or 19 percent of the total, still ends up in landfills.²²

Europe is particularly paying attention to packaging and packaging waste. With the application of the new calculation methodologies, Italy has already almost reached the targets set for 2025 for all packaging fractions except plastics.²³

The overcoming of the pandemic and economic crisis has led to an increase in municipal waste generation in Italy. In 2021, each inhabitant produced an average of 502 kg of waste, marking a 3 percent increase over the previous year. However, this increase is smaller than GDP growth, which rose by 6.7 percent, and household consumption, which increased by 5.3 percent. Separate waste collection also saw an improvement, reaching 64 percent of total waste generation, with 272 kg of waste sorted per inhabitant.²⁴

However, the data analysis clearly shows that it is necessary to accelerate the improvement of the municipal waste management system, especially in the Central and South, in order to meet the EU targets. As of 2019, the percentage of waste prepared for reuse and recycling is stuck at 48 percent, while 19 percent of municipal waste still ends up in landfills in 2021. To meet these challenges, it is essential to improve the quality of separate collection and invest in new facilities, making the waste management system more efficient and sustainable.

²¹ Utilitatis Fondazione, dati sulla gestione dei rifiuti urbani in Italia. Green Book 2023.

²² Ispra's Urban Waste Report 2022

²³ Ispra's Urban Waste Report 2022

²⁴ Ispra's Urban Waste Report 2022

The process of implementing local governance models required by legislation in several regions is still incomplete. On the management front, especially in the Center-South, the sector is characterized by strong fragmentation both horizontally, due to the large number of operators active in municipal territories, and vertically, within the integrated waste cycle. At the national level, waste management is mainly public (40 %), while in the South private operators prevail (48 %).²⁵

In 2021, the turnover of the waste sector, considering a sample of 534 companies, reached about 13.5 billion euros, accounting for about 0.8 percent of the national GDP. The sector employs more than 97,000 direct workers, accounting for 0.4 percent of total employment in Italy and about 1.7 percent of employment in the industrial sector. Companies that operate plants achieve the best economic performance, as confirmed by the value added per employee (150 thousand euros per employee). In contrast, companies involved in collection management or the integrated cycle record a lower level of productivity (80 thousand and 109 thousand euros per employee, respectively). In addition, companies with a turnover of more than 100 million euros achieve the best economic-financial performance.

These data underscore the importance of consolidating and improving local governance, especially in the South Central regions, to reduce fragmentation and increase the efficiency of the waste management system. Only through greater integration and targeted investment will it be possible to achieve a more sustainable and effective waste management system capable of meeting future needs and achieving community goals.²⁶

Southern Italy continues to have a significant plant deficit, which hinders the proper closure of the waste cycle and contributes to the urban sanitation service spending differential. This deficit imposes additional costs for transporting waste to plants located outside the region, resulting in a higher Tari than the rest of the country: in 2022, the South recorded an average Tari of 368 euros, compared to 335 euros in the Center and 276 euros in the North. However, the NRP, with 60 percent of the resources allocated to southern regions, could offer an opportunity to close this service gap.

With 2.1 billion euros allocated, the PNRR has given a major boost to investment in the environmental sector, particularly in southern Italy. The response from businesses has been significant, with the volume of candidate projects amounting to approximately 7 billion euros. The estimated need for the sector to 2035 is about €6-7 billion, or €0.5-0.6 billion per year.²⁷

²⁵ Utilitatis Fondazione, dati sulla gestione dei rifiuti urbani in Italia. Green Book 2023.

²⁶ Utilitatis Fondazione, dati sulla gestione dei rifiuti urbani in Italia. Green Book 2023.

²⁷ Utilitatis Fondazione, dati sulla gestione dei rifiuti urbani in Italia. Green Book 2023.

The pandemic and geopolitical crises have highlighted the vulnerability of strategic raw material supply chains that are critical to the energy and ecological transition. For this reason, it is crucial to develop a sustainable supply plan that integrates primary extraction with raw material recycling. The proper recycling of RAEE, with about 360 thousand tons collected in 2021, represents an opportunity to reduce dependence on third countries. However, to achieve this goal it is necessary to implement adequate infrastructure, improve the collection of technological products, and streamline permitting procedures for the construction of facilities.²⁸

The organic fraction constitutes about 40 percent of the municipal waste generated, and its proper management is essential to achieving community goals and protecting the environment. In recent years, there has been an increase in the quantities treated in all areas of the country, with integrated anaerobic/aerobic treatment and composting as the predominant methods. Overall, at the national level, about 1.3 million tons of organic waste are treated in plants in regions other than those of production, accounting for about 18 percent of the organic waste derived from separate collection. Estimated plant requirements to 2035 for the treatment of this fraction show the self-sufficiency of some areas of the country, such as Sardinia and the North, while the Center, the southern peninsular and Sicily will continue to have a significant deficit.²⁹

The obligation to separate collection of textile waste will lead to an increase in this fraction, partly from the fast fashion industry, which will need to be properly managed. Currently, 72 percent of Italian municipalities collect textiles separately, with a total of about 154 thousand tons collected by 2021. Investment in new sorting and recycling technologies is needed to ensure that circularity targets are met. The introduction of an Extended Producer Responsibility (EPR) model in this supply chain could generate environmental, social and economic benefits on a European scale, with savings of 4.0-4.3 million tons of CO2 emissions, the creation of more than 15 thousand new jobs and a turnover of between 1.5 and 2.2 billion euros.³⁰

The waste market in Italy is undergoing a phase of significant transformation, driven by structural reforms and massive public investment promoted by the National Recovery and Resilience Plan (PNRR). Approved in 2021, the PNRR allocates more than 200 billion in European funds for public investment in Italy until 2026. Within the Green Revolution and Ecological Transition Mission, $\in 2.1$

²⁸ Ispra's Urban Waste Report 2022

²⁹ Ispra's Urban Waste Report 2022

³⁰ Utilitatis Fondazione, dati sulla gestione dei rifiuti urbani in Italia. Green Book 2023.

billion is specifically earmarked for waste management. This sum is divided into 1.5 billion for public entities, with interventions aimed at improving separate collections, waste treatment and recycling, and the construction of facilities for special waste such as absorbents, sludge, and textiles. An additional 600 million is allocated to "flagship projects" for the treatment of e-waste, paper and cardboard, plastics and textiles. The National Waste Management Program (PNGR), approved in 2022, codifies the state's directions for efficient waste management, while the National Strategy for the Circular Economy (Snec) aims to support these directions through a reform program geared toward promoting sustainability and innovation in the sector. These interventions aim not only to improve waste management and recycling, but also to stimulate the growth of a circular economy, reducing environmental impacts and creating new economic opportunities.³¹

Valori in milioni di euro



Fonte: elaborazioni Laboratorio REF Ricerche su dati e informazioni Pnrr, Mase

The 1.5 billion earmarked for public agencies is spread over 991 interventions: these are collection centers or ecological islands and equipment dedicated to them, the purchase of bins and dumpsters, and the mechanization of separate collections. A myriad of small interventions designed to make a contribution to separate collections, with no real innovation content of the models in use. The problem with separate collections today is that of their progressive deterioration in quality: the gap between collection and recycling rates is widening, causing rising costs for waste disposal. The planned

³¹ Laboratorio REF Ricerche su dati e informazioni Pnrr, Mase

interventions do not offer answers to the issue: we need to raise awareness and introduce pricing models that support the quality of collections and not only, as is the case today, the reduction of undifferentiated waste.³²

In the instance of organic waste treatment plants, the territorial distribution of funds is then peculiar: regions with surplus treatment capacity, such as Lombardy or Veneto, receive more resources than deficit regions, such as Lazio or Campania. As for textiles, public initiatives do not seem to have grasped the needs of the sector, most likely due to the strong uncertainty that still reigns on the subject of rules. The attention received by the treatment of sewage sludge, a waste with clear opportunities for material and energy recovery, should be emphasized, but due to regulatory uncertainties and regulations that vary from region to region, it pays for a treatment deficit and difficulties in finding alternatives to spreading on fields, which is why landfilling is still often used.

The 600 million earmarked for private initiatives is another critical point in the plan. The allocation for private initiatives for textile and apparel waste appears particularly low, receiving only 60.6 million, compared to the 150 million originally planned. The low figure would seem to imply less need than for other supply chains. The reality, however, is different: the slow start of separate collections and the lack of an obligation on manufacturers to cover end-of-life costs, with the corollary of the high costs of disposing of recycling waste itself, are all conducive to the low interest.³³

Of those projects submitted with a specific theme, those with the highest funding concern so-called critical raw materials contained in waste from electrical and electronic equipment. Again, doubts arise about their effective implementation. Separate collections of this waste are still underdeveloped: they intercept only 35 percent of what is sold. Even the obligation to take back old devices when we buy a new one has never lifted off, unknown to most consumers: if collections do not grow, we then lack the critical mass to justify facilities.³⁴

Part of the funding is allocated to circular districts for the recovery of paper and cardboard waste. Unirima, the association of paper recyclers, has documented in its periodic reports the presence of more than 700 facilities spread throughout the country. This coverage is largely sufficient to meet both current and future needs. However, it remains uncertain how the new initiatives fit in with existing ones: do they meet a real need or do they risk overlapping with existing services, creating

³² Laboratorio REF Ricerche su dati e informazioni Pnrr, Mase

³³ https://lavoce.info/archives/103936/il-pnrr-dei-rifiuti-in-cerca-di-una-strategia/

³⁴ https://lavoce.info/archives/103936/il-pnrr-dei-rifiuti-in-cerca-di-una-strategia/

potential distortions in the market?³⁵

Chemical recycling of plastic waste received 100.3 million euros in funding, while mechanical recycling processes received less than a quarter. Chemical recycling can be an answer for plastics that cannot be mechanically recycled, are very degraded or of low quality. However, it should be remembered that mechanical recycling is currently the best solution for plastics from an economic and environmental point of view, while chemical recycling is still an experimental technology that needs to find an appropriate scale, will struggle to stay in the market, and needs targeted regulatory interventions.

Pnrr represents an unprecedented opportunity to reform the waste management sector in Italy, but to achieve concrete and lasting results it will be essential to address existing critical issues, improve the quality of separate collections, and promote innovative and sustainable models. Raising public awareness and actively involving the private sector will be crucial steps to achieve a true green revolution and an effective ecological transition.³⁶

³⁵ Unirima

³⁶ Laboratorio REF Ricerche su dati e informazioni Pnrr, Mase

2.2 Market structure and competitive dynamics of waste in Italy

The waste market in Italy, which includes both municipal waste (RU) and special waste (RS), is a dynamic and strategic sector for the circular economy and environmental sustainability. This market includes various segments of activities: collection, transportation, treatment, recycling, and disposal of waste generated by households, industries, and commercial activities. In 2021, Italy handled a considerable flow of municipal and special waste, exporting about 4.6 million tons and importing about 7.6 million tons. Of these, special waste accounted for the majority, with municipal waste making up only a small percentage of both exports (14.4 %) and imports (2.9 %).

Exports were dominated by non-hazardous waste, which accounted for 71.6 percent of the total exported, or about 3.3 million tons, while hazardous waste made up the remaining 28.4 percent, about 1.3 million tons. Lombardy was the Italian region that exported the largest amount of waste, with more than 1.2 million tons, accounting for 26.9 percent of the total.

Germany was the main recipient country of Italian exports, receiving 873 thousand tons of waste, accounting for 19.1 percent of the total. Among the exported waste, a significant part was waste from the mechanical treatment of waste, accounting for 65.7% of the total, including about 610 thousand tons of "Waste produced by waste treatment" (EER 191212)³⁷ and 472 thousand tons of "Plastic and rubber" (EER 191204)³⁸.

In terms of imports, the vast majority of waste (98.7%) was non-hazardous waste, amounting to about

³⁷ Elenco Europeo dei Rifiuti 191212

³⁸ Elenco Europeo dei Rifiuti 191204

7.5 million tons, while the remaining 1.3% (about 100 thousand tons) was hazardous in nature. Again, Lombardy stood out as the Italian region that imported the largest amount of waste, with more than 3.7 million tons, accounting for 49.1 percent of the national total.

Germany was the main country of origin of waste imported into Italy, sending 2 million tons of it, accounting for 26.5 percent of the total imported. The imported waste was mainly composed of "Waste produced by mechanical treatment" of waste, with about 3.1 million tons (40.5% of the total imported) and "Waste from construction and demolition operations" with 2.7 million tons (35.7% of the total). Particularly significant was the import of waste of metallic nature, which accounted for 76.3% of the total imported, amounting to about 5.8 million tons, mainly destined for steel mills located in Lombardy and Friuli Venezia Giulia.

However, let's analyze what is meant by urban and special waste and how it is managed in Italy. Municipal waste, arising from domestic, commercial and similar activities, represents a significant part of the waste cycle in our country. Municipal governments have the main responsibility for their management, often outsourcing the service to both public and private companies.

In 2021, municipal waste generation reached about 29.6 million tons, with a per capita average of about 497 kg³⁹. On a positive note, separate waste collection reached 63 percent, marking a steady improvement in the separation and recycling of materials.⁴⁰

Special waste, on the other hand, includes that generated by industrial, agricultural, sanitary and construction activities. In 2021, special waste generation reached 165 million tons, registering a 12.2 percent increase from the previous year.⁴¹

This increase was mainly influenced by the post-pandemic economic recovery. Almost half of the special waste came from construction and demolition activities, confirming the sector as the main generator of this type of waste.⁴²

The competitive dynamics of the waste sector in Italy are driven by a number of interconnected factors, including investment in technology, stringent environmental regulations, and the adoption of sustainability-oriented business models. These elements are crucial to understanding market evolution and trends. Analyzing each specific factor, we can see that in terms of technological investments in the sector, Italy has seen a significant increase in these, especially in infrastructure and

³⁹ ISPRA. Istituto Superiore per la Protezione e la Ricerca Ambientale

⁴⁰ ISPRA. Istituto Superiore per la Protezione e la Ricerca Ambientale

⁴¹ ISPRA. Istituto Superiore per la Protezione e la Ricerca Ambientale

⁴² ISPRA. Istituto Superiore per la Protezione e la Ricerca Ambientale

innovative technologies. According to data from "Waste Observatory," investment in the sector grew by 11.8 percent to 955 million euros in 2022. Much of these funds have been allocated to treatment and recycling facilities, which are essential for improving waste management and reducing environmental impact (Renewables & Savings) (Waste Observatory). It can also be noted that one of the advanced technologies that is transforming the sector is chemical recycling, which enables the recovery of raw materials from mixed plastic waste. Another significant innovation is the production of biomethane from organic waste, which not only effectively manages waste but also contributes to renewable energy production (Waste Observatory).

Regarding Italian waste management legislation, it is closely aligned with European Union directives, such as the Circular Economy Package, which sets ambitious targets for reducing waste sent to landfills and increasing recycling rates. Italy has made significant progress in this area, especially in the municipal waste sector, where separate collection has exceeded 63 percent, demonstrating the effectiveness of the policies implemented.

Current regulations not only require increased recycling and material recovery, but also call for a drastic reduction in landfill disposal. This forces companies in the sector to invest in more efficient and sustainable technologies, thus stimulating innovation and increasing their competitiveness. The circular economy has become a central pillar of waste management strategies in Italy. This approach aims to reduce the amount of waste generated and maximize the recovery of materials and energy, contributing to environmental sustainability and creating new economic opportunities. The National Recovery and Resilience Plan (PNRR) supports this transition with funding for innovative projects, including investments in advanced recycling facilities and waste-to-energy technologies that turn waste into energy. These initiatives improve waste management and foster the creation of new business models, further strengthening the circular economy.

Ministerial Decree No. 257 of June 24, 2022, issued by the Ministry of Ecological Transition (MiTE), introduced the National Waste Management Program (PNGR), which is a milestone in the implementation of Article 198-bis of Legislative Decree No. 152 of April 3, 2006. This program not only promotes more effective and sustainable waste management, but also represents one of the key pillars of the National Strategy for the Circular Economy. ⁴³

In the broader context of the National Recovery and Resilience Plan (PNRR), the PNGR assumes a

⁴³ Decreto legislativo del 3 aprile 2006, n. 152, norme in materia ambientale, GU Serie Generale n.88 del 14-04-2006 - Suppl. Ordinario n. 96.

crucial role as a structural reform designed to modernize and harmonize waste management practices nationwide. According to Article 198-bis, the PNGR establishes the broad objectives and strategic guidelines to be followed by the regions and autonomous provinces in drafting their regional waste management plans.

It is essential to note that regions are obligated under Article 199 section 8 of the aforementioned legislative decree to approve or adapt their waste management plans to the PNGR within 18 months of its entry into force. This process ensures that regional plans comply with the objectives defined by the PNGR and in line with European waste management regulations.⁴⁴

The PNGR not only sets general objectives, but also breaks them down into macro-objectives and concrete macro-actions needed to translate strategic intentions into effective day-to-day practices. This structured approach not only aims to improve recycling and sustainable waste management, but also helps to promote a more resilient and environmentally friendly circular economy.

The National Waste Management Program (PNGR) is a strategic document defined by Article 198bis of Legislative Decree No. 152364 of April 3, 2005, introduced by Legislative Decree No. 116 of September 3, 2020. It aims to provide guidelines and directions for waste management planning by the Regions and Autonomous Provinces in Italy.

The PNGR establishes the macro-objectives, criteria and strategic guidelines to be followed in the drafting of regional waste management plans. It is structured over a six-year time horizon, running from 2022 to 2028, and is based on the European framework to promote public policies and incentivize private initiatives that foster the development of a sustainable and circular economy. The goal is to improve society and environmental quality through responsible waste management.

The National Waste Management Plan (PNGR) is considered one of the key elements at both the strategic and operational levels within the National Strategy for the Circular Economy. This plan complements the National Waste Prevention Program and other related policies and instruments. This program is part of national policies to promote the transition to a circular economy, which aims to reduce waste generation, encourage recycling and resource recovery, and limit the environmental impact from waste management.⁴⁵

It provides an overview of the priorities and actions to be taken to improve waste management in Italy, ensuring compliance with European regulations and promoting innovative and sustainable solutions. On the basis of these guidelines, the Regions and Autonomous Provinces develop their own

⁴⁴ www.italiadomani.gov.it, *Italia Domani, il Piano Nazionale di Ripresa e Resilienza.*

⁴⁵ www.italiadomani.gov.it, *Italia Domani, il Piano Nazionale di Ripresa e Resilienza.*

Regional Waste Management Plans, adapting them to territorial specificities and local needs.

Therefore, it can be considered a strategic tool that guides public policies and promotes private initiatives for the development of a circular and sustainable economy. Its objective is to improve society and the quality of the environment through responsible and effective waste management. For its preparation, an interinstitutional technical table called 'Interinstitutional Table for the Waste Management Plan' was established in November 2020. This table was composed of representatives from the Regions, the Autonomous Provinces, the Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), the Associazione Nazionale dei Comuni Italiani (ANCI), the Ministero dello Sviluppo Economico (MISE) and the Autorità di Regolazione per Energia Reti e Ambiente (ARERA).

Within this technical roundtable, the strategic lines for the development of a shared Programme were defined. In particular, the importance of subjecting the PNGR to a Strategic Environmental Assessment (SEA) procedure was approved in order to guarantee maximum participation and transparency in the definition process and strengthen the administrative value of the instrument. Following an in-depth and detailed discussion based on the priorities established by the regions, the technical roundtable identified a series of strategically important flows to be examined in the drafting of the Programme. These strategic streams cover several areas, including: residual municipal waste from separate collection; waste from the treatment of municipal waste; waste from the treatment of separately collected dry and organic fractions; organic waste; waste from electrical and electronic equipment (RAEE); inert construction and demolition waste; textile waste; plastic waste; waste sudge. The analysis of these strategic flows is aimed at understanding the challenges, opportunities and solutions to be adopted for effective waste management in Italy.

This process allows the identification of objectives and actions to be included in the Programme, taking into account territorial specificities and local needs. Thus, the inter-institutional technical table played a fundamental role in defining the National Waste Management Programme. Its multidisciplinary composition and the collaboration between the different institutions and bodies helped to ensure a participatory and informed process in the drafting of the Programme, which covers a wide range of strategic streams related to waste management. The National Waste Management Programme is considered one of the structural reforms for the implementation of the National Recovery and Resilience Plan (PNRR).

This initiative aims to improve efficient and sustainable waste management and promote the circular

economy. The PNGR, in line with the objectives of the PNRR, aims to strengthen separate collection infrastructures, modernise or develop new waste treatment plants and reduce the gap between northern and central-southern regions. It also envisages the implementation of innovative projects in strategic sectors, such as waste from electrical and electronic equipment (RAEE), the paper and cardboard industry, the textile sector, and mechanical and chemical recycling of plastics. An important point to note is that the PNGR is committed to reducing the territorial gap between regions in terms of separate collection. The targets set in the Operational Arrangements of the PNRR include reducing the difference between the national average and the lowest-performing region in separate collection by 31 December 2023, as well as reducing the difference between the average separate collection percentage of the three best-performing regions and the average of the three lowest-performing regions by the same deadline.⁴⁶

Other targets defined in the document include the reduction of irregular landfills by 31 December 2023. The National Waste Management Programme (PNGR) plays a strategic role in the transition to a circular economy in Italy, taking into account regional and provincial policies and the principles of the global 2030 Agenda. Following the principles of the logical framework, the PNGR aims to contribute to sustainability in the use of resources and to reduce the negative environmental impacts of the waste cycle, to reduce socio-economic differences in waste management, to raise awareness and encourage economic actors and citizens to adopt responsible waste reduction and recycling behaviours, and to promote waste management in line with climate neutrality goals.

The PNGR serves as a guiding and supporting tool for regional waste management planning. On the one hand, it aims to ensure that planning criteria comply with the objectives of EU legislation in order to prevent legal disputes. On the other hand, the PNGR focuses on making waste management systems sustainable, efficient, effective and cost-effective throughout the country, also taking into account territorial cohesion objectives. A key priority of the plan is to overcome infrastructural differences between regions in order to ensure integrated waste management throughout the country and to meet the European targets of minimising final disposal, which should only be considered as a last available resource. Furthermore, attention is paid to combating the phenomenon of illegal waste disposal by monitoring the territory⁴⁷.

It also aims to guide and support regional planning for sustainable, efficient and effective waste

⁴⁶ Consiglio dell'Unione europea, 2021, Allegato riveduto della decisione di esecuzione del Consiglio relativa all'approvazione della valutazione del piano per la ripresa e la resilienza dell'Italia, pag. 225.

⁴⁷ www.mase.gov.it, *Strategia nazionale per l'economia circolare.*

management in order to contribute to the transition to a circular economy and the achievement of national and international waste management and climate neutrality targets. The Programme aims to provide direction and assistance for waste management planning to ensure that planning criteria are in line with the objectives set by EU legislation. This aims to prevent waste management disputes and to ensure compliance with the relevant EU directives. Furthermore, the Programme aims to promote efficient, effective, sustainable and economical waste management systems that also take into account the protection of cultural and landscape heritage.

The aim is to optimise the organisation and operation of waste management systems throughout the country, promoting territorial cohesion and efficient use of resources. Regional planning of waste management activities plays a key role in achieving these objectives. It provides a solid basis for properly organising the waste management system, resolving inefficiencies and overcoming infrastructural deficiencies. In this way, a well-structured waste management system aligned with European objectives is promoted. In order to achieve the objectives of efficiency, effectiveness and cost-effectiveness of waste management systems and to promote territorial cohesion, the analysed document indicates the importance of adopting regional planning based on waste stream analysis.⁴⁸

The National Waste Management Programme (PNGR) plays a crucial role in the transition process towards a circular economic model, in which the aim is to maximise the efficient use of resources and promote awareness that waste is no longer simply to be 'discarded', but can be a valuable resource. In this context, the PNGR is committed to promoting practices of waste reduction, reuse, product life-cycle extension, material recovery and recycling. The concept of 'product as a service' becomes fundamental, encouraging the adoption of economic models based on the provision of services related to products, rather than their mere sale. This approach fosters the maximisation of resource efficiency, reducing the amount of waste generated and helping to achieve targets. In addition, it is important to have a thorough understanding of the complexities of waste streams, treatment technologies and plant monitoring and control systems. These scientific, technological and socio-economic aspects are fundamental to assessing the costs and benefits of different territorial waste management choices and ensuring the sustainability of decisions taken, involving all stakeholders.

The awareness of these challenges and opportunities related to waste management, combined with the promotion of circular economy practices and the understanding of the processes and technologies involved, play a key role in making the best territorial choices and pursuing sustainable waste management, respecting the environment and the interest of all actors involved. Within the framework

⁴⁸ www.cisl.it, *Programma nazionale per la gestione dei rifiuti (PNGR).*

of the Programme's implementation, strategic and coordinated initiatives have been launched to promote awareness, strengthen virtuous practices and introduce new approaches. The Programme addresses different actors that are part of the waste management system and the production and consumption cycle. Target actors include, for instance, students from an early age and school staff, consumers, businesses, public administration, the third sector⁴⁹, universities and research centres, and financial system organisations. Through the combined action of all these actors, the aim is to promote awareness and innovative practices and approaches to achieve the objectives of sustainable waste management and the circular economy.

This requires extraordinary efforts in terms of training, communication and education at the national level in order to promote a comprehensive sustainable development in which resource efficiency is at the centre. The aim is to present the circular economy as a collectivist approach that goes beyond the environmental aspect, actively involving people and organisations in the transformation of production and consumption patterns, generating new job opportunities and economic development, and promoting greater awareness and participation to achieve sustainability goals.⁵⁰

2.3 Main industry players and their positioning

The waste management sector in Italy is characterised by a variety of actors operating in different market segments. This complex ecosystem includes large multi-utility companies, specialised private companies and public consortia, each with specific roles and different capabilities in terms of size, geographical coverage and technological expertise. Large multi-utility companies are among the main players in the waste management sector in Italy. These companies operate on a large scale and offer a wide range of services from waste collection and treatment to recycling and energy valorisation. Large multi-utility companies, such as the Hera Group, A2A and the Iren Group, are some of the main players in the sector. These companies manage a wide range of services from separate waste collection to the treatment and recycling of urban and special waste. Their presence is particularly strong in northern and central Italy, with extensive geographical coverage and technologically

⁴⁹ Third sector means non-governmental organisations and others to promote awareness-raising initiatives and circular economy projects, involving civil society in waste management.

⁵⁰ www.cisl.it, *Programma nazionale per la gestione dei rifiuti (PNGR).*

advanced plants. They continuously invest in innovative solutions to improve operational efficiency and reduce environmental impact, also contributing to the production of renewable energy through waste-to-energy plants and energy recovery projects from waste. In particular:

➢ Hera Group

Hera Group is one of Italy's leading multi-utilities, with a strong presence in the waste sector. It manages a wide range of services, from separate waste collection to the treatment and recycling of urban and special waste. Hera is known for its commitment to technological innovation and environmental sustainability, with numerous advanced treatment plants and projects for energy recovery from waste (Renewables & Savings).

► <u>A2A</u>

A2A is another large Italian multi-utility, operating mainly in northern Italy. The company is active in waste collection, treatment, and disposal, with an increasing focus on energy recovery and recycling. A2A invests in innovative technologies such as mechanical-biological treatment (TMB) and waste-to-energy plants, contributing to the reduction of environmental impact and the production of renewable energy (Renewables & Saving) (Waste Observatory).

➢ Iren Group

Iren Group is a key player in waste management in the Northwest regions of Italy. The company manages waste collection, transportation, and treatment services, with a focus on sustainability and the circular economy. Iren invests in automated waste sorting plants and material and energy recovery projects, improving efficiency and reducing waste going to landfill (Renewables & Savings).

➢ Veritas Group

Veritas Group is one of the leading public companies in the waste management sector in northeastern Italy. It provides integrated waste management services, from separate collection to treatment and recycling, with a strong emphasis on innovation and sustainability. Veritas operates biological and mechanical treatment plants, as well as projects for the production of biomethane from organic waste (Waste Observatory).

➢ Sogesid S.p.A.

Sogesid is a public company that operates as the operational arm of the Ministry of the Environment, providing technical and operational support in waste management and contaminated site remediation. Although not directly involved in day-to-day waste management, Sogesid plays a crucial role in planning and implementing sustainable waste management and environmental remediation projects (Waste Observatory).

In besides the large multi-utilities, the sector includes numerous specialised private companies operating in specific segments of the waste market. These companies tend to have a more limited geographical coverage, often focusing on local or regional areas, but offer highly specialised services. Many of these companies are at the forefront of the adoption of innovative technologies, such as mechanical-biological treatment (MBT) and the production of biomethane from organic waste. Their focus on innovation and process optimisation allows them to improve the efficiency and sustainability of their waste management operations. This approach reduces environmental impact, and it can also generate new economic opportunities through the valorisation of waste as a resource.

For instance, mechanical-biological treatment makes it possible to effectively separate organic waste from recyclable materials, improving the quality of the compost produced and reducing the amount of waste going to landfills. The production of biomethane, on the other hand, is a promising solution for organic waste management, as it allows waste to be converted into a renewable energy source that can be used for electricity production or heating.

Furthermore, many of these specialised companies invest in research and development projects to explore new technologies and continuously improve their practices. This commitment to innovation is often supported by collaborations with universities, research centres and others in the industry, creating a dynamic and fertile ecosystem for the development of advanced waste management solutions.

The sector is also enjoying the growing environmental awareness and sensitivity among consumers and companies, which is driving an increased demand for sustainable and responsible solutions. Increasingly stringent regulations on waste management and reducing greenhouse gas emissions further incentivise companies to adopt innovative and sustainable practices.

All major industry players place a strong emphasis on sustainability and the circular economy. Veritas

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and Hera, in particular, are known for their projects on energy valorisation and biomethane production from organic waste. Veritas has developed plants that transform organic waste into biomethane, which is then used as a renewable energy source for public transport and power generation. In addition to biomethane production, Hera is engaged in numerous environmental education and citizen awareness projects on waste reduction and recycling.

The geographical coverage of waste management companies in Italy is varied and responds to the specific needs of territories. A2A and Iren dominate Northern Italy, with a strong presence in the regions of Lombardy and Piedmont. Hera has a significant presence in both Northern and Central Italy, covering large areas of Emilia-Romagna, Marche and Tuscany. Veritas is a key player in the North-East, with operations mainly concentrated in Veneto. Sogesid, on the other hand, operates at a national level, supporting the Ministry of the Environment in strategic projects ranging from the remediation of contaminated sites to the management of water resources.

In Italy, public consortia play a key role in waste management, ensuring compliance with environmental regulations and promoting sustainable practices. These consortia, formed mainly by local authorities, work in close collaboration with private companies to provide integrated and efficient waste management services. Public consortia are essential in ensuring that all waste management operations comply with national and European environmental laws and regulations. Through continuous monitoring and enforcement of regulations, consortia ensure that waste collection, treatment and disposal processes do not harm the environment and meet established quality standards. This commitment is crucial for the protection of the environment and public health, as well as for the prevention of penalties that may result from non-compliance.

Public consortia offer a full range of waste management services, including collection, transport, treatment, recycling and final disposal. Integrated management provides complete control over the waste cycle, ensuring that each stage is managed in a sustainable and compliant manner. This integrated approach is key to reducing the overall environmental impact of waste management and maximising resource recovery.

CONAI, Consorzio Nazionale Imballaggi, plays a central role in the recovery and recycling of packaging waste in Italy. Its mission is to ensure that packaging is managed in a sustainable manner, minimising environmental impact and promoting resource recovery. To achieve these objectives, CONAI works with six specialised consortia, each of which is dedicated to the management of specific packaging materials:

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- 1. Ricrea. This consortium deals with the management of steel packaging. Ricrea works to promote the recycling of cans, jars and other steel containers, contributing to the reduction of waste and the saving of natural resources. Through awareness-raising campaigns and agreements with industries, Ricrea ensures that steel packaging is properly recovered and recycled.
- 2. Cial. The Consorzio Imballaggi Alluminio (Cial) manages aluminium packaging such as beverage cans, aluminium foil and food containers. Aluminium is a valuable material for recycling, as it can be recycled indefinitely without losing its properties. Cial promotes the separate collection of aluminium and supports projects to improve the efficiency of the recycling process.
- 3. Comieco. The Consorzio Nazionale Recupero e Riciclo degli Imballaggi a Base Cellulosica (Comieco) focuses on paper and cardboard packaging. Comieco works to increase the quantity and quality of separate collection of these materials, collaborating with municipalities, companies and citizens to raise awareness of the importance of recycling paper and cardboard.
- 4. Corepla. The National Consortium for the Collection, Recycling and Recovery of Plastic Packaging (Corepla) manages plastic packaging. Corepla is responsible for the collection, recycling and recovery of a wide range of plastic packaging, promoting innovation in recycling technologies and developing new solutions for the recovery of plastic materials.
- 5. Coreve. The Consorzio Recupero Vetro (Coreve) is dedicated to the management of glass packaging. Coreve works to ensure that glass bottles, jars and other containers are collected and recycled efficiently. Glass is a material that can be recycled infinitely, and Coreve works to maximise recycling rates and reduce the use of virgin raw materials.
- 6. Rilegno. The National Consortium for the Collection, Recovery and Recycling of Wooden Packaging (Rilegno) manages wood packaging such as pallets, crates and industrial packaging. Rilegno promotes the reuse and recycling of wood, contributing to the sustainable management of forest resources and the reduction of waste.

Another important consortium that is worth attention is Cobat, Consorzio Nazionale Raccolta e Riciclo. Cobat is a key organisation in Italy specialising in the collection and recycling of batteries, accumulators and waste electrical and electronic equipment (WEEE). Its main mission is to ensure that these hazardous materials are properly managed to minimise environmental impact and promote sustainability.

Cobat is a leader in the management of spent batteries and accumulators, which contain chemicals potentially harmful to the environment and human health. The consortium organises and coordinates the widespread collection of these materials through a network of collection points located throughout the country. Once collected, the batteries and accumulators are transported to specialised facilities where they are treated to recover valuable materials such as lead, nickel and cadmium. This process prevents the release of toxic substances into the environment, and also enables the reuse of raw materials, contributing to the reduction of the need to extract new natural resources.

In addition to batteries and accumulators, Cobat also collects and recycles WEEE, a fast-growing waste category that includes devices such as computers, mobile phones, household appliances and other electronic equipment. WEEE contains many valuable and rare materials, such as gold and copper, but also hazardous substances such as mercury and lead. Cobat ensures that this waste is managed in accordance with European and national regulations, promoting the recycling of recoverable materials and the proper disposal of hazardous components. The consortium continuously invests in innovative technologies to improve the efficiency and effectiveness of recycling processes. Through research and development, the consortium explores new methodologies for waste treatment, further reducing the environmental impact and increasing the material recovery rate. This commitment to innovation allows Cobat to maintain high standards of sustainability and to respond to the growing challenges of technological waste management.

Another crucial aspect of Cobat's activities is the education and awareness-raising of the public and companies on the importance of correct management of waste batteries, accumulators and electronic equipment. Through information campaigns and educational programmes, Cobat aims to actively involve citizens and companies, encouraging them to participate in collection and recycling programmes and to adopt more sustainable behaviour. Another body involved in this type of waste is the RAEE Coordination Centre.

The RAEE Coordination Centre (Cdc RAEE) is a key body in Italy for the management and coordination of the collection of waste electrical and electronic equipment (RAEE). Its main mission is to increase the recovery and recycling rates of RAEE, while ensuring proper environmental

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disposal. The Cdc RAEE plays a crucial role in coordinating the collection of RAEE through an extensive network of collection facilities and recovery systems. It cooperates with municipalities, distributors and treatment companies to ensure that RAEE is collected efficiently and transported to specialised facilities for treatment. This integrated system maximises the amount of waste collected and improves the quality of recycling.

One of the main objectives of the Cdc RAEE is to increase the recovery and recycling rates of RAEE. Through awareness-raising campaigns, training and technical support, the centre works to educate citizens and companies on the importance of RAEE recycling. It also promotes the adoption of best practices by industry operators to ensure that recovered materials are of high quality and can be reintroduced into the production cycle.

The Cdc RAEE ensures that RAEE is disposed of in accordance with European and national environmental regulations. This includes the proper treatment of hazardous substances contained in RAEE, such as mercury, lead and other toxic substances, to avoid environmental contamination.

Another player in the sector is Ecopneus. This is an organisation specialising in the collection, tracking and recycling of end-of-life tyres (ELTs). Its mission is to promote the recovery of materials from used tyres to produce new products and energy, thus reducing the environmental impact of tyre disposal. Ecopneus coordinates a capillary system for the collection of end-of-life tyres throughout Italy. It cooperates with manufacturers, distributors and operators in the sector to ensure that ELTs are collected efficiently and traced along the entire supply chain. This tracking system guarantees transparency and accountability in tyre management, ensuring that tyres are treated correctly.

A fundamental part of Ecopneus' mission is the recycling and recovery of materials from end-of-life tyres. ELTs are processed in specialised plants where the various components, such as rubber, steel and textiles, are separated and reused to produce new products. For example, recycled rubber can be used to make sports flooring, acoustic insulation and components for the automotive industry.

In addition to material recycling, Ecopneus promotes energy recovery from ELTs. Through pyrolysis and controlled combustion processes, end-of-life tyres can be converted into thermal and electrical energy. This approach helps to reduce dependence on fossil fuels and to make better use of the resources from ELTs, improving overall energy efficiency.

In addition, we find RICREA, the national consortium dedicated to the recovery and recycling of steel packaging in Italy. Its mission is to promote the collection and recovery of steel packaging, transforming it into new steel products and contributing significantly to the circular economy. RICREA works actively to encourage the collection of steel packaging, which includes cans, jars,

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caps and other containers used in various sectors, from food to beverages to chemicals. The consortium works with municipalities, local authorities, companies and citizens to raise awareness of the importance of steel recycling. Through information campaigns and environmental education programmes, RICREA raises public awareness of the benefits of recycling and the correct way to dispose of steel packaging.

Once collected, the steel packaging is transported to specialised treatment plants. Here, the packaging is cleaned, separated from other materials and reduced in size to facilitate recycling. The recovered steel is then melted down and processed into new steel products. This process not only reduces the amount of waste going to landfill, but also saves natural resources and energy. Recycling steel is in fact a highly energy-efficient process: steel can be recycled indefinitely without losing its properties, reducing the need to extract and process new iron ore.

Like the other consortia, RICREA plays a crucial role in promoting the circular economy in Italy. It not only manages the final phase of the life cycle of steel packaging, but also works to create a sustainable system involving the entire production chain. This includes working with packaging manufacturers to design more easily recyclable containers and implementing circular economy strategies that maximise the reuse and recycling of materials.

Finally, CONOU is a non-profit consortium dedicated to the ecological and efficient management of used mineral oils in Italy. Founded to ensure the collection, regeneration and disposal of these oils, CONOU plays a crucial role in environmental protection and the promotion of the circular economy. CONOU organises and coordinates the nationwide collection of used mineral oils, ensuring that this hazardous waste is treated safely and in compliance with environmental regulations. The collection network is capillary and includes a variety of authorised operators working to ensure that each litre of used oil is handled correctly. This system avoids the dispersion of oils into the environment, preventing soil and water pollution.

One of the main objectives of the consortium is to promote the regeneration of waste oils, turning them into new regenerated base oils. This process reduces dependence on virgin oil resources, conserves energy and lowers CO2 emissions. The collected oils undergo a treatment that allows their purification and the recovery of useful components, putting them back into the production cycle. This not only preserves natural resources, but also contributes to a more sustainable and circular production system.

Oils that cannot be regenerated are disposed of safely, complying with all environmental regulations to prevent soil and water contamination. CONOU ensures that these oils are treated in specialised

plants that neutralise their hazardous components, minimising their environmental impact.

Contrary to other economic sectors, waste management in Italy is not dominated by large companies. Instead, it is characterised by a network of specialised consortia operating in a coordinated manner under a strict regulatory framework. This consortium structure enables efficient, specialised and sustainable waste management, contributing significantly to the protection of the environment and the development of the circular economy. Each consortium, such as CONOU, specialises in the management of a particular type of waste, ensuring proper treatment and maximum recovery of resources. This approach allows for greater efficiency and sustainability than a centralised system. The collaboration between consortia, public and private entities, and citizens is essential for the success of this model. Together, these actors ensure that waste is managed responsibly and that resources are recovered and reused as much as possible.

There are no dominant players monopolising the market, which promotes greater participation and accountability among the different actors involved. This distribution of the sector among multiple consortia avoids the concentration of market power and promotes greater equity and participation. Nonetheless, a fragmented system is less vulnerable to failure of individual actors, ensuring greater overall resilience.

The absence of dominant players is balanced by a robust regulatory framework that ensures that all consortia operate according to high standards of sustainability and environmental protection. EU directives and Italian national laws provide the regulatory framework within which these consortia operate, ensuring compliance with recycling and waste reduction targets.

It has been analysed that the waste management sector in Italy is organised in a network of consortia, each specialising in the management of specific types of waste. This consortium structure allows for efficient and sustainable waste management, working in a coordinated manner to optimise collection, treatment and recycling processes.

The consortium structure allows for highly specialised waste management, with each consortium focusing on a particular waste stream. This specialisation allows high levels of recycling and recovery to be achieved. Each consortium develops skills and advanced technologies to optimally manage the specific waste for which it is responsible, improving operational efficiency. In addition, specialisation allows for high quality recycled materials, ready to be fed back into the production cycle. Finally, consortia continuously invest in research and development to improve recycling processes and reduce environmental impact.

Chapter 3: Waste within companies and the sustainability report

3.1 The Sustainability Report and its components

A sustainability report is a fundamental document that provides a detailed account of a company, organization or entity's performance in terms of environmental, social and economic sustainability. This type of report differs from traditional financial reporting in that it includes aspects that address the long-term impact of the organization's activities on the planet and communities. The main objective of a sustainability report is to provide a comprehensive and transparent view of the company's practices, highlighting how they contribute to the creation of not only economic, but also social and environmental value.

There are three main components of the Sustainability Report:

i. Environment

The first crucial element of the sustainability report concerns the environmental impact of the company's activities. This includes waste management, where the company monitors and seeks to reduce waste generated through responsible recycling and disposal strategies. Resource use is another key aspect, which includes the consumption of energy, water and materials, efficiency in the use of these resources, and the use of renewable resources. Emissions of greenhouse gases and other pollutants are closely monitored, with mitigation and reduction measures put in place to minimize environmental impact. In addition, the sustainability report addresses impacts on biodiversity, considering the effects of business activities on species and ecosystems.⁵¹

ii. Social

The social dimension of the sustainability report concerns the impact of the organization's activities on people and communities. This includes employee working conditions, workplace safety, diversity and inclusion policies, and skills development. Community relations are also central, with the company assessing its contribution to the well-being of local communities through social responsibility initiatives, philanthropy, and volunteerism. Another important aspect is stakeholder engagement, where the organization interacts with customers, suppliers, investors, and other

⁵¹ Eccles, Robert G., and Judith C. Stroehle. "Exploring social origins in the construction of ESG measures." *Available at SSRN 3212685* (2018).

stakeholders to understand and respond to their expectations and concerns.⁵²

iii. Economic

Finally, the sustainability report includes an assessment of the company's economic performance, but with a perspective that goes beyond mere financial results. This includes long-term value creation for all stakeholders, sustainable innovation, and the adoption of responsible governance practices. Economic performance is then presented in a broader context, which also includes the social and environmental benefits of the company's activities.⁵³

The environmental component of the sustainability report is crucial to understanding the ecological impact of business activities. One of the most critical areas in this context is waste management. Waste generated by a company can have significant effects on the environment, affecting air, water and soil quality, as well as contributing to climate change and biodiversity loss. A sustainability report that adequately addresses waste management demonstrates a company's commitment to responsible and sustainable practices.⁵⁴

3.1.2 The importance of corporate sustainability

Sustainability has become a crucial element for businesses in every sector. Growing awareness of environmental and social issues is driving governments, organizations and consumers to demand greater transparency and accountability from companies.

According to a 2024 Morgan Stanley study titled "Sustainable Signals: Understanding Corporates' Sustainability Priorities and Challenges," sustainability represents a value creation opportunity for 85 percent of companies. The study was conducted by interviewing more than 300 public and private companies globally, all with revenues over \$100 million, with the goal of better understanding the sustainability priorities and challenges they face. ⁵⁵

Key findings of the study include the integration of sustainability as a norm: the research reveals that integrating sustainability into business strategies is now a common practice in North America,

⁵² Eccles, Robert G., and Judith C. Stroehle. "Exploring social origins in the construction of ESG measures." *Available at SSRN 3212685* (2018).

⁵³ Eccles, Robert G., and Judith C. Stroehle. "Exploring social origins in the construction of ESG measures." *Available at SSRN 3212685* (2018).

⁵⁴ Kolk, Ans. "Sustainability reporting." *VBA journal* 21.3 (2005): 34-42.

⁵⁵ Morgan Stanley: Sustainable Signals Understanding Corporates' Sustainability Priorities and Challenges MAY 2024

Europe and Asia Pacific.

Despite difficulties in developing specific skills and appropriate financing models, business leaders recognize the importance of sustainable practices for value creation and risk mitigation. Fifty-five percent of respondents said sustainability criteria influence strategic decisions such as capital expenditures, research and development, new product launches, and M&A.

However, only 37 percent believe that their board of directors has sufficient sustainability expertise, highlighting the need for more knowledge about sustainability regulations and financial instruments.

Value creation is the main reason why companies adopt sustainability strategies, followed by regulatory compliance and corporate moral responsibilities. Of the companies covered in the study, 53 percent see sustainability as a primary opportunity for value creation, while 32 percent see it as partially so. Only 26 percent of respondents cite pressure from NGOs, activists and the media as a significant motivation, placing it at the bottom of the list.

The high investment required is perceived as the main barrier to implementing sustainability strategies. In fact, 70% of respondents consider this a significant or very significant obstacle. Other obstacles include conflicts with corporate financial objectives (28 percent) and macroeconomic uncertainties (25 percent). Access to capital is crucial, with 84% of respondents believing that investor support is critical to implementing sustainability strategies. 76% anticipate that sustainability measures could reduce capital costs in the next five years.⁵⁶

The research also shows that 90% of companies predict that climate change will affect their business model by 2050, and nearly a quarter have already seen the effects. This is comparable to responses to traditional business risks such as geopolitical conflicts and technological change.

Contrasting views also emerge about the impact of sustainability on financial data.⁵⁷ Looking towards the future, nearly three-quarters of respondents believe that sustainability could increase cost pressures due to raw materials, regulation or change in existing processes. However, more than 80 percent see sustainability as an opportunity to generate stronger cash flows, increased profitability, and revenue growth in the coming years. These mixed views may reflect limited visibility into short-term costs that could be offset by long-term financial benefits, or a belief that companies will be able to handle the pressures.

⁵⁶ Morgan Stanley: Sustainable Signals Understanding Corporates' Sustainability Priorities and Challenges MAY 2024

⁵⁷ Morgan Stanley: Sustainable Signals Understanding Corporates' Sustainability Priorities and Challenges MAY 2024

In today's environment, sustainability has become a crucial component of corporate strategy and investor decision making. However, the transparency and reliability of sustainability reports are still heavily criticized by investors. PwC's Global Investor Survey 2023 reveals that 94 percent of investors believe that companies' sustainability reports contain claims that are not supported by hard data.⁵⁸ This high level of skepticism has significant implications for how companies communicate their sustainable practices and how investors trust ESG (Environmental, Social, and Governance) funds.⁵⁹

The PwC survey involved about 345 investors and analysts from around the world, as well as 15 in-depth interviews with industry professionals. The results show a significant increase in distrust compared to 2022, when 87 percent of investors expressed similar concerns. This finding suggests that despite companies' efforts to improve the transparency of their sustainability reports, many investors still feel that the information provided is insufficient or misleading.

James Chalmers, head of global assurance at PwC UK, said, "We are moving from a time of raising awareness about the importance of climate and technological change to a time when investors are increasingly asking specific and difficult questions about how companies address these issues in their strategy, how they assess risks and opportunities, and what is really material to them. In this context, corporate reporting must continue to evolve to provide reliable, consistent and comparable information that investors-and other stakeholders-can rely on."⁶⁰

Transparency in sustainability reporting is crucial to maintaining investor confidence. Documents such as the Sustainability Report are not only communication tools, but also indicators of how seriously a company takes its environmental and social responsibilities. The lack of hard, verifiable data fuels the fear of greenwashing, where companies present a falsely positive image of their sustainable practices to attract investors without implementing real change.

The rise in concern about climate change, from 22 percent to 32 percent among investors, puts increasing pressure on companies to demonstrate authentic and measurable commitments. In a world where climate risks are viewed on par with cyber risks, sustainability reports must provide detailed, accurate and verifiable information.

⁵⁸ PwC. Global Investor Survey, 2023

⁵⁹ Osservatorio Economia Circolare, 2023

⁶⁰ PwC. Global Investor Survey, 2023

Perceptions of unreliability in sustainability reports are driving investors to demand a stricter regulatory framework and clear standards. Fifty-seven percent of investors said that compliance with upcoming regulations, such as the CSRD (Corporate Sustainability Reporting Directive), the SEC's proposed U.S. climate disclosure rules, and the International Sustainability Standards Board (ISSB) standards, will meet their information needs for decision-making.

Furthermore, 85 percent of investors believe that reasonable assurance, similar to the audit of financial statements, would increase their confidence in sustainability reporting. This indicates a strong demand for external audits and reviews that can ensure the veracity of information reported by companies.⁶¹

To meet investor demands, companies must commit to improving the quality and transparency of their sustainability reports. This involves not only providing more detailed and verifiable data, but also adopting reporting practices consistent with international standards. Companies must clearly demonstrate how their sustainability strategies fit with their day-to-day operations, how they assess sustainability-related risks and opportunities, and what the real impacts of their activities are on the environment and society.

Nadja Picard, Global Reporting Leader at PwC Germany, said, "We are seeing significant steps towards more consistent reporting by companies on climate change, however, improvement is needed. In the meantime, investors are calling for more engagement on how companies manage the opportunities and risks of new technologies, particularly generative artificial intelligence, as new technologies increasingly drive business transformation and investment."⁶²

In this context, Sustainability Assurance Reporting assumes a key role in ensuring the reliability and credibility of the information disclosed in sustainability reports. Assurance Reporting is the process by which an independent body verifies and certifies the accuracy and completeness of the information presented in companies' sustainability reports. This process not only increases stakeholder confidence, but also helps improve internal sustainability management practices.⁶³ However, what is the status of companies with respect to the Sustainability Assurance Report requirement? This question was answered by KPMG in its recent study "KPMG ESG Assurance Maturity Index".

The KPMG study shows that 29 percent of companies feel ready to independently assure their

⁶¹ PwC. Global Investor Survey, 2023

⁶² PwC. Global Investor Survey, 2023

⁶³ Osservatorio Economia circolare, 2023

data. This figure is up, albeit only by a fraction from nine months ago, despite the fact that regulatory deadlines for mandatory Sustainability Assurance are rapidly approaching (in the EU, reports from the largest companies are expected to be published in early 2025 with data on 2024).⁶⁴

"Preparing for ESG Assurance is a journey, and companies are finding that the further they progress down this path, the more there is to do and learn. The goal line is constantly evolving. That's why progress may seem slow, although many companies have indeed made significant strides. This effort will pay off: boards are increasing their focus on this and leaders are reporting a growing range of benefits as the discipline involved in preparing for ESG Assurance permeates all systems, processes, controls and governance," commented Larry Bradley, Global Head of Audit at KPMG International.

The survey divided companies based on their ESG readiness into three categories: Leaders (29 percent), Advanced (46 percent) and Beginners (26 percent). When analyzing in detail, progress is noted in the individual categories: the percentage of companies in the Leader category increased, and the average score of these Leaders increased by 6 percent. The average score of the middle group of companies, the Advanced, also increased by 3 percent.

The revenue-to-earnings ratio in terms of ESG Assurance reveals that companies with revenues over \$100 billion achieve a score of 69.5 (on a scale of 0 to 100) in progress for Sustainability Report Assurance, while those with revenues under \$5 billion score 39.3.

The survey also conducted a geographic analysis to see where the companies most prepared for Sustainability Report Assurance operate from. In first place is France (52.4), followed by Germany (52.3) and Japan (50.2). Closing the top 5 are the United Kingdom (49.9) and the United States (49.5). The average maturity index score by sector sees the insurance sector in first place (52.8), followed by the banking sector (52.1) and the energy and natural resources sector (49.5).⁶⁵ KPMG highlighted the benefits and challenges so far associated with the Sustainability Assurance Report requirement.

Benefits include increased market share (56 percent), cost reduction (48 percent) and new business models (46 percent). Leading companies show increasing benefits over last year, such

⁶⁴ KPMG ESG Assurance Maturity Index 2024: The journey continues: Navigating the road to readiness ⁶⁵ KPMG ESG Assurance Maturity Index 2024: The journey continues: Navigating the road to readiness

as reduced costs (+18 percentage points), improved product/service quality (+12), reduced business risks (+11), better staff engagement (+8), improved credit rating (+8) and expanded market share (+6).⁶⁶

The most frequently cited challenges relate to obtaining and maintaining internal core competencies, a challenge made more difficult by competition among firms for the same skills and the continual evolution of the skills required. As a result, more than half of companies (54 percent) plan to hire external staff (among Leaders, the percentage rises to 59 percent). Other challenges include insufficient IT and digital solutions, scarce available funding, and the complexity of reporting requirements.

Finally, the importance of supplier focus emerged. Among Leaders, more than four in ten (42 percent) impose specific requirements on their suppliers, up from 28 percent in 2023. The number of Leaders requiring suppliers to share ESG data in their systems (64 percent), to integrate ESG criteria into supplier screening (48 percent), and to obtain ESG certifications is also growing, although this is still an early stage.

3.2 GRI 306: Waste 2020

The Global Reporting Initiative (GRI) is one of the fundamental pillars of sustainability reporting. Through its detailed and structured standards, GRI provides a comprehensive framework for organizations to transparently and responsibly communicate their environmental, social, and economic impacts.

The Global Reporting Initiative (GRI) is an independent, international organization that provides a framework for sustainability reporting. Founded in 1997, GRI's main goal is to help companies, governments and other organizations understand and communicate their impact on critical sustainability issues such as climate change, human rights, governance and corruption.

The core of GRI's work are the GRI Standards, which are a set of sustainability reporting guidelines used globally. The GRI Standards are modular and interconnected, allowing organizations to select and use the standards most relevant to their reporting needs. GRI standards are divided into three

⁶⁶ KPMG ESG Assurance Maturity Index 2024: The journey continues: Navigating the road to readiness

main series:

i. Universal Standards (GRI 101, 102, 103)

GRI 101: Foundation: Provides the foundation for sustainability reporting by defining the principles for the use of GRI standards.

GRI 102: General Disclosures: Requires general information about the organization, its structure, context and management practices.

GRI 103: Management Approach: Requires organizations to describe how they manage their material impacts.

ii. Topic-Specific Standards.

These standards deal with specific topics and are divided into three categories: Economic (e.g., GRI 201: Economic Performance) Environmental (e.g., GRI 301: Materials, GRI 302: Energy, GRI 306: Waste) Social (e.g., GRI 401: Employment, GRI 403: Occupational health and safety)

iii. Sector Standards.

These standards are under development and focus on specific needs of particular industries.

GRI standards are based on fundamental principles that ensure the quality and transparency of the information reported:

Materiality: The topics covered in the report should be those that reflect the significant economic, environmental and social impacts of the organization or that substantially influence stakeholder assessments and decisions.

Stakeholder Inclusiveness: The reporting process must consider stakeholder expectations and interests.

Sustainability Context: Information reported must be presented in the context of overall sustainability.

Completeness: The report must include all information necessary to provide a balanced and reasonable representation of the organization's sustainability performance.

Reports produced following GRI standards greatly improve the transparency and credibility of corporate information. This increased clarity helps build and strengthen trust between the company and its stakeholders, which include customers, investors, employees, and local communities.

Detailed reporting enables organizations to identify, assess, and manage sustainability-related risks and opportunities. This proactive approach allows them to effectively address emerging challenges and capitalize on new opportunities for sustainable growth.

Using GRI standards helps companies comply with local and international regulations and legal expectations. This not only avoids potential penalties, but also ensures that the company is operating in line with globally recognized best practices.

Demonstrating a concrete commitment to sustainability through transparent reporting can significantly improve corporate reputation. A good reputation for sustainability can also translate into a competitive advantage, attracting new customers and retaining existing ones.

The process of reporting according to GRI standards encourages active stakeholder engagement. This involvement improves relationships, promotes open communication, and ensures that stakeholders' needs and expectations are considered in business decisions.

GRI reporting provides detailed and valuable information that supports strategic and operational decision making. Having reliable and comprehensive data enables organizations to make more informed decisions and develop sustainable business practices, thereby improving their long-term efficiency and resilience.⁶⁷

GRI was one of the first organizations to develop sustainability reporting standards and continues to play a leadership role in promoting corporate transparency. GRI standards are used by thousands of organizations around the world, including many of the largest global companies, governments and NGOs. The widespread adoption of GRI standards has helped raise the bar for sustainability reporting, promoting greater accountability and positive impact on society and the environment.⁶⁸

GRI 306: Waste 2020 is one of the specific standards of the Global Reporting Initiative (GRI) and focuses on waste management. This standard was developed to help organizations communicate their waste management practices in a transparent and detailed manner.

⁶⁷ GRI, Global Reporting Initiative. "About GRI." (2014).

⁶⁸ GRI, Global Reporting Initiative. "About GRI." (2014).

The first step for an organization in applying GRI 306 is to describe its operating context regarding waste generation and management. Companies should identify the main sources of waste within their operations, such as production processes, products and services offered. Providing a clear picture of the operating context helps stakeholders better understand the challenges and opportunities the company faces in waste management.⁶⁹

In addition, the organization must outline specific policies, practices and objectives for waste management. This includes describing the strategies adopted to reduce the amount of waste generated, improve management practices, and promote recycling and reuse of materials. Integrating waste management into the overall business strategy is crucial to demonstrate a genuine commitment to sustainability.

GRI 306: Waste 2020 requires companies to report detailed information on various aspects of waste management through a set of performance indicators:

✤ Waste Generation and Significant Impacts.

Companies must quantify the total amount of waste generated and describe the significant impacts associated with the management of this waste. This includes identifying the types of waste generated and the management methods adopted.

Management of Significant Impacts.

Actions taken to manage and mitigate significant waste impacts should be clearly described. Initiatives may include waste reduction, recycling and materials recovery programs.

✤ Waste Generated.

Companies must provide a detailed breakdown of waste generated by type and method of disposal. This involves distinguishing between hazardous and nonhazardous waste and specifying the disposal methods used, such as landfills, incinerators or special treatment.

✤ Waste Diverted from Disposal.

It is important to report waste that has been diverted from disposal through recycling, reuse, or other

⁶⁹ GRI 306: Waste 2020, Report

forms of recovery. This figure highlights the company's efforts to reduce the environmental impact of waste generated.

✤ Waste Sent for Disposal.

Companies must detail the waste sent for final disposal, providing specific information on the quantities and disposal methods used. This includes quantification of waste sent to landfills, incineration without energy recovery, and other forms of final disposal.

A crucial aspect of GRI 306 is the emphasis on reducing waste and promoting the circular economy. Companies are encouraged to describe initiatives taken to minimize waste generation, optimize resource use, and promote recycling and reuse. Adopting circular economy practices not only helps reduce environmental impact but can also lead to significant economic savings and greater operational efficiency.

To successfully adopt GRI 306: Waste 2020, companies must follow several crucial steps. first, it is essential that companies establish efficient monitoring systems to collect data on waste generated and managed. This requires the use of advanced technologies to track and analyze waste, thus ensuring that reporting is accurate and reliable.⁷⁰

Companies must actively collaborate with suppliers, customers, and other stakeholders to improve waste management practices. Stakeholder engagement is key to developing innovative solutions and sharing best practices, promoting a culture of sustainability at all levels of the organization. In addition, training employees on waste management practices is a key step. Promoting a sustainability-oriented corporate culture helps ensure the success of waste management initiatives. Internal awareness creates a conscious and responsible work environment where each team member understands the importance of his or her own contribution.⁷¹

As pointed out by the various studies above, providing transparent and verifiable information increases the company's credibility in the eyes of stakeholders. Greater transparency improves

⁷⁰ GRI 306: Waste 2020, Report

⁷¹ GRI 306: Waste 2020, Report

corporate trust and reputation by demonstrating a serious commitment to sustainability.

Regular waste reporting allows companies to identify areas for improvement and monitor progress over time. This fosters a continuous improvement process, where the company can continuously optimize its waste management practices.⁷²

Finally, following GRI standards helps companies comply with local and international waste management regulations. This reduces the risk of penalties and improves relations with regulators, ensuring that the company operates in accordance with recognized best practices. all of this leads to improved operational efficiency resulting in reduced costs and optimized management.

3.3 The transition to a circular economy

3.3.1 The role of small businesses

A survey conducted by CNA in collaboration with the Circular Economy Network on small Italian businesses confirms that awareness of the importance of the circular economy is now widespread. Companies recognize the circular economy as a means to save on raw materials and energy, minimize waste, and increase recycling.⁷³ However, small businesses face challenges in implementing circularity measures due to a lack of expertise and a clear, easily enforceable regulatory framework. The most significant European regulation of 2023 is the new Regulation on Packaging and Packaging Waste, which is now in its final text and is expected to be definitively approved soon. Additionally, a proposal for a Regulation to increase and diversify the supply of critical raw materials was approved, and the new Batteries Regulation came into effect in August 2023. Amendments to the Directive on Waste Electrical and Electronic Equipment (WEEE) have also been published and must be transposed by October 2025. It should be noted that there is still no available reporting on the implementation of the National Strategy for the Circular Economy for 2023, despite this being required annually.

Italian SMEs, which make up nearly the entire entrepreneurial fabric, play a fundamental role in the transition to a circular economy. Increasingly aware of the importance of sustainability, these companies view the circular economy not only as a way to reduce environmental impact but also to seize economic opportunities related to greater product sustainability, reduced energy and raw material costs, and market competitiveness. However, many SMEs still do not fully understand how sustainability can affect access to credit, participation in public tenders focused on green procurement,

⁷² GRI 306: Waste 2020, Report

⁷³ 6° RAPPORTO SULL'ECONOMIA CIRCOLARE IN ITALIA – 2024, Circular Economy Network

and public incentives. It is essential that SMEs learn to measure their performance in terms of energy efficiency, emission reduction, and circularity.

Results of the Survey Circular on the Economy in Craft Enterprises: Between December 2023 and January 2024, CNA, together with the Circular Economy Network, conducted a survey of over 800 businesses. Sixty-five percent of these reported implementing at least one process related to the circular economy, a percentage more than double that recorded in a 2021 survey (30.2%). Furthermore, 10% of companies plan to adopt circular economy practices in the near future. The most frequent actions involve the use of recycled materials (68.2%), reduction of (64%), packaging and increasing product durability and repairability (53.2%). The main benefits reported by companies include greater environmental sustainability (70.4%), reduced production costs (61%), greater efficiency (35.6%), and a boost to innovation (34.2%). However, several factors continue to slow the adoption of circular economy measures.⁷⁴

The survey highlights that small businesses can be key players in the transition to a circular economy, thanks to the Italian production system's historic commitment to efficient resource use. However, public policies must be more focused in this direction. The following proposals emerged:

- Support initiatives to help SMEs use available public resources to support the transition to a more circular economy.
- Reform environmentally harmful subsidies to fund tax incentives for SMEs that use secondary raw materials or engage in reuse activities.
- Promote industrial symbiosis platforms for the exchange of by-products, freely accessible to SMEs.
- Promote and finance circular economy training activities at national and regional levels, involving industry associations.
- Promote the dissemination of indicator sets to measure and assess the circularity of SME activities.
- > Increase funding for research and experimentation in the circular economy for SMEs.
- Create an online platform for the dissemination of circular economy best practices, freely accessible to SMEs.

3.3.2 The point on European and national legislation for the development of the circular economy

⁷⁴ 6° RAPPORTO SULL'ECONOMIA CIRCOLARE IN ITALIA – 2024. Circular Economy Network

The year 2024 will see the elections for the renewal of the European Parliament, followed by the renewal of the European Commission. This presents a significant opportunity to assess the progress of initiatives related to the transition towards a circular economy that were launched during the current legislature. This period has been a crucial moment for the circular economy in Europe, marked by the adoption of the European Green Deal, which placed the circular economy at the heart of ecological transition policies. Furthermore, the update of the European Circular Economy Action Plan introduced new ambitious targets, contributing to a particularly dense and significant regulatory output.

Among the main regulatory developments is the imminent approval of the new Regulation on Packaging and Packaging Waste, which will replace the current regime governed by a Directive. Once in force, this new Regulation will have direct and binding effects in all Member States' legal systems, eliminating the need for national transposition.⁷⁵

The Circular Economy Network (CEN) played a significant role in defining the necessary compromises for the approval of the Regulation, helping shape several key provisions:

- i. Article 7: The CEN requested the exclusion of food packaging and non-PET beverage containers from the recycled plastic content targets, achieving that this exclusion applies to packaging for children's products and plastic food packaging where recycled content could pose a threat to human health. This exclusion was incorporated into the final text of the Regulation.
- ii. Article 7, paragraph 6: The CEN's proposal to modulate the environmental contribution based on the amount of recycled plastic used in packaging was accepted. The approved text stipulates that the financial contributions paid by producers under extended producer responsibility can be modulated according to the percentage of recycled content, taking into account the sustainability of recycling technologies and environmental costs.
- iii. Obligation to establish deposit return schemes: The Regulation mandates the establishment of deposit and return schemes for plastic or metal beverage bottles if a 90% separate collection rate is not achieved. The CEN proposed postponing this obligation until 2035, a proposal that was conditionally accepted. Member States may be exempted from this obligation if, by 2026, they achieve a separate collection rate exceeding 80% and notify the European Commission of an implementation plan to reach the 90% target by 2029.

⁷⁵ L'ECONOMIA CIRCOLARE NEL PIANO NAZIONALE DI RIPRESA E RESILIENZA, Viviana Molaschi

- iv. Reusable packaging: The CEN requested the removal of mandatory reusable packaging requirements for specific product categories, instead proposing the use of single-use packaging, provided that at least 85% is collected and recycled. The approved text eliminated the reusable packaging requirements in specific situations, such as for Member States that exceed waste packaging recycling targets by 5% by 2025 and achieve waste prevention targets.
- v. Packaging made from renewable materials: The CEN proposed the exclusion of packaging made from renewable materials, such as paper, cardboard, and biodegradable and compostable plastics, from reuse targets. The Regulation now limits reuse obligations to packaging for transporting goods within the European Union, excluding, for example, cardboard packaging used for grouping products.

Beyond the Packaging Regulation, another significant initiative is the approval of the "Regulation on the Supply of Critical Raw Materials", aimed at ensuring a more secure and sustainable supply. This regulation stipulates that by 2030, 10% of the annual production of critical raw materials must come from extraction activities within the EU, 40% from processing activities, and at least 25% of the EU's annual demand must be met through recycling.⁷⁶

Among the most significant European initiatives, several recent developments stand out. In particular, the new Battery Regulation, which introduces innovative standards for the production and recycling of batteries, came into force in August 2023. Another important change concerns the WEEE Directive (Waste Electrical and Electronic Equipment), which has been amended and must be transposed by Member States by October 2025.⁷⁷

Further progress is represented by the Regulation on the Ecodesign of Sustainable Products, approved by the European Parliament, aimed at promoting a market for products that are easier to repair, reuse, and have a longer lifecycle. In July 2023, a proposal for a Regulation on Circularity Requirements for Vehicles was also presented, establishing new standards for the design and management of endof-life vehicles.

At the national level, the National Recovery and Resilience Plan (PNRR) has highlighted some issues related to waste management. Most of the funding allocated for the construction of new treatment

⁷⁷ L'ECONOMIA CIRCOLARE NEL PIANO NAZIONALE DI RIPRESA E RESILIENZA, Viviana Molaschi

⁷⁶ L'ECONOMIA CIRCOLARE NEL PIANO NAZIONALE DI RIPRESA E RESILIENZA, Viviana Molaschi

plants has been assigned to northern regions, which already have adequate plant capacity. This risks widening the gap with southern regions, such as Lazio and Campania, which continue to suffer from a shortage in organic waste treatment capacity.⁷⁸

Moreover, the PNRR has provided for the adoption of a National Circular Economy Strategy, approved last year. However, in light of the numerous reforms adopted or in progress at the European level, there is a need to update the national strategy and the corresponding timetable to align with the European Union's regulatory developments.⁷⁹

The application of the new monitoring framework confirms Italy's leading position. The assessment of circularity performance among the five main European countries analyzed (Italy, France, Germany, Spain, and Poland) is conducted based on the new monitoring framework published by the European Commission. This evaluation uses a set of indicators grouped into five dimensions: production and consumption, waste management, secondary raw materials, competitiveness and innovation, and ecological sustainability and resilience. Italy maintains its lead with 45 points, followed by Germany with 38 points and France with 30 points. Poland and Spain share the last position with 26 points each. Italy's strong performance, which puts it seven points ahead of the second-place country, is primarily due to its excellent results in the dimension related to waste management (18 points). Additionally, Italy shows significant achievements in the production and consumption dimension (10 points) and the competitiveness and innovation dimension (10 points).

The second ranking, which analyzes circularity trends over the past five years, again places Italy in the top position with 41 points. However, compared to the previous ranking, the countries in the second and third positions are closer to the leader, with Germany and Spain both scoring 40 points. Poland and France trail significantly, holding fourth and fifth positions with 25 and 21 points, respectively. Italy's top ranking in this assessment is attributed to its outstanding performance in waste management indicators (14 points) as well as in competitiveness and innovation (14 points).

In 2022, Italy's material consumption was 12.8 tons per capita, lower than the European average of 14.9 tons per capita, but up 8.5% from 11.8 tons per capita in 2018. Among the five major European countries, only Spain, with a material consumption of 9.8 tons per capita, has a lower level than Italy, while Germany and Poland have significantly higher material consumption levels at 15.7 and 19.9 tons per capita, respectively. France, with 13.2 tons per capita, is below the European average. Over the five-year period from 2018 to 2022, the per capita material consumption trend remained stable

⁷⁸ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

⁷⁹ L'ECONOMIA CIRCOLARE NEL PIANO NAZIONALE DI RIPRESA E RESILIENZA, Viviana Molaschi

across Europe, decreased by 11.1% in Spain, 3.2% in France, and 2.7% in Germany, while it increased by 5% in Poland.⁸⁰

In 2022, resource productivity in Italy generated 3.7 euros of GDP for every kilogram of resources consumed, a slight improvement (2.7%) compared to 3.6 euros/kg in 2018. The EU average in 2022 was lower than Italy's, at 2.5 euros/kg, and the performance of other European countries was also below that of Italy: Spain at 3.4 euros/kg, France at 3.2 euros/kg, and Germany at 3 euros/kg, with Poland trailing far behind at 1.5 euros/kg. Over the last five years (2018-2022), this indicator's performance has shown a significant improvement at the European level, with a 16% increase. Other countries have also seen positive trends: Germany +19%, Spain +16%, France +18%, and Poland, starting from a much lower base, achieving a 27% improvement.⁸¹

3.3.3 Waste Management

In the EU27, per capita urban waste production in 2022 was 513 kg per capita. In Italy, per capita urban waste production decreased by 2.1%, from 504 kg per capita in 2018 to 494 kg per capita in 2022. Comparing with other countries, per capita urban waste production in Germany and France in 2022 exceeded the EU27 average, with Germany recording 593 kg per capita and France 439 kg per capita. Italy, with 494 kg per capita, is in third place, followed by Spain with 467 kg per capita, and Poland, with 364 kg per capita. Over the past five years, per capita urban waste production has increased by 2.6% on average in the EU, while it has slightly decreased in the other major European countries: -3.2% in France, -2.1% in Germany, -2.1% in Italy, and -1.7% in Spain. In Poland, however, it has increased by 10.6%, but from a much lower starting point of urban waste per capita. With regard to recycling, in the past five years, Italy's municipal waste recycling rate has improved by 3.4 percentage points, reaching 49.2% in 2022. This is close to the 2020 EU target of 50%, but Italy must continue to increase its recycling rate to meet future EU targets: 55% by 2025, 60% by 2030, and 65% by 2035. In 2022, when comparing the recycling rates of the five largest EU countries, Italy's rate was above the EU average of 48.6%, but still behind Germany's impressive 69.1%. Other major countries like France (41.8%), Poland (40.9%), and Spain (38.6%) performed worse than Italy.

⁸⁰ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

⁸¹ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

In 2020, Italy was the leader in recycling among the five main EU countries, with a total waste recycling rate of 72%, significantly above the EU average of 58%. Germany followed with a 55% recycling rate, while Poland, Spain, and France lagged behind with rates of 52%, 48%, and 47%, respectively. Italy's recycling efforts have shown substantial progress over the years. For example, Italy's recycling rate for packaging waste reached 71.7% in 2021, which was nearly 8 percentage points above the EU27 average (64%). This rate was also the highest among the five largest EU countries, with Spain (70.1%) and Germany (67.9%) trailing behind. France and Poland had lower rates, both below the EU average, with 61.8% and 55.5%, respectively.

Regarding Waste Electrical and Electronic Equipment (WEEE), Italy achieved an 87.1% recycling rate in 2021, slightly lower than the 2017 rate but still the highest among the major EU countries analyzed. This rate also exceeded the EU27 average of 81.3%. Germany (86.1%) and Poland (85.9%) followed closely, while France (77.2%) and Spain (73%) were below the European average. However, Italy's collection rate for WEEE, compared to the average market input over the previous three years, remains quite low. As of 2021, it stood at 33.8%, which is far below the EU27 average of 46.2% and well short of the EU target of 65% set for 2019.

Italy has historically been advanced in circular material use, which measures the ratio of recycled materials to the total material consumption. In 2022, Italy maintained a strong position with a CMU rate of 18.7Across the EU27, the CMU rate has also been stable, decreasing slightly from 11.6% in 2018 to 11.5% in 2022. Among the major EU countries, France led with a CMU rate of 19.3%, despite a small drop of 0.2 percentage points since 2018. Germany, with a CMU rate of 13%, was just above the EU average, while Poland (8.4%) and Spain (7.1%) were below it.

In 2021, Italy ranked third in the EU27 for gross investments in the circular economy, with $\notin 12.4$ billion, representing 0.7% of its GDP. This was behind Germany ($\notin 31.5$ billion) and France ($\notin 20.4$ billion). Since 2017, Italy's investments in the circular economy have increased by 14.5% in absolute terms, rising from $\notin 8.3$ billion in 2017 to $\notin 12.4$ billion in 2021. In terms of GDP percentage, investments grew from 0.6% in 2017 to 0.7% in 2021. Among the five largest EU countries, all except France showed growth in both absolute investment and as a percentage of GDP during this period.

Employment in the circular economy was also significant in Italy, with 613,000 people employed in 2021, making up 2.4% of the workforce. This percentage is higher than the EU27 average of 2.1%, placing Italy second among the five major EU countries, just behind Poland (2.7%). In absolute numbers, Italy was second only to Germany (785,000 employees). Between 2017 and 2021, the

number of people employed in the circular economy in Italy grew by 4%, from 590,000 to 613,000. The value added by the circular economy to Italy's economy also increased, rising from 2.1% of GDP in 2017 to 2.5% in 2021. In absolute terms, this value grew from €36.7 billion in 2017 to €43.6 billion in 2021. This growth was stronger in Italy than in some other major EU countries, such as France and Poland, where the value added by the circular economy decreased during the same period.⁸²

3.3.4 Strategic Raw materials

Rare Earth Elements (REEs): These are critical and strategic for various high-tech industries, including renewable energy, electric mobility, defense, aerospace, and electronics. The global reserves of REEs are concentrated in China (44 million tons), Vietnam (22 million tons), Brazil (21 million tons), and Russia (12 million tons). China is the primary supplier of refined REEs to Europe, accounting for around 80% of the supply. There are currently no technologically or economically viable substitutes for REEs. However, recycling REEs from end-of-life products offers future profitability, as secondary extraction is less polluting and often yields higher concentrations of REEs than natural extraction. Currently, Neodymium is the only REE with a positive recycling rate, though it is still very low at 1%. In Italy, the use of REEs is crucial in sectors like automotive and energy, contributing approximately 11.4% to the revenue of the entire Italian manufacturing sector.⁸³

Copper: For the first time, copper was classified as a strategic raw material by the EU in the 2024 Critical Raw Materials Act. Although it does not exceed the criticality threshold, copper is deemed strategic due to its essential role in key electrification technologies. The largest copper reserves are found in Chile (31%), which is also the world's leading producer, followed by Peru (11%) and the Democratic Republic of Congo (9%). China dominates copper refining, producing about 42% of the world's refined copper. Europe has limited copper reserves, with extraction concentrated in Poland and refining in Germany. While there are few alternatives to copper, it has a high recycling rate at end-of-life, around 30%. In Italy, copper is extensively used in electronics, automotive, and energy sectors, which collectively account for 6.6% of the manufacturing sector's revenue.⁸⁴

Italy's performance in sustainability is mixed. In 2021, the ecological footprint of consumption in Italy matched the EU27 average (104), with only France (98) and Germany (95) performing better among the five major EU countries. In contrast, Poland (120) and Spain (105) had higher ecological

⁸² Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

⁸³ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

⁸⁴ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

footprints. Over the past five years, Italy's footprint decreased by 3%, France's by 2%, and Germany's by 10%, while Poland and Spain saw increases.⁸⁵

In terms of greenhouse gas emissions, Italy's per capita emissions from productive activities in 2022 were 5,432 kg CO2 equivalent, lower than the EU27 average of 6,481 kg CO2 equivalent. Among the five major EU countries, only France (4,861 kg CO2 eq.) and Spain (4,925 kg CO2 eq.) had lower emissions than Italy. In contrast, Poland (9,587 kg CO2 eq.) and Germany (7,392 kg CO2 eq.) had significantly higher emissions. All five countries reduced their emissions over the last five years, with Germany (-15%) and Spain (-13%) achieving the most significant reductions, while Italy and Poland both saw a smaller decrease of 1%.

Italy's dependency on imported materials remains high, at 46.8% in 2022, more than double the EU average (22.4%). However, this dependency has decreased by 3.8 percentage points since 2018, when it was 50.6%. Among the five major EU countries, only Poland had a lower dependency on imported materials than the EU average (19.7%). France (36.1%), Germany (36.5%), and Spain (42.8%) were all above the EU average but had a lower dependency than Italy.⁸⁶

Chapter 4: The waste industry and its future: the CONOU case

⁸⁵ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

⁸⁶ Il Riciclo in Italia, Rapporto 2023, a cura di Edo Ronchi

4.1 The Consortium

CONOU, the National Consortium of Used Mineral Oils, represents an absolute excellence in the Italian circular economy, standing as a virtuous example of how hazardous waste can be transformed into resources. Specifically, the Consortium is dedicated to the collection, management and regeneration of used lubricating oils, which are considered environmentally hazardous waste. Through an advanced and consolidated process, CONOU ensures that these oils are not simply disposed of, but regenerated for reuse, contributing significantly to the reduction of environmental impact.

Currently, in Europe, only 61 percent of collected mineral oils undergo regeneration, a percentage deemed insufficient by the European Commission itself during consultations to update the Waste Directive. As a result, the remaining 39% of used oil, despite the shortage of raw materials, is destined for combustion. In Italy this percentage approaches 99 percent, a figure that reflects the quality and soundness of the consortium model.

Through this process, multiple environmental benefits can be achieved, including a significant reduction in CO2 emissions, reduced consumption of water and land, and a reduction in energy-related costs, resulting in tangible savings in energy bills.⁸⁷

CONOU was founded in 1982, established by Presidential Decree 691, and until 2017 was known as COOU (Consortium for Compulsory Used Oils). Operating since 1984, CONOU is a non-profit legal entity under private law.

This consortium was the first environmental body at the national level dedicated exclusively to the management of used mineral oils, a waste classified as hazardous. The consortium operates throughout Italy, using a network of about 60 specialized companies, which are involved in the collection and treatment of used oil. The process involves the oil first being collected from workshops and industrial plants, then sorted and pretreated in consortium facilities, and finally sent for regeneration.

From 1984 until 2006, CONOU's activities have made it possible to achieve important results in defense of the environment: - 4.3 million tons of used oil have been collected and reused, avoiding the dispersion of a hazardous waste; - 1.5 billion euros saved on oil imports through the reuse of products obtained from the regeneration of used oil.

⁸⁷ CONOU Report, 2022

CONOU's concessionary collection companies operate under very high quality and safety standards, guaranteed by ISO 9001 (quality) and ISO 14001 (environmental) certifications, as well as EMAS (Eco-Management and Audit Scheme) registration. These standards ensure that the entire process, from collection to final disposal, takes place in full compliance with environmental and safety regulations.⁸⁸

The most important phase of CONOU's operations is the regeneration of used oil. This process takes place in three domestic plants, which boast a high yield: from 100 kg of used lubricating oil it is possible to obtain about 65 kg of regenerated base oil, 22 kg of diesel fuel and 8 kg of purified water, which can be released back into the environment. Only a very small part of the process, about 5 kg, generates waste, which is destined for further valorization. This achievement represents not only an example of technical excellence, but also a concrete saving in terms of energy resources, since about 25 percent of the lubricant base market in Italy consists precisely of regenerated bases.

CONOU not only engages in regeneration, but also in economic support for regenerating companies, offering them financial consideration, provided for in Law 166 of 2009, to ensure that regenerated bases can be marketed at competitive prices in the market. The used lubricating oil collection service is completely free of charge for holders, provided that the oils do not contain substances that prevent their regeneration. Otherwise, the oils are sent for combustion or, in extreme cases, thermodestruction, with the associated costs borne by the producer.⁸⁹

⁸⁸ Equilibri nº119, 2024

⁸⁹ CONOU, Report 2022

4.2 The levels of analysis in the sustainability report

The 2023 Sustainability Report of the National Consortium for the Management, Collection and Treatment of Used Mineral Oils (hereafter referred to as "the Consortium" or "CONOU") provides a comprehensive overview of its economic, social and environmental achievements. This document is a testament to the central role that the Consortium plays within the Italian green economy landscape, contributing significantly to the sustainable management of used mineral oils.

The Report, covering fiscal year 2023 (January 1 - December 31), has been prepared in accordance with GRI (Global Reporting Initiative) Standards by adopting the "in Accordance" approach, which ensures an accurate and transparent analysis of the Consortium's performance. The document has three main levels of analysis, each of which delves into crucial aspects of sustainability.⁹⁰

In the first level of analysis, the Consortium focused on governance and its sustainability performance. One of the central elements of this section was the implementation of materiality analysis, as required by GRI standards. This process made it possible to identify and report on so-called "material issues," i.e., those sustainability issues deemed most relevant to both Stakeholders and the Organization itself. The objective of this analysis is to ensure that the issues addressed in the report accurately reflect the most significant impacts, directing the Consortium's strategic actions toward more responsible and sustainable management.⁹¹

The second level of analysis was devoted to the environment, with a focus on assessing the environmental impact of the used mineral oil collection and treatment system. To obtain an accurate quantification of these impacts, the Consortium adopted the LCA - Life Cycle Assessment methodology, in accordance with ISO 14040:2021 and ISO 14044:2021. This methodology makes it possible to assess the entire life cycle of waste oils, from the time of collection to the final treatment stage.⁹²

The result of the analysis produced nine "midpoint" environmental indicators, including:

- 1. Global Warming Potential (GWP100a) for assessment of greenhouse gas emissions,
- 2. Water Scarcity Index (WSI) for water scarcity,
- 3. Ozone Layer Depletion (ODP) for ozone depletion potential,
- 4. Acidification Potential (AP) for acidification assessment,
- 5. Eutrophication Potential (EP) for impacts related to eutrophication,

- 6. Particulate Matter (PM) for particulate matter in the air,
- 7. Quality Soil Index (QSI) for soil quality,
- 8. Abiotic Depletion Potential fossil fuels (ADP) for fossil resource consumption,
- 9. Human Toxicity (cancer and non-cancer) for human health effects.

These indicators provide an overall picture of waste oil management along the entire consortium value chain, including not only the Consortium but also the main players in the chain, such as the 60 Concessionaires and the 2 Regeneration Companies, to ensure an accurate and transparent representation of the environmental impacts of the entire system.

Finally, the third level of analysis focused on economic and social aspects. This section assessed the creation and distribution of economic value generated by the CONOU system to its Stakeholders, in compliance with GRI standards (Spec 201-1). This analysis made it possible to examine the positive impact that the Consortium has had not only from an environmental point of view, but also in terms of economic and social development, highlighting its contribution to the sustainable growth of the country.⁹³

A sustainability report is structured into several levels of analysis that allow the overall impact of an organization to be assessed from environmental, social and economic perspectives. This subdivision helps to provide a clear and detailed view of the actions put in place by the organization to improve the sustainability of its activities. Generally, the report has three main levels: governance and sustainability performance, environment, and economy and society. Let us look in detail at how each of these aspects is analyzed within the report.⁹⁴

The analysis of the three levels within a sustainability report aims to provide a comprehensive and transparent view of the organization's activities. Each level is interconnected with the others: governance establishes the basis for proper management of sustainability; environmental analysis measures how the organization minimizes negative impacts on the planet; and economic-social analysis assesses how the company's activities contribute to the creation of value for stakeholders while promoting the development of society and collective well-being.

⁹⁰ CONOU, Sustainability Report 2023

⁹¹ CONOU, Sustainability Report 2023

⁹² CONOU, Sustainability Report 2023

⁹³ CONOU, Sustainability Report 2023

⁹⁴ Global Waste of management outlook 2024, ISWA

In this way, the sustainability report becomes a key tool not only for reporting, but also for guiding and improving future strategic choices, demonstrating an ongoing commitment to a responsible and sustainable growth model.

The first level concerns how the organization integrates sustainability into its governance, that is, into its management and control system. In this section of the report, the organization describes the governance model adopted to ensure that sustainability is a strategic and operational priority. The roles and responsibilities of the various decision-making bodies, such as the board of directors, sustainability committees, and managers responsible for monitoring sustainability issues, are explained.⁹⁵

One of the central elements of this analysis is the conduct of materiality analysis, a process through which the organization identifies the sustainability issues that are most relevant, both to stakeholders and to the company itself. This analysis is conducted through stakeholder consultation, which may include surveys, interviews and workshops. Issues considered most "material" are those that significantly affect the organization's environmental, social and economic performance and are reported in detail.

In this section, the organization also presents the results of its sustainability performance, showing how it has addressed sustainability risks and what goals it has achieved. It describes the strategy it adopted to continuously improve its impacts in these areas and how business decisions were geared toward achieving long-term goals.

The second level of analysis concerns the environmental impact of the organization's activities. This is one of the most relevant aspects in a sustainability report, as it provides insight into how committed the company is to reducing adverse effects on the environment and promoting greener practices.⁹⁶

Environmental analysis is often based on the LCA - Life Cycle Assessment - methodology, an approach that assesses the environmental impact throughout the life cycle of products or services offered by the organization. The assessment starts from the collection of raw materials, goes through the production processes, and ends with their use and disposal. This approach provides a comprehensive view of all phases of the life cycle, allowing environmental impacts to be quantified accurately.

Several environmental indicators are usually used in a sustainability report, such as:

♦ Global Warming Potential (GWP): measures the impact on climate change, in terms of

⁹⁵ Global Waste of management outlook 2024, ISWA

⁹⁶ Global Waste of management outlook 2024, ISWA

greenhouse gas emissions.

- ♦ Water Scarcity Index (WSI): assesses the consumption and management of water resources.
- Ozone Layer Depletion (ODP): analyzes the contribution to ozone layer depletion.
- Particulate Matter (PM): measures particulate matter emissions and their impact on air quality.

These indicators provide a range of data to help the organization understand and monitor the impact of its activities on the environment⁹⁷. In the report, input from all key players in the supply chain, such as suppliers, partners and contractors, is also highlighted to ensure a comprehensive assessment of the system and its operations.

The third level of the report focuses on the economic and social impacts of the organization. Here the consequences of the organization's activities in terms of economic value creation and their impact on society as a whole are assessed.

One of the main aspects of this analysis is the creation and distribution of economic value, an element in understanding how much the organization contributes to economic development. In this section, items such as revenues generated, wages paid to employees, contributions to local and national taxes, and investments reinvested in the company or community are reported.

On the social side, the report analyzes the organization's contribution to social responsibility projects, such as educational programs, initiatives to support the local community, or projects to improve the living conditions of its employees. This level also includes inclusion and diversity policies, describing how the organization promotes equal opportunities and protects human rights. In addition, data on working conditions, employee safety and health, and commitment to improving corporate welfare may be included.⁹⁸

This section of the report not only presents economic data, but also seeks to demonstrate how the organization contributes to creating a positive and lasting impact on society by integrating sustainable practices into its daily operations.

⁹⁷ Global Waste of management outlook 2024, ISWA

⁹⁸ Global Waste of management outlook 2024, ISWA

4.2.1 The value chain

The value chain is a useful tool for analyzing and breaking down the value creation process within a company. Conceived and developed as an aid to strategic planning, it enables the identification of costs associated with individual activities and the suggestion of alternative choices to improve their efficiency and effectiveness.⁹⁹

This tool divides the value generation process, or margin, into primary and supporting activities. Primary activities involve specific steps such as input acquisition, processing, distribution, and aftersales support. Support activities, on the other hand, facilitate these operations by serving as a link and integration between primary activities.

The primary activities are arranged in a technical sequence that represents the path followed by the raw materials and semi-finished products until their valorization in the market and in final consumption. This sequence is linear, with no explicit feedback or control mechanisms. The main feature of the value chain, according to the traditional conception, is thus its distinction into well-defined and sequential activities, which are represented graphically in this model.¹⁰⁰

To fully understand the core business of the CONOU Consortium, it is essential to examine in detail the various stages of its value chain. Given the complexity of the operations involved, the value chain has been divided into five main macro-stages, which comprehensively describe the operations conducted by the organization. These stages encompass the entire lifecycle of the oil, from its initial use to its eventual disposal or regeneration through collection and treatment. The five macro-phases are discussed in more detail below¹⁰¹:

1.Oil use by keepers (Upstream).

In this initial stage, keepers (which may be industries, workshops, gas stations, or other professional users) purchase and use oil according to their operational needs. The oil used can be either virgin oil (produced for the first time from raw materials) or regenerated base oil, that is, obtained through the process of regenerating used oil. The choice between virgin or regenerated oil often depends on the technical specifications required by the equipment or the economic and ecological preferences of the user. This stage represents the beginning of the oil's life cycle and lays the foundation for its subsequent management, which will be necessary once the oil has exhausted its lubricating properties.

⁹⁹ (Porter, 1985)

¹⁰⁰ CONOU, Sustainability Report 2023

¹⁰¹ CONOU, Sustainability Report 2023

2.Used oil collection and delivery to CONOU (Upstream).

Once the oil has completed its cycle of use, it becomes used oil and must be properly managed to avoid its dispersion into the environment and to be able to start it to a new life through regeneration or disposal. At this stage, the CONOU-authorized dealer is responsible for collecting used oil from the various holders, which may be industries, machine shops, service stations or ecological islands. The collection is done according to established protocols to ensure the safety and quality of the process. Once collected, the oil is transported to the dealer's facility, where it is temporarily stored until it reaches the minimum quantity required for delivery to the CONOU depot. This step is crucial to ensure centralized and controlled management of used oil, avoiding potential environmental risks.

3.Operations: used oil analysis and storage (Direct).

CONOU's main activity takes place at this stage, which is the heart of the operational process. Once the used oil is received, CONOU is responsible for analyzing its qualitative characteristics to determine the most appropriate destination. The analysis is essential to identify any contaminants or impurities in the oil, which could affect its subsequent treatment. Based on the results obtained, the used oil is directed to one of two main routes: regeneration or thermodestruction. During this phase, CONOU uses its depots for temporary storage of the oils, ensuring that they are kept in safe conditions before being destined for the next stages of the life cycle.

4.Used oil regeneration or thermodestruction (Downstream).

Following the analysis conducted in the previous step, the used oil is sent to one of two main treatment options. The first option, when the oil is found to be suitable for recovery, is regeneration: in this process, the oil is sent to specialized plants that transform it into regenerated base oil, which can be put back on the market for new uses. Regeneration saves significant resources and reduces the environmental impact associated with the production of new oil. If, on the other hand, the used oil has contamination or other characteristics that make recovery or energy recycling impossible, it is destined for thermal destruction. This process involves the controlled destruction of the oil through specialized incinerators, ensuring the neutralization of hazardous compounds and the least possible environmental impact.

5.End use and end of product life (Downstream).

The last stage of the value chain concerns the return of regenerated or disposed oil to the circular economy. The regenerated base oil is sold to new end-users, such as industries, gas stations, or garages, who will use it in their operations. Once used again, this oil can be reintroduced into the collection and regeneration cycle, closing the product life cycle in a virtuous circular economy system. Alternatively, if the oil has reached a point where it is no longer reusable, it will be disposed of safely, ensuring compliance with environmental regulations. This step testifies to the importance of responsible management of oil throughout its life cycle, maximizing resource recovery and minimizing waste.

4.2.2 Quality Control

The quality standards for used oil, which determine whether the waste is destined for Regeneration or combustion or, in the worst case, thermodestruction, have been in place since 1996 with the tables of Ministerial Decree 392, which established the parameters for the selection of used oil. With the 2008 and 2018 European Directives, the Consortium has expanded its role in sorting used oil, also taking on the very delicate task of prioritizing to regeneration used oil of a quality compatible with regulations and plant operation.

Quality, in the CONOU Supply Chain, is the key to success for Circularity: the management of incoming Quality determines the possibility of obtaining a regenerated product that is not B-series; a regenerated A-series base easily re-enters circulation and the wheel can keep turning.¹⁰²

The Consortium carries out this activity directly, using laboratories run by specialized companies one for each regeneration site, following a competitive bidding process held in December 2020; SGS oversees the Lodi depot, Lab-Analysis the one in Ceccano, and Amspec the one in Naples.

In these three laboratories, an extensive set of analyses is carried out for each tanker truck that the Collector wishes to deliver to the Consortium to verify DM 392 standards.

During 2023, the Consortium carried out about 8,000 sets of analysis of used oil, verifying, in detail and with certainty, the original hypothesis formulated for the individual tanker by the Collector, and based on his knowledge of the producer of the waste, the periodic characterizations carried out by him, and preliminary analyses conducted at his own authorized depot.

¹⁰² CONOU, Sustainability Report 2023

The proper destination control barrier established by Ministerial Decree 392 in 1996 has always guided the Consortium, on the one hand, to ensure adequate support for those who must regenerate and, on the other hand, to compliance with environmental regulations in the treatment of a hazardous and polluting waste such as used oil. The effects of such sorting are sometimes disputed precisely because of their economic significance. It is clear that "it makes a difference" between using 30 tons of used oil in regeneration instead of sending it to the less profitable combustion or, worse, to the expensive thermodestruction in special facilities. ¹⁰³

For these reasons, the Consortium has initiated with UNICHIM the process of updating the methods provided by the DM itself, aiming to conduct the measurement of DM 392 parameters with modern methods, but, at the same time, confirming the value of the control thresholds.

¹⁰³ CONOU, Sustainability Report 2023

4.2.3 Governance

The current Governance of CONOU, reformed with the approval of the new Statute in 2017, fully complies with Law 4/2008, which supplements the Consolidated Environmental Act. This update ensured the participation within the Consortium of all actors involved in the used oil supply chain, organized into four specific categories of consortium members.¹⁰⁴

The Consortium's Governance model was designed with the objective of ensuring strategic and efficient management of activities and resources, enabling optimal operational implementation of established strategies. As an entity with a consortium nature, the Consortium has unique characteristics in terms of representing the interests of the different categories of consortium members, ensuring that all parties have an equal voice in the decision-making process.

CONOU's corporate governance system is divided into various bodies, each with specific tasks and responsibilities:¹⁰⁵

- Soard of Directors: The main decision-making body that manages the Consortium's activities.
- Assembly of Consortium Members: The place where categories of consortium members meet to discuss and deliberate on the most relevant issues.
- Board of Auditors: Responsible for auditing the accounts and the regularity of the Consortium's activities.
- President and Vice President: They represent the leadership of the Consortium and ensure its strategic direction.
- Dues Committee: Body responsible for managing the dues and holdings of consortium members.
- The four categories of consortium members

The Consortium is composed of four categories of consortium members, each representing a specific stage or segment of the oil supply chain:

¹⁰⁴ CONOU, Sustainability Report 2023

¹⁰⁵ CONOU, Sustainability Report 2023
Category	Consortium members
А	Enterprises that produce, import or market virgin
	base oils.
В	Enterprises producing base oils through
	regeneration processes.
С	Enterprises engaged in the collection and
	recovery of waste oils.
D	Enterprises engaged in the collection and
	recovery of waste oils.

Table2: classification of categories of CONOU members

CONOU's governance system, which is structured to ensure equal representation of the four categories, makes it possible to balance the interests of the different stakeholders. Thanks to this structure, all actors, regardless of their role in the used oil supply chain, can be guided toward achieving the Consortium's common goals. The inclusion of all categories ensures a coordinated and participatory decision-making process. In 2023, CONOU continued to invite companies that, while contributing financially to the Consortium, had not yet acquired consortium status, allowing them to actively participate in consortium life. This led to the membership of an additional 18 companies, thus covering the total quantity of lubricating oils released for consumption by these companies.¹⁰⁶

The Consortium is managed by a Board of Directors, composed of 14 members elected every three years by the Assembly of Consortium Members. The current board, appointed on May 24, 2021, reflects a diverse representation in terms of gender and age:

- 9 directors (including the Chairman) are men over the age of 50 (65 percent of the total);
- 2 directors are men between the ages of 30 and 50 (14%);
- 3 directors are women, of whom 2 are over 50 years old (14%) and 1 is between 30 and 50 years old (7%).¹⁰⁷

¹⁰⁶CONOU, Sustainability Report 2023

CONOU has implemented an effective system for the management of internal and external reports, in accordance with Legislative Decree 231/2001 and updated according to the legislation on Whistleblowing (Law 179/2017). Reports are addressed to the Supervisory Board (SB), which ensures the safe and transparent management of the information received.

The Consortium provides a toll-free number, managed by the Legal and Procurement Department, which is also responsible for General Services. These services are responsible for receiving inquiries from the public and directing them to the appropriate divisions to provide timely and comprehensive responses.

A set of policies and procedures have been implemented within CONOU that govern all consortium activities, in line with the guidelines issued by the major trade associations and ratified by the President. These procedures outline the rules of conduct for the various business processes, while also providing for internal controls necessary to ensure fairness, efficiency and transparency. Each policy is managed by a designated manager, in accordance with the Consortium's internal organization and governance system.

The organization of the Consortium is divided into three main Directorates, each with specific responsibilities and tasks.¹⁰⁸

The Technical-Operational Directorate is responsible for supervising the companies involved in the collection and disposal of materials, managing collection contracts, used oil sales, and storage and analysis operations. It also provides technical and regulatory support to industry operators, including working on updating and adapting used oil regulations.

The Administration, Finance and Control Department (AFC) is responsible for the financial management of the Consortium. Its tasks include the management of the Consortium Contribution, preparation of the annual budget and balance sheet, monitoring of management performance, and economic and financial analysis. In addition, it takes care of tax and contribution requirements and provides necessary ICT services. The director of this directorate is also responsible for Occupational Health and Safety, supported by an external consultant who serves as the Prevention and Protection Service Manager (RSPP).

Finally, the Legal and Procurement Directorate, established in December 2021, is responsible for contract management for the purchase of goods and services, as well as overseeing legal services, switchboard, secretariat and General Services. Thanks to this new directorate, the Consortium has

¹⁰⁷ CONOU, Sustainability Report 2023

¹⁰⁸ CONOU, Sustainability Report 2023

been able to strengthen its internal legal oversight over the past two years, developing specific skills to effectively manage legal and regulatory issues.

CONOU's organizational model is based on the efficient management of activities related to the collection, storage, classification and final treatment of used oil throughout Italy. The Consortium operates in accordance with fundamental principles such as free competition, effectiveness, efficiency and cost-effectiveness, always guaranteeing the protection of health and the environment, with particular attention to the protection of air, water and soil.¹⁰⁹

In compliance with European regulations, CONOU adopts the principle of the waste hierarchy, established by Article 179 of the Environmental Code, which gives priority to waste prevention and preparation for reuse. The Consortium particularly prioritizes regeneration of used oil over other forms of recovery or disposal.

CONOU works with about 3,000 contributors, of which 1,013 are Consortium members, who play a key role in the used mineral oil collection and regeneration system, supporting the transition to a circular economy model. Consortium members come from different sectors, all related to the lubricating oil life cycle, and include:

- Oil companies, which actively participate in the production and distribution of lubricating oils, integrating the used oil cycle with the new oil cycle, thus creating a virtuous cycle.
- Lubricating oil importing and distributing companies, which ensure that the oil, once it becomes waste, is properly managed, ensuring its traceability and disposal.
- Used oil collection companies, specializing in the collection and storage of oil at workshops and industrial plants, preventing the risk of dispersion into the environment.
- Used oil regeneration refineries, which transform the collected oil into new lubricating oil, reducing the use of natural resources and environmental impact.
- Machine shops and fuel distributors, which collect used oil from automobiles and industrial equipment, ensuring its proper disposal and recycling.¹¹⁰

¹⁰⁹ CONOU, Sustainability Report 2023

¹¹⁰ CONOU, Sustainability Report 2023

4.3 The Conou system and its supply chain

For the concessionaires Collectors, The Consortium plays a very important hinge role among the companies in the Supply Chain, as well as being a role model, not only for its work, but also for the degree of awareness and information it is able to convey, contributing to the growth and evolution of collection companies.

The CONOU collection team, which was born and has developed with the CONOU, has now expanded its expertise and facilities to include numerous other wastes as well (batteries, tires, vegetable oils, electrical equipment, other types of scrap...) while maintaining its adherence to principles and standards that make it a qualified system and, moreover, also attractive to investors from high-level groups, including those that are not only Italian. For Producers, the Consortium remains, in addition to being the fundamental tool to cover their responsibility for the hazardous waste their products generate, a standard bearer and forerunner of their commitment to the energy transition that now sees them all heavily involved.¹¹¹

Lastly, Regenerators see in the Consortium a great ability to bring order to the system's flows, keeping their guard up on the quality of used oil and on the legal and environmental compliance of those who are their key suppliers and, at the same time, they can rely on the attention to the qualification of any new regenerators who are called upon by CONOU to comply with the rules and uniform standards for all.

Collection, the heart of the Consortium's environmental function, is the activity that guarantees, on the one hand, lubricant producers (committed by the Manufacturer's Extended Responsibility system to take care of the proper disposal of used waste generated by their customers) and, on the other hand, the users of lubricants themselves, who are subject to criminally binding regulations regarding the duration and size of temporary storage of waste with them. In other words, the Consortium, at the behest of the lubricant producers, must "collect" i.e., make sure that the users never have a problem getting rid, within the timeframe prescribed by the regulations, of this hazardous waste.

In 2023, the network of Concessionaires in the CONOU system has 59 companies that have fulfilled about 297 thousand withdrawal requests (86% used oil and 14% emulsions) from about as many as 103 thousand holders (89% used oil, 6% emulsions and 5% both oil and emulsions) distributed throughout the country. Used oil only collection requests are distributed with the following

¹¹¹ CONOU, Sustainability Report 2023

percentages: from the automotive sector comes 92% of used oil collection (much more fragmented), the industrial sector contributes 8% of the collection (with a very high average intake from 1.2 tons). Directly collected oil is about 175,000 tons, although oil delivered is about 8,000 tons more (183,000 tons) due to the contribution of oil recovered from emulsions and filters.

In 2023, the lubricant market showed substantial stability, with consumption in the light automotive sector increasing, while industry-related consumption remained unchanged. While lubricant base prices remained high compared to historical values, they were lower than the peaks recorded in 2022.¹¹²

At the macroeconomic level, according to Bank of Italy forecasts, national GDP grew by about 0.7 percent in 2023 and is expected to increase by 0.6 percent in 2024, accelerating to +1.1 percent in both 2025 and 2026. Inflation, which reached +5.9% in 2023, is expected to moderate to +1.9% in 2024 and continue to decline, reaching +1.7% in 2026.¹¹³

Under this economic scenario, the market for lubricating oils has recovered after the downturn in 2022. Specifically, national consumption of lubricating oils increased from 384,000 tons in 2022 to over 387,000 tons in 2023, marking a growth of 0.9 percent. Within consumption, there is a slight prevalence of the industrial sector, which absorbed 51.5 percent of the total oils placed on the market, compared to 48.5 percent for automotive.¹¹⁴

Micro-collection, traditionally divided into three bands, is designed to encourage the collection of even small amounts of used oil by including hard-to-reach areas. In this context, loads of intermediate weight, between 200 and 400 kg, account for 27 percent of the tons collected. Heavier loads, above 400 kg, make up 25%, while lighter loads, below 200 kg, account for 10%.

From 2022, a new contract band was introduced for micro-collection, covering loads between 720 and 1000 kg, with the aim of offsetting the higher costs associated with collection at non-industrial sites. This band contributed 38% to micro-harvesting in 2023.

Micro-harvesting is a key component of the Consortium's mission. Although the market is competitive among Concessionaires-Collectors, the environmental goal remains a priority. The incentive for micro-harvesting stems from the complexity of the situation: on the one hand, Concessionaires are obliged to collect oil anywhere and in any quantity; on the other hand, they operate in a competitive environment without territorial allocation. The Consortium plays a crucial

¹¹² Bank of Italy, Economic Bulletin No. 1, 2024.

¹¹³ Bank of Italy, Economic Bulletin No. 1, 2024.

¹¹⁴ International Monetary Fund (IMF), 2024

role in balancing collection costs, which vary depending on the reachability of sites and the volume of the collection, helping to maintain a balance among the different geographic areas of Italy. These differ not only in spatial and infrastructural characteristics, but also in the variety of industrial and production settings.

The success of micro-collection depends heavily on the deep-rooted presence of Concessionaires in the territory, established relationships with waste producers, and the in-depth knowledge of the collection areas gained by drivers over time. Despite the introduction of digital tools, the human factor continues to be essential to the smooth operation of the system.

Regeneration activities are another key part of the Consortium's environmental commitment. Collecting used oil is not enough: it is imperative to prioritize regeneration, as required by European Union directives, avoiding less sustainable uses such as combustion. Regeneration is crucial to ensure the complete circularity of mineral oil in Italy, making the country an excellence at the European level.

After the sorting process conducted by the Consortium, used oil is directed, through free bargaining between Collectors and Regenerators, to one of three certified regeneration plants in Italy. These plants, originally built in the 1960s, have been constantly upgraded to ensure that regenerated bases are competitive with those produced from the most modern oil derivatives.¹¹⁵

¹¹⁵ CONOU, Sustainability Report 2023

Conclusion

This thesis analyzed the waste sector in the context of a transition to a circular economy, with particular attention to its impact on biodiversity. Starting with an overview of the regulatory framework governing the sector, both globally and in Italy, we saw how waste management has become a central issue for economic and environmental development, with increasingly stringent regulations aimed at promoting sustainable practices.

In the first chapter, the definition and classification of waste was addressed, illustrating how its management is not only an environmental issue, but also an economic one, with global implications. The analysis of Italian and European regulations showed how the regulatory framework is essential to ensure effective management in accordance with environmental protection principles.

The second chapter delved into the waste market in Italy, showing growth trends and competitive dynamics. The waste industry in Italy has seen strong expansion, with an increase in the number of operators and a growing diversification of services offered.

The analysis of the main companies in the sector showed how they are at the forefront of the transition to a more sustainable management model, exploiting innovative technologies and integrating circular economy principles.

In the third chapter, the role of companies in waste management was examined, focusing on the Sustainability Report as a tool for measuring corporate commitment to sustainability. The key role that international standards such as GRI 306: Waste 2020 play in guiding companies toward more responsible waste management practices was highlighted. In addition, the importance of small businesses in the transition to the circular economy was analyzed, highlighting their potential contribution in reducing environmental impact.

The CONOU case provided a concrete example of how a consortium can transform a hazardous waste such as used mineral oil into a resource, through an efficient and sustainable model that aligns with the goals of the circular economy and the preservation of biodiversity. The success of CONOU, which regenerates more than 99 percent of the used oil collected, demonstrates how waste management can be combined with environmental protection and economic development.

In conclusion, the waste industry faces a crucial challenge: that of becoming a leading sector in the transition to the circular economy, reducing environmental impact and contributing to the protection of biodiversity. The regulatory framework, technological innovation, and corporate commitment, as demonstrated by the CONOU case, will be key to ensuring that this transformation is successful. The adoption of sustainable practices and the promotion of virtuous models such as CONOU's represent not only an environmental necessity, but also a growth opportunity for the future of the entire waste sector.

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