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**The circular economy of Italian enterprises
in the international market: opportunities
for growth and development.**

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Introduction

Since the early 2000s, the international political, economic and social scenario has experienced significant changes and transformations, resulting from the following factors: globalization, digital transition and hyper-connectivity in transnational relations have generated a complementarity of markets, but at the same time, have caused high levels of competitiveness, giving rise to fierce competition between countries in the Euro-Atlantic area and those in the Indo-Pacific area.

Recent years have witnessed a gradual shift in the center of gravity of international affairs from the Euro-Atlantic to the Indo-Pacific area, resulting in an erosion of the dominant position of the United States and the European Union to the benefit of new competitors-particularly China and India-which, endowed with high potential in structural, economic and demographic terms, are trying to grab ever larger shares of the global market.

At the same time, within the international political, economic and academic world there has been a growing awareness of environmental and social issues, stemming from the realization that the economic-productive policies pursued to date have caused serious consequences in terms of environmental pollution, scarcity of available resources, and climate change.

These negative effects are further implemented by demographic trends projected to increase significantly for the foreseeable future globally.

Against this complex and dynamic backdrop, go the recent crises that, beginning in early 2020, have further contributed to changing the balance of the international chessboard: the first, of a sanitary-economic nature resulting from the spread of the Covid-19 pandemic; the second, of a geopolitical, humanitarian and economic nature, caused by the invasion of Ukraine.

In particular, the Russian-Ukrainian crisis has produced significant consequences within the European Union regarding the functioning of the energy and supply market, causing increases in the cost of raw materials such as mineral resources and fossil fuels.

Given the importance of the issue, the policies pursued by the institutions of the European Union - in implementation of precise guidelines of international rank, with which Italy is also required to comply - are aimed at implementing strategies to boost the competitiveness of the industrial sector at the international level and, at the same time, implementing resilience, sustainability and strategic independence from abroad.

Increased awareness of population growth - a phenomenon deemed inevitable in the near future with the forecast of a world population of about 9 billion people by 2025 - and the insufficiency of natural resources (particularly raw materials) to meet an ever-increasing global demand, have necessitated the adoption of economic policies capable of reconciling the needs of development with the demands of future generations to see the same rights and expectations recognized as those of current generations.

For these reasons, as documented throughout this paper, major international organizations (UN, OECD, EU) are pursuing a plurality of projects and initiatives on the issues of sustainability, which is known to be one of the main objectives to be pursued in the current political, industrial and academic rationale.

In this context, the domestic industrial sector is facing quite a few challenges and changes, making it necessary to invest in strategies aimed at increasing productivity and international competitiveness through reducing dependence on raw materials from abroad and implementing resilience and strategic autonomy.

In line with the policies of the European Union, Italy is required to implement economic growth models based on the criteria of sustainability and corporate social responsibility, which are able to ensure greater convergence between economic-financial interests (profit), rational exploitation of the environment and available resources, and reduction of pollution.

Said models must be able to effectively balance economic profit with "hot" social, environmental, political, economic, and cultural issues.

Based on these premises, this paper aims to examine the issue concerning the circular economy *business model* and its applicability to the domestic industrial sector, with the goal of making it more competitive, less dependent on the consumption of nonrenewable resources and more responsive to new demands from a growing and evolving global market.

The paper first provides a general description of the circular economy as an "innovative" alternative *business model* to the traditional linear economy based on the concept of "*take - make - dispose*" (transl: supply-produce - use - discard).

The paper goes on to describe the concept of *Corporate Social Responsibility* (CSR), which, particularly in recent years, has become a key factor in a company's success, given that a company's economic value is no longer expressed solely by its ability to produce goods or provide services, but also by its "overall impact" on the social, economic and environmental context of reference.

The economic value of a company can be attributed, fundamentally, to a wide range of factors, such as: the *human capital* employed (*human capital*), awareness of its environmental impact, open dialogue with *stakeholders* (both direct and indirect), reputation with the public, and the implementation of sustainability policies.

This is because successful strategies based on *Corporate Social Responsibility* (CSR) should lead to better performance not only financially but to an increase in the overall value of the enterprise.

This is followed by a discussion of the five ways in which this *business model* can be applied in the manufacturing sector: 1) circular supply chain; 2) product life cycle extension and waste minimization; 3) sharing; 4) recycling and recovery; and 5) product as a service.

The second chapter describes the current international competitive scenario, with particular reference to the policy strategies pursued by European Union institutions to foster circular economic models that are based on climate neutrality and sustainable growth through the pursuit of the following objectives:

- 1) Strengthening the resilience of the single market;
- 2) Reduction of foreign dependence in strategic technological and industrial sectors;
- 3) Implementation of the green and digital transition.

After an analysis of the national production sector, an analysis of some "*case studies*" having as their subject the circular economy in Italian companies will be proposed, with the aim of demonstrating the existence of the prerequisites for the applicability within the system-Italy of the circular *business model*, in a framework of effective balancing between productivity needs and objectives of social, environmental and cultural sustainability.

Lastly, some considerations will be given regarding the growth and development prospects for the near future resulting from the adoption of the circular model.

CHAPTER I: THE CIRCULAR ECONOMY

1. The circular economy: an "innovative" *business model*

The term circular economy denotes a *business model* based on the application of the concepts of energy needs, reuse, recycling, sharing and sustainability at different stages of the value chain.

This is a *business model* that has been gradually spreading from academia to international political and economic circles with the aim of overcoming (*rectius* replacing) the traditional model of production and consumption defined as "linear" with an "innovative" one, in which the value of resources, materials used and products made is maintained within the economic system for as long as possible.

The adoption of the circular model presupposes, in fact, a clear break from previous economic-productive theories, because it is based on a completely "innovative" conception of economic activity, based on: 1) minimizing environmental impact; 2) saving on raw material supply costs; 3) durability, reparability, reuse and recycling; and 3) increasing competitive capacity.

Before describing the characteristics, operation, and goals that can be pursued through its implementation, it is deemed useful to make an important clarification regarding the concept of circular economy.

From a strictly theoretical-scientific point of view, a fully circular economic system is "closed" to relations with the external environment; in reality, a fully circular economy is not feasible because the economy and the external environment are two "open" systems, capable of exchanging matter and energy with each other, albeit within a range of variation from "zero" (total absence of circularity) to "one" (maximum level of circularity).

This means that the economy and the external environment must always be regarded as two "open" systems, capable of exchanging matter and energy with each other; in this reciprocal relationship, the environment plays a key-role because it is the source that provides the economic system with the natural resources that enable it to produce goods and provide services, and receives the waste materials of production and waste at the end of their use.

At the same time, increased use of renewables does not imply increased circularity since the use of solar or wind energy instead of fossil-derived energy only implies the substitution of one source for another: in other words, an economic-productive system that uses

renewable sources in (progressive) substitution for fossil sources is based on the logic of pollution reduction, but not on the logic of circularity.

That being said, a description of the "innovative" concept of circular economy is given.

From a strictly economic-productive point of view, the circular economy enables the creation of value by minimizing the negative impact on the environment and resources, while at the same time ensuring high levels of growth and the ability to respond to changing market needs and demands.

The circular economy has "innovative" characteristics compared to traditional economic models based mainly on the concepts of "*take - make - dispose*," because it aims to effectively reconcile the needs of business productivity and competitiveness with the goals of sustainability.

It is based, in fact, on the adoption of production logics based on the practices of recovery, reuse, recycling, extension of the useful life of manufactured products, sharing and cooperation.

The goal of the circular economy is, in fact, the valorization of "secondary raw materials," i.e., those sources and resources that can be obtained by extending the life cycle of products, reducing business waste, recovering and recycling, and sharing.

According to an interesting industry study, the circular economy constitutes an economic-productive model capable of causing significant change in all the stages that make up the supply chain, from the (initial) supply chain to the (final) consumer use.

As will be discussed in more detail below, its implementation can be implemented through five different ways (referred to as "circular capabilities"), depending on a number of factors, particularly organizational structure and business type:

1. circular supply chain "from the beginning": this is a business logic that provides direct access to renewable, recyclable or biodegradable raw materials.
This seeks to achieve less volatility in prices, which are more controlled and not subject to sharp rises;
2. recovery and recycling: the goal of recovery and reuse is to derive resources from the production *outputs*, i.e., business waste products, so that they can be reused in alternative production processes in the same enterprise, or sold to other enterprises.
3. extension of product life: this is the ability to derive the greatest possible value from each individual unit of resource consumed; it is achieved by developing products that are as durable as possible over time, through upgrades, replacement and replacement services;

4. sharing platform: the option provides the possibility of creating sharing platforms to connect owners of consumer goods with users interested in using them. By allowing shared access to manufactured products and/or their co-ownership, for the end consumer the costs associated with the purchase of the manufactured product are reduced;
5. product as a service: companies retain ownership of the product made which, is offered "for use" to consumers through agreements. Thus, the responsibility (and costs) related to the maintenance and disposal of products does not fall on the end consumer, but remains with the producer.

The study also notes that the benefits achievable, over a medium- to long-term time horizon, through the adoption of the circular model are significant and range from better management of available resources to savings in primary energy costs; in addition, there is a reduced amount of waste and emissions produced.

Thus, the circular economy represents an "innovative" way for businesses to manage value creation through the reuse of available resources and, at the same time, an effective solution to issues such as scarcity of available resources, population growth and volatile commodity prices.

One of the difficulties for its implementation is the low propensity of enterprises to replace the linear *business* model of resource consumption with the circular one.

This behavior, according to some industry studies, can be attributed to the following factors:

- 1) risk aversion on the part of corporate *leadership*: top decision makers are afraid of making investments to move from a linear model to a circular one, which could jeopardize the life and operations of the company and, as a result, its reputation with the various stakeholders- first and foremost, customers-with whom it has relationships. The reasons are related not only to the lack of clear industry regulations, but also to the scarcity of incentives and funding;
- 2) lack of adequate financial resources to deal with an effective *business* model change path;
- 3) lack of *governance* that is capable of assessing the potential benefits of adopting such a *business model* and, consequently, planning the company's *mission* over a long-term time horizon and taking advantage of the opportunities that the market offers in terms of expansion and, consequently, implementation of competitiveness.

2. Circular Economy and *Corporate Social Responsibility*

The circular economy is an economic-productive growth model closely linked to the concept of corporate social responsibility.

The concept of *corporate social responsibility* (CSR) has an interdisciplinary nature and *rationale*, as it involves not only the "typical" function of the company, which is to produce profits, but also the relationships it weaves with the external environment.

In a nutshell, the CSR concept encompasses those business strategies that aim to satisfy three needs simultaneously: economic, social and environmental.

In this perspective, we can speak of the responsible behavior that the company assumes towards all its *stakeholders*, both internal and external to it, with whom it interacts directly and indirectly: employees, suppliers, consumers, public authorities, free institutions, etc.

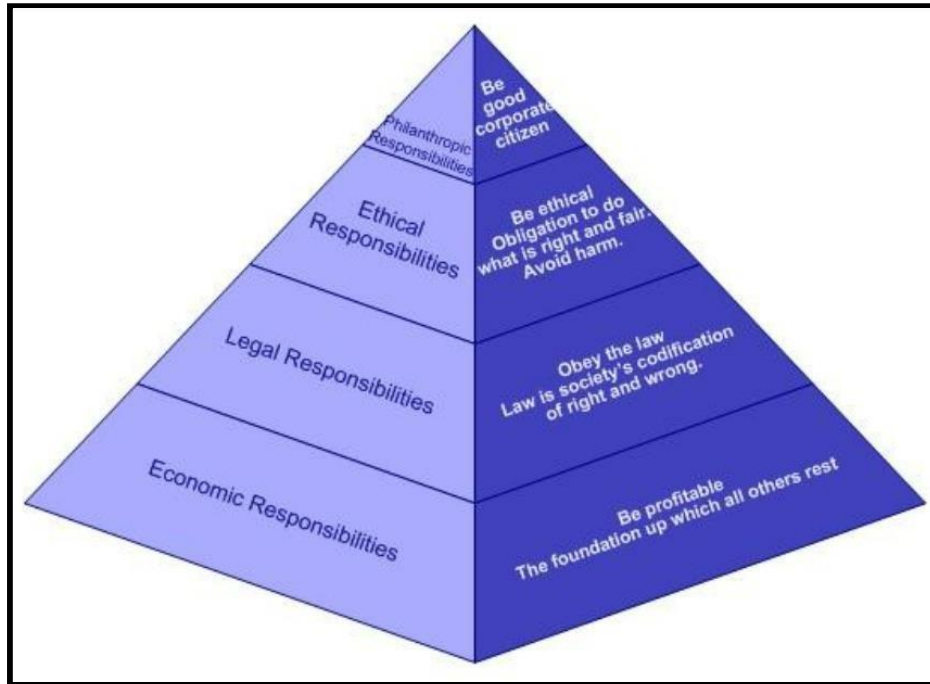
Over the years, the concept of corporate social responsibility has undergone various interpretations in the business literature.

CSR implementation can occur as a result of initiation by corporate *management* (*top-down* approach) or by employees (*bottom-up* approach).

In particular, the early 1970s saw the spread of the neo-classical theory, which considers the enterprise as an economic entity possessing a plurality of "duties" towards a wide range of subjects and social demands from outside.

As a result, its objectives are not only that of mere profit, but also to invest in factors such as human capital, the environment, and relations with the various stakeholders-particularly consumers-with whom it interacts.

This conception was taken up and deepened by the economist Carroll, who embedded corporate social responsibility within corporate *management* strategies through the provision of a multi-level "pyramid" in which the corporate *mission* can be divided into four "planes."



Source: INAIL (2018) *Corporate and organizational social responsibility.*

Starting from the bottom, economic responsibilities related to the (mere) realization of profits emerge; on the second "floor" are legal responsibilities (compliance with legal regulations); this is followed by ethical responsibilities comprising authenticity and transparency, prerequisites for maintaining a high reputation with *stakeholders*; and at the top is indicated philanthropic responsibility, which consists of implementing all necessary actions to contribute to environmental and social sustainability.

According to Carroll, a company is socially responsible when it is able to combine its own interests with those of all those with whom it interacts directly or indirectly.

Other theory notes that corporate social responsibility assumes that in order for companies to carry out effective *business* strategies, they must focus their *mission* toward three areas, which are closely interrelated and marked by "3 P's" (so-called *Triple Bottom Line*): *planet*, (*Planet*), *people* (*People*), *profit* (*Profit*). The "3Ps" theory has points in common with the concept of circular economy, because it places economic, environmental and social issues on the same level, highlighting the need for businesses to adopt eco-sustainable organizational behaviors and processes that provide for the effective use of (limited) natural resources.

The more recent literature, building on the definition provided by the neo-classical orientation of the 1970s, has used the term "CSR *awareness*" to refer to the increased sensitivity on the part of corporate *governance* to social and environmental issues over a long-term time

horizon: in line with this orientation, it is possible to speak of expanded or "*multi-stakeholder*" *governance*.

In recent years, the concept of CSR has undergone a tremendous evolution in view of the increased sensitivity on the part of academia, politics and business to the "hot" issues plaguing society, particularly growth in environmental pollution, reduction of available resources, and climate change.

For this reason, recent guidelines advocate the adoption of *business* models that are responsive to the needs of sustainability, recovery, reuse, collaboration and capable of producing clear positive environmental, social and economic impacts.

In the current view of the economic literature, the main objective of corporate social responsibility is to contribute to the minimization of impacts on society, environment and resources and, at the same time implement the social value of companies in terms of improving reputation, transparency, reliability in a long-term time horizon.

From this perspective, the concept has a number of points of convergence with the circular economy, particularly in aspects concerning the verification of socio-economic-environmental impacts and the benefits that economic activity can bring

These goals are achievable through the promotion of programs and incentives that effectively minimize negative impacts on the planet while intensifying resource optimization and reuse activities.

3. The application of the circular model to the business world

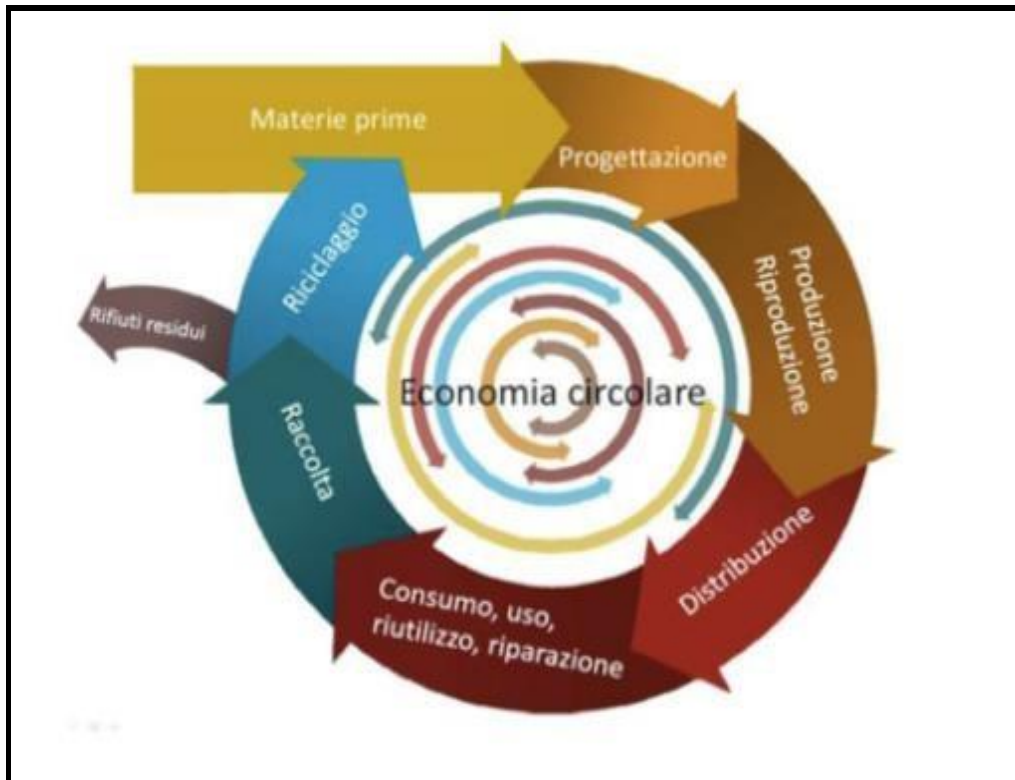
Applying the principles of the circular economy to the business environment on the one hand requires a radical transformation of the *business* model (from linear to circular), and on the other is an opportunity to create new business models to generate competitive advantages through improved resource management, and reduced waste and emissions generation.

As anticipated earlier, the majority literature on the circular economy has theorized the configurability of five different *business* models-also referred to as "core pillars"-adoptable by companies, depending on their organizational structure and *mission as* well as risk appetite:

- 1) the circular supply chain; 2) reuse and recycling; 3) product life extension; 4) sharing; and
- 5) product as a service.

The chart below describes the five "key pillars" that make up the circular economy

and the benefits that can be achieved through the adoption of such a *business* model.



Source: Ministry of Ecological Transition, *National Strategy for Circular Economy*, 2022

Choosing the *business model* that best fits a company's organization and *mission* is not an easy task; since these are long-term strategies, it is crucial for companies to choose the right model and understand the obstacles and benefits of adopting it.

For this reason, corporate *leadership* is required to carry out a series of assessments having to do with the following factors: 1) the ability of their organization to sustain the *business* model change; 2) the capital to be invested in the project; 3) the risk appetite; 4) the model to be adopted; 5) the *process* to be undertaken to implement the model; and 5) the external reference environment.

This means that the enterprise must proceed along two basic lines of development, internal and external: from an internal point of view, the enterprise must be able to implement its ability to innovate from both *managerial* and organizational perspectives. From an external point of view, the enterprise must carefully examine the competitive environment in which it is operating and the existence of an environment-regulatory, political, logistical-that is capable of supporting such *business* change.

In the following sections, the aforementioned models will be discussed in detail in order to understand their operation and purposes.

3.1 The circular supply chain

The circular supply chain is a *business* model that provides for the establishment of "virtuous" synergies and collaborative relationships among all actors-economic, administrative and political-that, directly or indirectly, are part of a *supply chain* (suppliers, manufacturers, industrial organizations, research and development institutions, government agencies etc.) and that share geographic and economic proximity. The model is applicable to all stages of the *supply chain*, from the initial sourcing of resources and raw materials, through the production of the good, to the (final) stage of bringing the product to market for consumer enjoyment.

The circular supply chain presupposes an all-inclusive approach, through which enterprises present within a specific territorial economic sphere promote and develop interrelationships based on the exchange and sharing of *know-how*, technologies and skills, in complete "industrial symbiosis," so that the *output of* one company can be used as an *input by* another company within its own production process.

The direct benefit of implementing such an economic model is the possibility of realizing economies of scale. Added to this is the reduction in costs due to lower consumption of sources and resources, reduced environmental impacts, and reduced waste generation. On the other hand, companies wishing to adopt it face a number of upfront costs to facilitate the transition from the linear to the circular model; these costs include expenses for research and development and deployment of technologies that enable access to and use of renewable, recyclable or biodegradable raw materials.

3.2 Reuse and recycling

One of the principles underlying the linear economy is that *"if resources and energy sources are available at competitive prices and the impact of their consumption on the environment is not a cause for significant concern, the linear model can lead to excellent results."*

In the current economic-productive scenario, which is characterized by the progressive scarcity of raw materials from fossil sources and the increase in their cost in international markets (think, in particular, of the growth in the prices of the main *commodities* such as oil, natural gas, copper), access to primary resources is an issue of strategic importance.

Through reuse and recycling it is possible to recover products and resources that can be re-introduced within new production cycles.

Reuse and recycling are part of those *business* strategies that are able to provide an end-of-life asset with new value, because they make it possible for it to be re-inserted within a new production cycle and, at the same time, produce significant economic savings for companies that are able to implement such an economic model.

Reuse and recycling are, in fact, two models intended to extend the *life cycle of a* consumer good.

They pursue the following objectives: on the one hand, they help to maximize the efficient management of resources and raw materials intended for the production of consumer goods; on the other hand, they stand as a viable alternative to the linear economy because, through the reintroduction within the production cycle of recovered materials, they extend the life cycle of products and minimize waste generation.

For some time now, the institutions of the European Union have been pursuing targeted policies that have as their main *focus* the transition of the industrial sector to sustainability and climate neutrality; as will be discussed in more detail below, these policies are based on the implementation of "innovative" ways of sourcing energy sources through reuse and recycling.

The goal is to implement a gradual reduction in foreign dependence, especially in those production sectors for which competition is increasingly high.

In particular, the European Commission has highlighted that the logics of reuse, recycling, and minimizing waste generation are the actions with the absolute highest endorsement among those for which consumers show a greater propensity to commit.

Within this framework, the policies of each member country, including Italy, must be oriented toward the implementation of effective interventions, both conjunctural (e.g., through the provision of tax relief, exemptions and tax credits for economic operators who decide to invest in the sustainable) and structural (replacement of current production systems with others that aim to "value" all three phases of the *supply chain*, from resource sourcing and production to distribution) to restore value through recovery and recycling.

As far as structural interventions are concerned, it is essential to implement economic systems oriented primarily toward the two dimensions of reuse and recycling, which, in application of the concept of "zero waste" (literally, "zero waste"), allow waste and obsolescence to be valorized, transforming them into new *inputs* to be re-inserted within production processes.

As is well known, the linear *business* model implies that a production waste i.e., a good that has reached the end of its useful life, becomes waste for landfill.

On the contrary, their recycling and reuse provides that added value in terms of savings for their procurement.

Consider, for example, the recovery and re-introduction within production processes of "*Critical Raw Materials*" (CRMs including lithium, cobalt, titanium, nickel, which have a high supply risk and are critical to ensuring the digital and ecological transition) and "rare earths" that are key components for renewable energy (wind and solar) and the operation of electric batteries.

3.3 The concept of *life cycle assessment* and product life extension

Closely related to the circular economy are the concepts of *life cycle assessment* and product life extension.

The concept of *life cycle assessment* (LCA) constitutes one of the tools - *rectius* "indicators" - used by environmental accounting - a branch of official statistics that deals with the analysis of the interactions that exist between the economy and the external environment (or, more generally, between the anthropic system and the natural system) - to understand the efficiency of the economic systems adopted, the intensity of the use of natural resources in production processes, the impact of these production processes on the environment, the degree of "materiality of lifestyles etc.

In this framework, *life cycle assessment* means the evaluation of the overall impact produced on the environment by the performance of all activities associated with the production of a good (or provision of a service), its use and final disposal. Specifically, the assessment covers the following aspects associated with the production of a good or provision of a service: amount of energy consumed, raw materials used, production processes adopted, and waste generated. The purpose of this assessment is to formulate suitable proposals containing the solutions and technologies to be adopted to reduce the environmental impact.

In this regard, a recent *Paper* prepared by Cassa Depositi e Prestiti notes that one of the requirements that can provide companies with the ability to be competitive in the near future is the adoption of effective solutions and technologies that enable product life-cycle

monitoring, an essential prerequisite for *eco-design*¹.

Therefore, the concept of *life cycle assessment* is linked to that of reuse and recycling, in that the assessment of impacts on the environment makes it possible to understand and manage the complexity of the supply chain-both upstream and downstream of the production process-to identify critical issues and formulate solutions that achieve savings and recovery of materials and energy.

In addition, the circular economy involves extending the useful life cycle of goods for consumption, aimed at minimizing the impact on the environment and resources in terms of waste generation, but without risking becoming less competitive or incurring large production costs.

Reducing waste through production logics and models aimed at extending the life cycle of products-keeping them in their original function and maximizing their economic value-are certainly preferable goals to material recovery alone because they minimize waste for disposal.

Extending the useful life of a product allows, in fact, its extended use, over a long-term time horizon, with less exploitation of available resources and less pollution in the production phase.

It is, therefore, a *business model whose goal is to target upstream* circularity through obtaining the greatest possible value from the realization of an asset for the public.

Of course, this goal requires that the design, implementation, and maintenance phases be implemented in such a way as to enable the repairability, reconditioning, and upgrading of the same over time with the goal of disincentivizing the purchase of new products.

In fact, the advantage for companies derives from the longevity of the product (and not from the high quantity brought to market), which allows them to intervene over time with maintenance and updating activities.

In order to be implemented effectively, such a *business model* requires, not only the development of a service and maintenance network that allows consumers to receive the necessary support, but also "educational" initiatives towards consumers so that they change their behavior: the way they choose products, use them and finally get rid of them determines consequences towards the environment and resources.

¹ *Eco-design* is one of the 10 dimensions that make up circularity: of these, 7 are economic and environmental in nature (*eco-design*, sourcing of materials and resources, consumption of materials and resources, waste management, waste and emissions, transportation and distribution, promotion of sustainable lifestyles, circular supply chain) and 3 are social in nature (shared value and territorial communities, social inclusiveness, environmental standards and recognition)

For this reason, initiatives toward consumers to educate them toward "new consumption patterns" that are oriented toward respect for the environment and resources are a key tool for achieving greater awareness of the need to help the planet and, consequently, implementing a change in habits by the greatest number of *stakeholders*.

3.4 The sharing or sharing platforms

The sharing or *sharing* platform is a *business* model consequent to the profound changes and transformations that have characterized the economic, political, social and cultural scenario in recent years, which has been strongly affected by the spread of digitization and globalization.

In an increasingly interconnected, competitive and unstable global market, the sharing platform can be an effective organizational strategy aimed at obtaining economic and competitive advantages from the sharing and transfer of a wide range of resources among economic players, including materials, energy by-products, water, tools and skills, *know-how*, technologies, by-products, *databases*, waste, etc.

The synergies and interactions that result from the adoption of such a model produce economic, environmental and social benefits (lower resource consumption, avoided environmental impacts, local enhancement of resources) thus realizing *win-win* logics in which all actors involved can benefit from each other's interactions.

Part of the literature defines the model as an "*industrial symbiosis*" (IS) involving a plurality of companies that agree to cooperate within a "*network of ecological innovation and cultural transformation over a long-term horizon*," in an integrated manner, so that the *outputs* produced by one business operator can be reused as *inputs* by another business operator within its own business process.

From a practical point of view, the model makes it possible to optimize the use of resources and achieve both economic and environmental benefits: from an economic standpoint, companies are more competitive because they benefit from access to cheaper resources, avoiding disposal costs and/or gaining additional revenues from the sale of by-products; from an environmental standpoint, community benefits result from reduced resource consumption and reduced waste generation.

As will be discussed in more detail in the last chapter, an example of "industrial

symbiosis" is the SUN (*Symbiosis Users Network*) network implemented in 2017 by ENEA, which promotes a *business* model that combines the need for productivity with research and development activities aimed at safeguarding the environment and the territory.

The project, the first in Italy, involves 39 *stakeholders* including research institutions, universities, public administrations and economic operators, who collaborate with each other to pursue the following common goals: boosting competitiveness, reducing dependence on raw materials; promoting the improvement of the industrial economy and implementing resilience through the provision of "territorial ecosystems" that are able to absorb any exogenous imbalances, achieve economic benefits and minimize the impact on the environment and resources.

3.5 The product as a service

Product as a service or "servitization" (from English *servitization*) constitutes a *business model* that is based on the rationale whereby companies, while continuing to retain the right of ownership of a manufactured product, grant it for use to the consumer for a fee that also includes the provision of a range of related services.

These include the following *business* types: 1) performance-based agreements; 2) rental; 3) lease; and 4) *pay-per-use* formula.

The majority literature uses the concept of *Product Service System* (PSS) to describe initiatives in which companies provide customers with a product that they retain ownership of while providing a range of collateral services, such as service, maintenance and repair, and end-of-life disposal.

In detail, the adoption of the model enables a number of benefits, both for the producing enterprise and the consumer:

- 1) differentiation from its *competitors* through an offer of collateral services that accompany the product throughout its life cycle;
- 2) consumer loyalty;
- 3) Maximization of product life and reuse of end-cycle components.

Add to this the obvious positive impacts produced toward the environment and resources because the model avoids obsolescence and reduces waste generation.

4. Monitoring systems

To date, there is no universally valid and recognized indicator to monitor all the progress made at the macro (system-country), meso (industrial areas, production and material supply chains, geographic areas and industrial districts) and micro (individual companies, individual local government units) levels through the addition of the circularity model.

This is mainly due to the following factors: each supply chain has its own specificity; economic operators belong to heterogeneous market segments; and each company has its own internal organization and *mission that is* different from its *competitors*.

For these reasons, identifying a "transition index" or assigning a "score" does not adequately capture the complexity and multiple aspects related to the transition to such a *business model* (think, for example, of the coexistence within the same market segment of companies that have long since adopted circular systems and others that are in transition).

While waiting for the standardization of monitoring systems, the following plans and programs on circularity have been issued within the European Union, in accordance with the guidelines emanating from the UN's "2030 Agenda for Sustainable Development" (containing the so-called "17 Sustainable *Development Goals*," Sustainable Development Goals, SDGs in environmental, economic, social and institutional matters)²: the New Circular Economy Action Plan (CEAP) and the *Green Deal*³.

In the context of these programs and projects-which will be discussed in more detail in the second chapter-CEAP highlights the importance of strengthening the systems for monitoring the plans and measures adopted by each member state in order to verify the progress made-at the level of system-countries, geographic areas and individual production realities-in the processes of transition to the circular economy.

Within this framework, as far as Italy is concerned, the multiple transition "indicators" have been brought back to the following four macro-areas:

1. production and consumption: as far as production is concerned, the *performance* achieved in production processes is measured in terms of efficiency, that is, the economic value generated per unit of material consumption (so-called resource productivity); while consumption is evaluated in its twofold dimension, that relating to the use of available

² In this sense, UN, *2030 Agenda for Sustainable Development*, 2015 at www.agenziacoazione.gov.it

³ EUROPEAN COMMISSION, *Communication from the Commission, The European Green Deal*. COM/2019/640: In a nutshell, the *Green Deal* indicates a plurality of policy initiatives that aims to steer the European Union toward a green transition with the ultimate goal of pursuing climate neutrality by 2050.

resources and that relating to waste generation;

2. waste management: the capacity in waste management and recycling through the construction of facilities and the implementation of processes that allow their collection and subsequent re-introduction within production cycles is assessed;
3. secondary raw materials: the ability to obtain "new" resources from production waste, i.e., recycling and reuse processes, in order to meet the demand for raw materials is assessed. This means checking the possibility of reintroducing materials obtainable from production waste and recycling processes within the production cycle as new raw materials;
4. competitiveness and innovation: the assessment of competitive and innovative capacity presuppose the analysis and evaluation of the effectiveness and efficiency of the "typical" pillars of the circular economy: recycling and reuse of waste, maintenance and repair, and reuse.

Despite the high level of interest expressed by the international community in the implementation of models that enable the monitoring of transition processes to the circular *business model*, there is an awareness that, to date, much still needs to be done to enable a measurement of circularity.

As will be discussed in more detail below, effective implementation of circular policies would enable the entire country-system to reduce dependence on foreign countries and strengthen national industrial and strategic autonomy through strengthening the recycling and waste recovery supply chains.

CHAPTER II: THE INTERNATIONAL COMPETITIVE LANDSCAPE

1. The international competitive scenario

Since the early 1990s, we have been witnessing a series of changes and transformations in the international geopolitical, economic and social framework. Over the years, in fact, the phenomenon of globalization has gone beyond the purely economic dimension to expand into political, social, technological, and cultural dimensions as well.

As shown by a study concerning the future of international competitiveness, these changes and transformations can be traced to five interrelated "trends."

1. Aging global population and widening social disparities;
2. shift of economic weight and political power to the Asian continent;
3. technological and digital revolution;
4. Increased consumption and prices of raw materials and energy;
5. Greater interdependence among countries.

The entry on the scene of new major *players-primarily* China, flanked by other emerging economies from Southeast Asia (India) and South America (Brazil)-has led to the spread of economic models based on the concepts of *offshoring* and fragmentation of production processes: consider, for example, that in recent years most digital devices placed on the market constitute the result of a set of interrelated activities and phases-research, development, production and distribution-that are carried out, for the most part, in countries distant from those of end use.

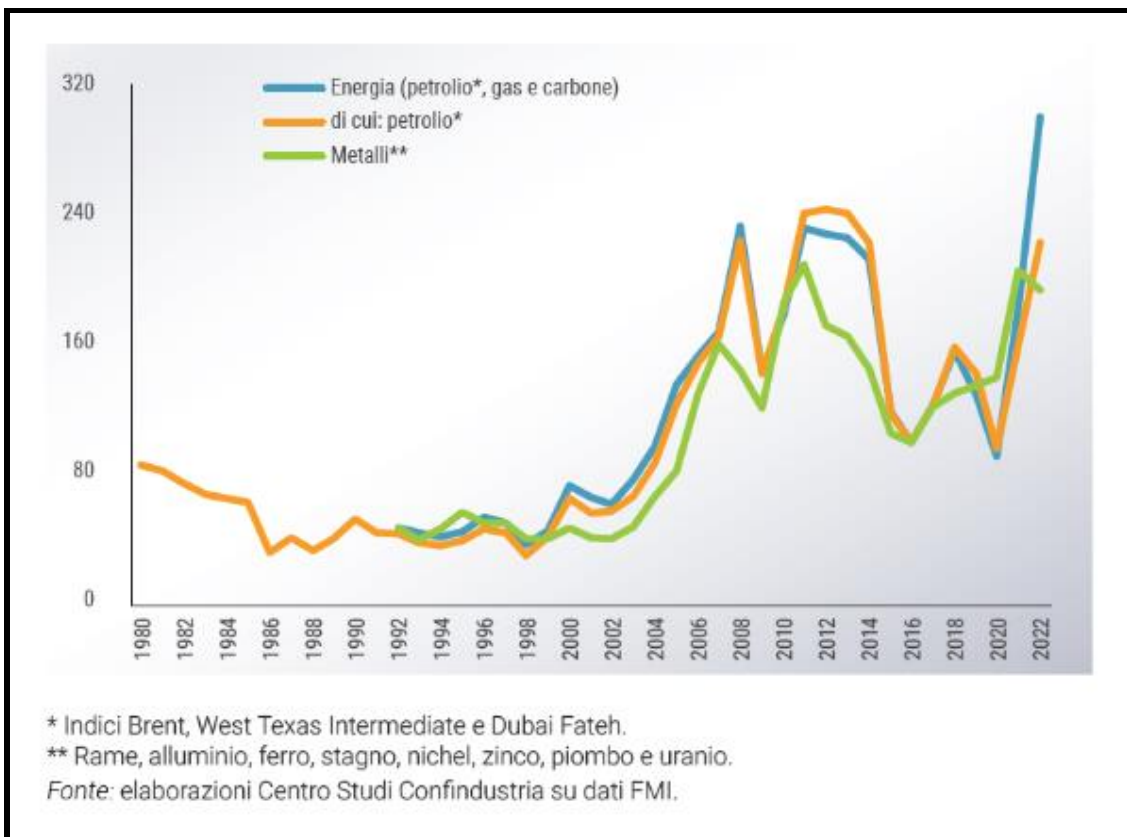
The combination of all these dimensions, descended from the evolution of the globalization phenomenon, is called hyper-globalization.

The international scenario has been further enriched by recent events since early 2020 that have greatly affected global competitiveness: the Covid-19 crisis and the Russian-Ukrainian crisis.

The Covid-19 pandemic and Russia's invasion of Ukraine have, in fact, highlighted that global supply chains can undergo serious disruptions very quickly.

The two crises have, in fact, contributed to a condition of uncertainty in international markets, which, in turn, has led to *shock* situations on supply chains and sudden rises in the prices of raw materials (minerals, energy and vegetables) and semi-processed goods (food, textiles, plastics etc.).

As illustrated in the graph below, over the three-year period from 2020 to 2022, the price trend of the main global commodities-oil, coal and gas-has been sharply upward.



Source: Centro Studi Confindustria, 2023, in www.confindustria.it

The graph shows that the price increases in energy commodities that occurred from the first half of 2020 (coinciding with the onset of the pandemic crisis from Covid-19) continued through 2022 (coinciding with the continuation of the Russian-Ukrainian crisis).

According to one study, the main reasons for the prolonged price increases of fossil raw materials are the difficulties connected with their supply in international markets; this is compounded by the phase of market uncertainty and a sharp slowdown in productivity.

The resulting economic downturn has profoundly affected the functioning of production processes, highlighting a number of fragilities in the economic models implemented so far even in those sectors characterized in recent years by high levels of *performance*.

This scenario does not seem likely to improve at least in the short term, given that for the remaining 2023 the global economic trend does not seem to provide clear signs of recovery.

A recent analysis conducted by ISTAT confirmed that the main causes of the rise in

raw material costs and the slowdown of the industrial sector in the old continent are to be found precisely in the Russian-Ukrainian crisis, which has greatly affected global supply and demand trends and provoked inflationary pushes that have not occurred for several decades.

However, the crisis in the East of the European Union does not seem to be destined to be resolved in a short period of time: the increasing isolation of Russia implemented by the countries of the Euro-Atlantic area has led to a gradual rapprochement of Moscow toward China, which, as is well known, requires large amounts of energy resources and raw materials, in particular gas, to feed its productive industrial fabric.

For this reason, the Asian giant's growing demand for energy sources could be met by Russia itself, given that the two countries have recently entered into a series of oil and gas supply agreements.

The current snapshot of the international competitive environment, therefore, shows a complex and highly dynamic scenario: the global GDP growth rate has fallen from 6.2 percent in 2021 to 3.4 percent in 2022; during the same period, that for world trade in goods and services by volume has decreased from 10.4 percent to 5.4 percent, *primarily* due to the rise in commodity prices that characterized almost all of 2022, and then began to decline between the end of the year and the beginning of 2023.

Data in hand, the two crises and price increases in energy, agricultural and industrial commodities that have characterized the three-year period 2020 - 2022 have produced significant impacts on the dynamics of production sectors, international trade and producer prices.

Against this backdrop, the main challenge facing the European and global economy in the near future concerns the sudden strains that can hit commodity supply chains-especially in the energy sector-and the consequences they are capable of causing vis-à-vis production processes in terms of reduced *exports* and sales, inflation and rising labor costs.

For these reasons, the transition to climate neutrality and the reduction of dependence on fossil fuels is an issue of strategic importance and an effective solution to promote the revitalization of global competitive capacity.

For several years, major international organizations (UN, OECD, EU) have been carrying out a plurality of projects and initiatives to encourage sustainable development, environmental protection⁴

The U.N. 2030 Agenda and the 2015 Paris Agreement indicate the guidelines needed

⁴ The United Nations Framework Convention on Climate Change, also known as the Rio Accords, is an international treaty signed in 1992 and ratified by 196 member countries.

to guide the transition to economic development models that have as their main goal not only the achievement of profitability and profit, but also social progress and the protection of the environment and resources.

Specifically, the Paris Agreement on climate change contains an "action plan to limit global warming" that requires signatory countries to pursue the following binding targets:

- 1) Implement sustainable economic growth by committing to keep the global average temperature below 2°C above pre-industrial levels and to continue efforts to limit it to 1.5°C;
- 2) Submit National Action Plans to promote *green* technology innovation to reduce respective emissions
- 3) Provide climate finance to developing countries to help them reduce emissions and become more resilient to counter the effects of climate change.

The 2030 Agenda for Sustainable Development is an action agenda to strengthen resilience for people, planet and global prosperity while preparing the world for future *shocks as the* twin green and digital transitions begin. The Agenda was signed into law in 2015 by the governments of the 193 member countries of the UN and contains 17 *Sustainable Development Goals* (SDGs) that are part of a broad program of action comprising a total of 169 "targets" or milestones that countries have declared they will pursue by 2030.

The following image describes the 17 Goals to be pursued.



Source: 2030 Agenda for Sustainable Development at <https://unric.org/it/agenda-2030/>

With regard to the preservation of the planet and ecosystems, the UN Agenda promotes more rational and sustainable management of natural resources by a growing global population through the implementation of production and consumption patterns based on sustainability and reduced degradation of natural environments (Goal No. 12⁵ and Goal No. 13⁶).

With this in mind, the UN Agenda proposes that states implement intervention policies in the two "dimensions": (Ministry of Ecological Transition, 2020)

1. *upstream* of production processes by providing measures to ensure more efficient management of available resources and reduction of waste; the aim is to maintain the value of products and materials as much as possible;
2. downstream of production processes (*downstream*), preventing anything that still inherently possesses residual utility from being disposed of in landfills rather than being recovered and reintroduced into the economic system.

These two "dimensions" constitute the *core value* of the circular model whose main goal is to make production activities more efficient and less harmful to the environment.

From this perspective, the implementation of the Goals by national governments will contribute to combating climate change, reducing future economic, environmental and social costs, improvements in economic competitiveness and poverty reduction.

2. The strategies of the main *competitor* countries regarding the circular economy

The term *competitor* is used to refer to those countries in the Indo-Pacific region that, in recent decades, have emerged on the global competitive scene with the aim of eroding the dominant position of the West (*primarily the* United States, the United Kingdom and the European Union) within the international geo-political chessboard through the acquisition of ever larger market shares, giving rise to fierce competition with countries in the Euro-Atlantic

⁵ Goal 12 aims to "Ensure sustainable patterns of production and consumption." The Agenda promotes the practical implementation of such models because they are able to implement the benefits in terms of social welfare. In particular, they contribute to the reduction of resource use, the decrease of degradation and pollution in the production cycle, and the improvement of quality of life;

⁶ Goal No. 13 aims to "Promote action, at all levels, to combat climate change." The Agenda highlights that climate change is a global challenge because it affects all countries in the world. Since greenhouse gas emissions are the main cause of climate change, all producing countries are required to take action through national policies that are geared toward circularity of production and consumption processes and reducing their impact on the environment.

area.

The opening of new outlet markets and the fragmentation of production processes globally have greatly transformed the ways in which economic players operate, making the international competitive scenario more complex and dynamic.

In recent years, in fact, countries such as China, India and Brazil have been directing their production strategies toward the adoption of circular economic models, with the aim of making the productivity of the industrial sector more competitive and efficient and, at the same time, fostering environmental sustainability and the "regenerative approach" through optimal waste management, reuse and recycling.

In the roster of new *competitors*, therefore, China, India, Brazil deserve special attention:

1. China is among the major emerging economies that, since the early 2000s, has shown a willingness to make a concrete commitment to the transition from the linear to the circular economic model, putting itself in line with the goals pursued by major Euro-Atlantic economies such as the United States, the European Union and the United Kingdom. In fact, over the past two decades, the Beijing government has been moving toward the promotion by the manufacturing sector and citizens, of behavior patterns geared toward the dissemination of the circular *business model* that include the enhancement of resource reuse and the extension of the life cycle of products.

Indeed, the transition to a circular economy is seen as an effective strategy for creating new value in terms of economic growth and improved living conditions for the population. With this in mind, the Beijing government has directed its efforts toward implementing the domestic manufacturing sector with the aim of creating new market opportunities abroad for those enterprises in the sector that decide to invest in *green* strategies.

In July 2021, the Chinese government approved the "*14th Five-Year Plan for the Development of the Circular Economy*," which envisions, as a national priority, the implementation in the five-year period from 2021 to 2025, of a plurality of programs and initiatives containing measures aimed at developing the circular economic model through the enhancement of recycling, remanufacturing, *green* product design and the use of renewable resources.

The "*14th Five-Year Plan*" is a key component of China's broader climate strategy as the Beijing government aims to achieve a "*carbon neutral*" national production system by 2060, after decades of heavy industrialization and uncontrolled economic growth that have resulted in pollution of the environment and resources and problems such as soil

deterioration, water depletion and biodiversity loss. The "*Plan*" is based on the implementation of the following lines of action:

1. Promotion of research and development activities for the realization of an industrial system that operates through green supply chains and is capable of clean production through recycling of renewable resources, regeneration and reuse of "second-hand" resources;
2. Incentivizing the use of waste material recycling systems through the enactment of regulatory measures that incentivize such activities and provide financing tools for companies that switch from the linear to the circular model;
3. development of a national agricultural circular economy, including through the creation of consortia to develop the establishment of agricultural waste recycling facilities.

The Beijing government stipulates that all initiatives, programs and projects-including those pertaining to the circular economic model-are to be implemented in three different "organizational levels": 1) macro: includes villages, provinces and cities; 2) meso: includes symbiotic associations, and industrial parks (eco-industrial parks, EIPs and supply chains); 3) micro: includes individual organizations, such as their products and services). With this in mind, consistent with the "*14th Five-Year Plan*," tremendous efforts have been made within each of the three "organizational levels" to implement effective recycling systems for industrial, agricultural and material waste reuse.

Nevertheless, the current snapshot of China's manufacturing scenario shows that, twenty years after the introduction of the circular model into national policies, a number of issues such as challenges in coordinating inequalities between geographic areas and the lack of a unified research and development policy toward *green* models, condition the path for implementing a concrete transition to the circular model.

2. India is the world's third largest consumer of resources and raw materials: about 80 percent of its domestic energy demand is met by polluting fossil resources such as coal, oil and solid biomass.

The sectors that consume the most raw materials and rare earth elements are, in fact, electronics and electricity. In order to make efficient use of resources and raw materials, in May 2021 the Ministry of Electronics and Information Technology published a draft policy paper, titled "*Circular Economy in the Electronics and Electrical Sector*," containing a "*roadmap*" for a concrete transition to the circular model. The *Paper* calls for the implementation of plans and projects to facilitate the transition of the domestic

manufacturing sector to the circular model through the involvement of all stages of the *supply chain*, from raw material acquisition, to product design, to consumption, including the end-of-life, collection, recycling and reuse of secondary materials stages.

According to a report published in 2021 by the *International Energy Agency* (IEA) titled "*India Energy Outlook 2021*," the Asian giant is expected to become the world's most populous nation in the near future.

With this in mind, the goal of the New Delhi government is to implement long-term programs and projects to preserve and optimize natural capital, ensuring a longer product life cycle, and addressing the challenges of end-of-life products (e-waste) by 2040.

Last June 2023, the second edition of the *India Circular Economy Forum* was held in New Delhi, which was attended by business *leaders*, political representatives and experts from around the world. The *forum* was an opportunity to analyze the main solutions that the country is adopting on circular economy and the opportunities and competitive advantages that this *business model* can provide in the near future to the national manufacturing sector, in line with the sustainable development goals emanating from the United Nations.

3. Brazil is a major *player in Latin America*, characterized by a relatively stable economy, a plurality of natural resources, and emerging green technologies that are capable of facilitating its energy transition to sustainable goals.

The country covers a vast territory, divided into "major geographic areas," each of which has its own climatic characteristics and different levels of development; industries are mainly concentrated in the country's southern and southeastern regions, within which about 56 percent of the population lives and where the most efficient logistics infrastructure is located. The implementation of the circular model can be an important opportunity for growth and "value creation" for the country, given Brazil's unique characteristics, such as large amount of available natural resources and the considerable size of the domestic market, both in terms of territory and population.

However, the presence different socio-economic and territorial conditions (the most developed geographical areas are flanked by others that are in extreme backwardness) are still the main obstacle to the improvement of the country's economic, social and environmental conditions and, consequently, to the introduction of the models of corporate sustainability and circular economy.

Nonetheless, the central government is pursuing a number of initiatives and projects that focus on the transition to circular models through the reduction of natural resource use and the valorization of waste materials and products.

Said initiatives and projects are based on the pursuit of the following macro-objectives: 1) implementation of industrial waste recovery activities; 2) improvement of municipal solid waste selective collection capacity; and 3) reuse and recycling in the final stage of product life.

On the legislative side, in order to facilitate the transition to circularity, the Brazilian central government has issued a series of regulatory measures by which it assigns responsibility to the national production sector for control activities of all aspects concerning the life cycle of products, from the raw material procurement stage to the marketing stage. The goal is to further implement raw material valorization and product recovery and recycling activities at all stages of the *supply chain*, consistent with urban and rural population growth⁷.

In May 2022, the Economic Commission for Latin America and the Caribbean (ECLAC), the Embassy of Italy, the Embassy of the United Kingdom, and representatives of the Italian energy giant ENEL organized a meeting under the Declaration of Circular Cities of Latin America and the Caribbean, downstream of which a blueprint was outlined containing a series of courses of action to be implemented by the five major Brazilian cities (Santo André, São Caetano do Sul, Rio de Janeiro, Maricá and Curitiba) ^{that} have joined it.

The goal is to identify all areas where development plans can be implemented to achieve the transition to the circular economy, taking into account what is stipulated by current regulations and possible *business* models that can be adopted to accelerate the transition.

4. As far as the African continent is concerned, a number of major states have launched a number of projects and initiatives related to the circular economy. In particular, in the capital cities of Nairobi in Kenya, Accra in Ghana and Cape Town in South Africa, the *Circle City Scan Tool* pilot project has been implemented for some time now, which involves the creation of *open data* platforms containing socio-economic data, photo collections and *case studies* to which local governments can have access in order to acquire information useful for the implementation of programs and projects for the transition to those circular models that best suit the local reality: collection and recycling, waste reuse, *sharing* and life-cycle extension.

The main goal of these programs and projects is to achieve "circular cities" that are able to involve even informal settlements and neighboring urban conglomerates (so-called *slums*).

Although major international organizations have been promoting the implementation of programs and projects to benefit individuals, the planet and prosperity for decades, the

⁷ This is the so-called "waste prevention policy."

current snapshot of the global scenario still shows clear differences between more industrialized and developing countries.

In particular, within the 17 Sustainable Development Goals that are part of the UN 2030 Agenda, the one related to promoting inclusive, sustainable and environmentally resilient urban development has significant *gaps*: while in Europe, North America, Latin America, and East and Southeast Asia, at least three-quarters of the inclusive policies pursued by national governments are in the concretization stage, in Oceania (excluding Australia and New Zealand), in many regions of sub-Saharan Africa and West Asia, about 60 percent of urban policies are still in the early stages of development.

This means that, as of today, most developing countries still lack access to technologies and infrastructure that would enable a transition to the circular model.

4. European Union strategies for transition to circular economy

In a global context of increasing economic competition and frequent disruptions in commodity supply chains, European institutions have long been committed to implementing growth policies aimed at "virtuously closing" the life cycle of products.

The above growth policies call for the realization of an economy with the following characteristics by 2050: 1) zero carbon emissions; environmental sustainability; 3) banning toxic substances; and 4) complete transition from the linear to the circular model.

The Covid-19 pandemic and the Russian-Ukrainian crisis have, in fact, put a strain on the European Union's production apparatus, highlighting a number of fragilities related to foreign dependence on raw materials, which are necessary for the functioning of the domestic market and the support of international competitiveness.

In this context, the European institutions are aware of the need to achieve a more ecological and digitized economic and industrial system that will empower Europe toward resilience and strategic autonomy. The acceleration towards the circular model is, therefore, not only an opportunity for the revitalization of the economy of the old continent, but an irreversible path to strengthen competitiveness on a global scale. (Senate of the Republic, 2022).

The first concrete steps in the circular economy date back to 2015, when the European Commission, through the Circular Economy Action Plan (CEAP COM/2015/614) called "*Closing the loop - An EU action plan for the Circular economy*," promoted the first

package of measures to accelerate the transition to the circular economic model in the five key areas concerning production, consumption, waste management, secondary raw materials and innovation, and investment.

The 2015 Action Plan identifies a set of guidelines for member states to facilitate the process of transforming the European economy from an essentially linear (take-make-use-dispose) model to an entirely circular one (European Parliament, 2019).

The Plan is in line with two previous *Papers* issued in 2011, the *Roadmap to a Resource Efficient Europe* (COM (2011) 571) and the *Seventh Environment Action Programme* (7th EAP).

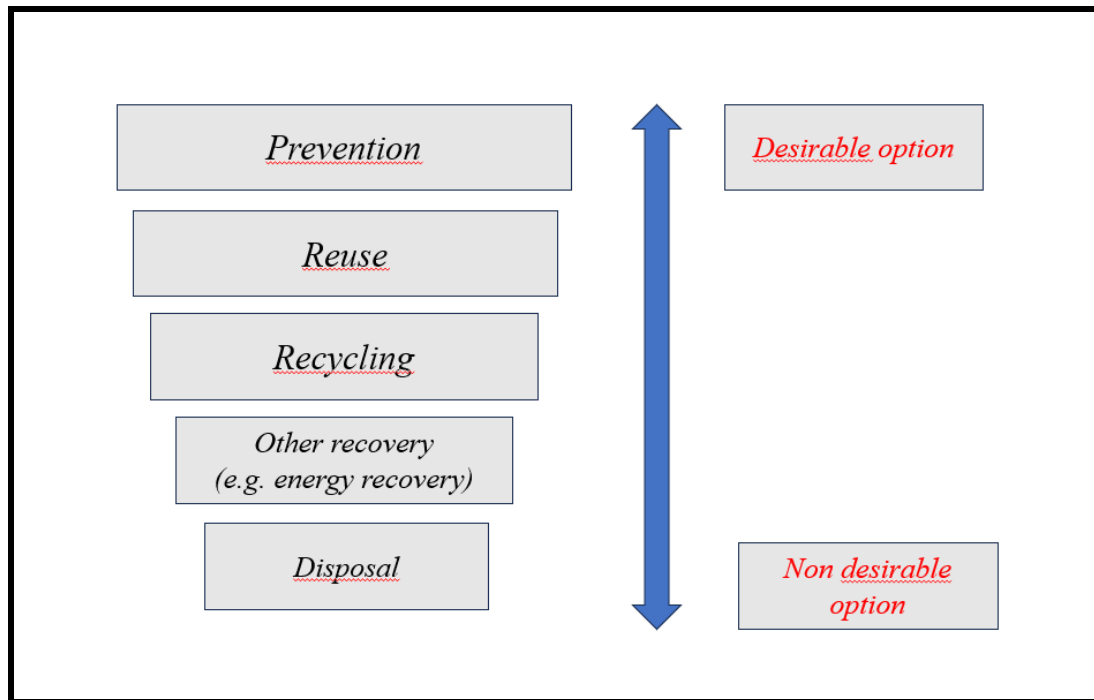
The goal is to facilitate the transition of the European production fabric to the circular model through the active involvement of all *stakeholders*, from policymakers to end consumers through interventions both "upstream" and "downstream" of production processes (Cassa Depositi e Prestiti, 2020):

1. "upstream," through the implementation of measures that enable more efficient management of available raw materials and resources, in order to increase productivity and, at the same time, reduce waste;
2. "downstream," through reducing landfilling (the solution of last resort according to the European strategy) and promoting more desirable options for all waste that still inherently has residual utility.

The importance of the Action Plan lies in the provision of a hierarchical system of resource management and waste treatment activities; the system provides for different "levels" each of which indicates a different "practice" to be implemented to meet the *requirements of* the circular model.

At the highest "level" are included the activities with the highest value, such as waste reduction and waste prevention; at the next level are included reuse and recycling activities; and at the lowest levels are included, respectively, waste recovery activities to be reintroduced into productive civil nuocations (so-called "secondary" raw materials) and landfilling.

The graph below, prepared by Cassa Depositi e Prestiti, shows the hierarchical system of waste treatment that can be traced back to the circular model. The graph shows, at the upper end, the desirable (most virtuous) option and at the lower end, the undesirable (least virtuous) option.



Source: CASSA DEPOSITI E PRESTITI, *Circular Economy 2020*, P. 5

As part of the initiatives stemming from the Action Plan, the European legislature, in order to effectively implement waste management and treatment systems from a more circular perspective, has enacted the following regulatory measures:

1. Directive 2018/851/EU, which stipulates that 65 percent of municipal waste must be recycled by 2035 (interim targets are to recycle 55 percent of municipal waste by 2025 and 60 percent by 2030); in addition, the Directive introduces the concept of "*extended producer responsibility*," stating that "the producer of a good has both financial and organizational responsibility for managing the entire life cycle of the product he has made. This responsibility covers all stages of the *supply chain*: from the (initial) procurement of raw materials to the (final) treatment of the waste after its use by the consumer;
2. Directive 2018/852/EU, which states that 70% of packaging waste must be recycled by 2030; the Directive sets different percentages for each material used (30% wood, 55% plastic, 60% aluminum, 75% glass, 80% ferrous metals, 85% paper/cardboard);
3. Directive 2018/850/EU requiring the landfilling of less than 10 percent of municipal waste by 2035; the Directive also prohibits the landfilling of separable waste.

The objectives pursued by the European legislature through the enactment of the aforementioned regulatory measures are to: (1) encourage prevention in waste generation; (2) implement reuse and recovery activities; and (3) ensure optimal waste management over a long-term time horizon.

In the second half of 2019, the European Parliament, four years after the Circular Economy Action Plan was issued, declared a climate emergency, calling on the Commission to implement further action to reduce emissions by 55 percent by 2030 (so-called "Ready for 55 percent" package) while achieving climate neutrality by 2050⁸.

With this in mind, in January 2020, the European Commission unveiled the *Green Deal*, an "Investment Plan for a Sustainable Europe" containing the roadmap to achieve a "*climate-neutral, resource-efficient and competitive*" European economic system.

The *Green Deal* is part of the strategies for the transition to the circular economy because it is aimed at achieving the following goals, by 2030: 1) decrease in CO emissions²; 2) promotion of the use of alternative fuels and renewable energy; and 3) minimization of waste generation and its valorization (European Commission, 2020).

The Investment Plan calls for significant investments both public (at the EU and member-state level) and private for the implementation of a plurality of strategic programs and initiatives to accelerate the transition to an "*ecologic and regenerative growth model*" ("*ecologic and regenerative growth model*") that is capable of making Europe more self-sufficient in the supply of resources and more efficient in their use in the near future.

The Investment Plan is based on financial initiatives, targeting the implementation of climate- and environment-friendly *green economy* investment plans. These plans involve the mobilization of EU funds (at least €1 trillion to be invested by 2030) to stimulate public and private investment to foster the transition to a climate-neutral, competitive and inclusive green economy.

To realize this growth model, the European institutions have identified a series of actions to be implemented.

The actions are part of a holistic approach involving a variety of *stakeholders at the* political, economic and social levels: national and regional governments; public administrations; businesses; associations; and citizen-consumers.

In detail, the *Green Deal* envisions the implementation of ambitious projects and initiatives targeting a plurality of highly interconnected sectors: climate, environment, energy, transportation, industry, agriculture and finance (Ministry of Green Transition, 2020).

Also as part of the strategies for the transition to the circular economy, the Commission presented a new Circular Economy Action Plan in March 2020, on which the

⁸ The main goal of climate neutrality is to limit global warming by 1.5° C while concretely reducing emissions of gases and substances that contribute to the greenhouse effect. Pursuing the time targets of 2030 (55 percent emissions reduction) and 2050 (climate neutrality) will enable the European Union to maintain global *leadership* in the fight against climate change and achieve the post-2050 negative emissions target.

Council adopted conclusions in December 2020. These also highlight the role of the circular economy in ensuring a green recovery from COVID-19.

On March 11, 2020, the European Union's strategy on the circular economy was implemented by the *New Circular Economy Action Plan* (COM/2020/98), which is in line with the previous 2015 plan, although it has additional elements of integration.

The new Action Plan, adopted as an integral part of the *European Green Deal*, aims to achieve, in the decade 2020-2030, a reduction in the impact of consumption on the environment and, at the same time, to double the percentage of use of circular materials.

Unlike the 2015 Action Plan, which was mainly based on the concept of recyclability of products, the new Plan promotes the following goals: circularity of production processes, sustainability of consumption and reduction of the amount of waste produced.

In particular, the new Plan focuses attention on the need for action on seven key sectors of the European economic and productive sector, which are considered "resource-intensive."

- 1) electronic products: the Plan promotes the implementation of initiatives such as eco-design, maintenance and repair, product performance, and banning hazardous materials and components.
- 2) batteries and vehicles: the Plan promotes a number of initiatives and projects for increasing the recycling rate and removing non-rechargeable batteries from the market⁹ ;
- 3) Packaging: the Plan promotes the reuse and recycling of packaging;
- 4) Plastics: the issue of plastics reduction is highly felt in the European Union. For this reason, the Action Plan encourages activities on monitoring, labeling, standardization, certification and verification of environmental damage;
- 5) textiles: the Plan promotes the design of eco-friendly textile products; the implementation of a "digital passport" to know how products are made, especially the sourcing of raw materials along the production chain; finally, the Plan supports extended producer responsibility. The goal is to reduce waste production in the textile sector as well through the implementation of a strategy for sustainability and circularity (COM 141 of 03/30/2022);

⁹ An important initiative under the 2020 Plan involving the European Commission, interested member countries, the European Investment Bank, and the industrial technology sector is the *European Battery Alliance* (EBA), which promotes along the entire battery *supply chain* safe access to raw materials, effective support for technological innovation, and the establishment of an appropriate regulatory system that limits and controls the generation of hazardous waste.

- 6) construction: since this is a sector that consumes a significant amount of resources and produces high waste, the Plan focuses on the recovery of construction materials and life cycle assessment in public procurement;
- 7) food, water and nutrients: the Plan promotes the reduction of food waste and the phasing out of single-use utensils.

As noted in the first chapter, the health emergency due to the Covid-19 pandemic and the invasion of Ukraine have caused major consequences in the old continent regarding the energy and supply market, with increases in the cost of raw materials, mainly gas and oil, and a rise in inflation.

Against this backdrop, the institutions of the European Union have decided to accelerate the process of transition to the production and consumption patterns promoted in the 2020 Circular Economy Action Plan.

The goal is to encourage resource efficiency, material recovery and recycling, and long-term competitiveness while protecting the environment.

Also part of the European Union's strategies for the transition to a circular economy is the "Critical Raw Materials Action Plan," contained in a Communication published in September 2020 by the European Commission¹⁰.

The Commission, aware of Europe's shortage of certain critical raw materials-many of which are sourced from third countries and for which global competition is intense-has highlighted resource access and sustainability as a strategic security issue for Europe's ambition to achieve the *Green Deal*¹¹.

For these reasons, the Commission for the purpose of implementing the Critical Commodities Plan has called on member states and all stakeholders (companies, subnational institutions, lending institutions, intermediaries, distributors) to join efforts to initiate a common alliance for critical commodities, with the aim of developing the resilience and strategic autonomy of the European Union.

Within this framework, the following actions need to be put in place:

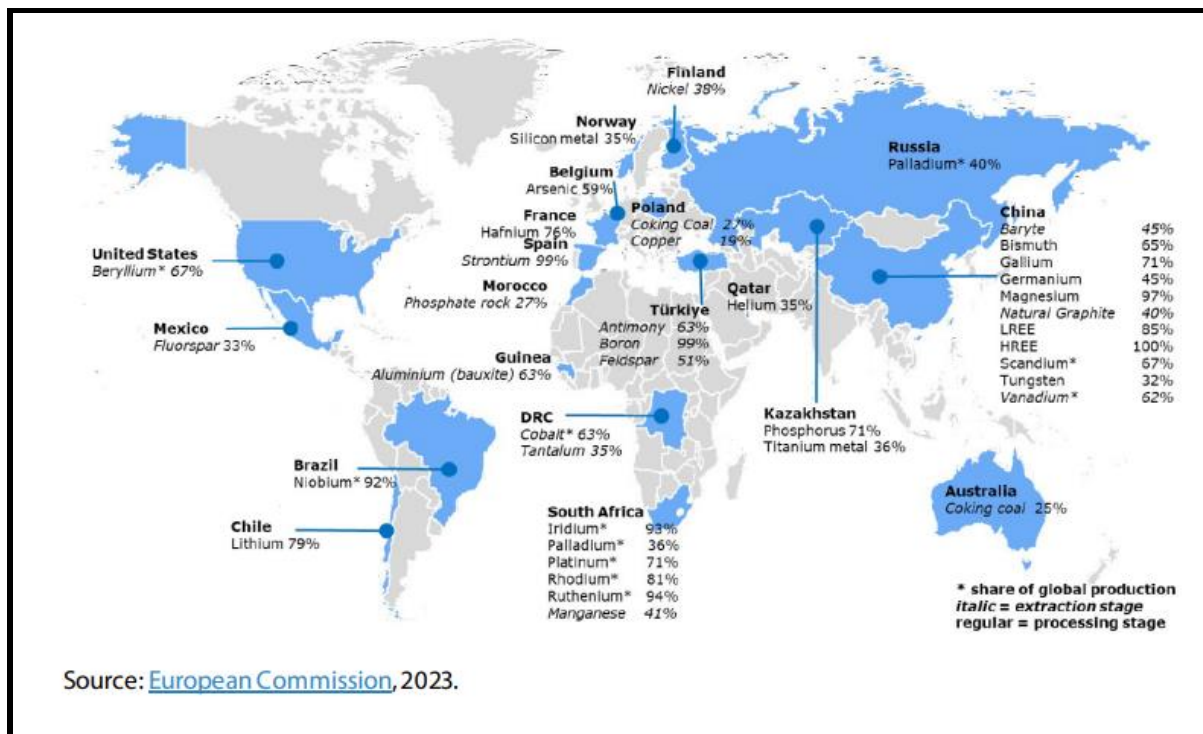
1. Diversify supply arrangements in the international market for primary and secondary sources;

¹⁰ Communication COM (2020) 474 *Final*, dated September 3, 2020, is titled "Resilience of critical raw materials: charting a course toward greater security and sustainability"

¹¹ The list of critical raw materials, updated in 2020, is a key tool to support EU policy development. The list includes: antimony, hafnium, barite, bauxite, beryllium, bismuth, borate, carbon coke, cobalt, fluorsparite, phosphorite, phosphorus, gallium, germanium, natural rubber, natural graphite, indium, lithium, magnesium, platinum group metals, titanium, niobium, scandium, silicon metal, strontium, tantalum, light rare earths, heavy rare earths, tungsten, vanadium.

2. Strengthen global trade based on respect for shared rules and the elimination of unfair and/aggressive trade practices;
3. Reduce foreign dependence of raw materials critical to the ecological and digital transition;
4. Implement circularity and resource efficiency.

The image below shows the main countries that supply critical raw materials to the European Union.



Source: *European Commission, 2023*

On a long-term horizon, the Action Plan aims to chart a course for the realization of a true industrial revolution in the European economy: the goal, again, is to foster the transition from the linear *take-make-use-dispose* model to a circular one, through reducing the use of new raw materials and promoting the durability of products, their reuse and recycling.

A recent study conducted by the Ministry for Ecological Transition noted that, over the past decade, the circular economy has been able to generate about 4 million jobs in the European Union.

In contrast, another study, by the University of Cambridge, predicted that implementation of the circular model could bring additional net increase of 700,000 jobs in the European Union by 2030.

In spite of these optimistic forecasts, even in terms of employment, there still seems to be a long way to go to achieve a radical transformation from the linear to the circular model.

Indeed, the Ministry for Ecological Transition itself points out that despite the efforts made so far to concretize the implementation of circular economic-productive models, the European Union as a whole still continues to produce a high amount of waste, and the progress made so far in "circular" practices such as recovery, reuse and recycling of materials and components still appears distant from the 2030 and 2050 targets.

CHAPTER III: THE NATIONAL MANUFACTURING SECTOR

1. The national manufacturing sector: qualitative analysis

Overall, the domestic manufacturing sector constitutes a highly representative segment of the *made in Italy* within the global market. It can be divided into the following macro-sectors:

- 1) small and medium-sized enterprises (SMEs), many of which are run as *family businesses* (*family business*¹²), taking into account the high proportion of family labor in total employment within the company's organization;
- 2) medium- to large-sized companies that combine the needs to operate in the domestic market with those of internationalization;
- 3) *global companies* operating mainly in the international market.

The current snapshot of the national productive sector (which mainly includes the manufacturing sector, followed by the service delivery and transportation sectors) shows a particularly heterogeneous reality, characterized by the presence of a large number of small and medium-sized enterprises, which make up almost the entire productive fabric and express a high level of specialization in the production of goods and supply of services. They are flanked by medium- to large-sized companies that, although fewer in number, produce a significant share of national income.

The shift from the linear to the circular model represents an important opportunity for the national production system to create new business models that are able to meet the changing needs coming from the market.

For this reason, as noted earlier, the majority literature proposes five *business* models that can be implemented in order to achieve a production system consistent with the circular model: 1) circular supply chain "from the beginning"; 2) recovery and recycling; 3) product life extension; 4) sharing platforms; and 5) product as a service.

As far as the national production sector is concerned, for several years Italy has been pursuing a series of programmatic policies aimed at fostering the transition from the linear to the

¹² Family business is governed by Article 230-bis of the Civil Code, which defines it as "*that business in which, together with the entrepreneur, the spouse, the person civilly united, relatives within the third degree and relatives-in-law within the second degree cooperate continuously.*"

circular model, placing itself in line with the Sustainability Plans and Programs that have been defined at the international (Agenda 2030) and European (Commission Strategic Plans) levels¹³.

Specifically, in the three-year period from 2020 - 2023, despite the Covid-19 pandemic and the Russia-Ukraine crisis, about 60 percent of domestic enterprises have undertaken a series of "sustainability practices" aimed at reducing dependence on raw materials from abroad, recycling and reuse, and implementing resilience and strategic autonomy from abroad¹⁴.

The above-mentioned "sustainability practices" include:

- 1) the Ecological Transition Plan, introduced in October 2021, which aims to pursue the following goals: a 30 percent increase in the use of recycled materials by 2030; enhancement of the circular bio-economy; and a 50 percent reduction in waste generation by 2050;
- 2) the National Strategy for the Circular Economy (SEC) and the National Waste Management Program (NRP), two reforms under the National Recovery and Resilience Plan (NRRP) approved in June 2022, which outline the main regulatory and operational guidelines to implement the country's ecological transition, to safeguard the soil (reclamation and reconversion) and national water resources (wastewater reuse).

Last April 2023, ISTAT produced a *paper* in which it outlined ways to implement the above-mentioned "sustainability practices."

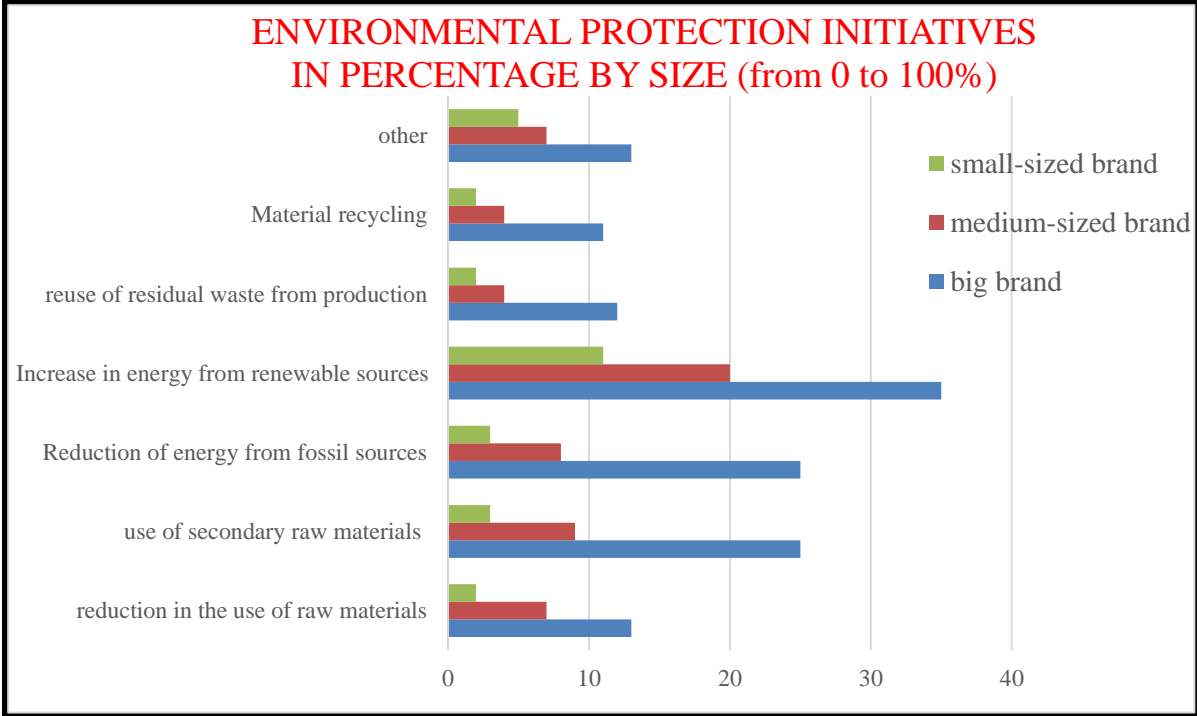
In order to monitor progress on circularity, the *paper* contains a description of the main initiatives that have been put in place, in the year 2022, by national companies to implement energy efficiency and increase the use of renewable sources.

The *paper* shows that within the national production fabric, large enterprises have implemented the largest number of programs and projects on circularity and environmental sustainability: more than 4/5 of large enterprises (about 81.5 percent) and only 36.1 percent of small and medium-sized enterprises put in place programs and projects geared concretely toward sustainability.

¹³ Within the scope of programmatic policies on circular economy and sustainable development is the National Strategy for Sustainable Development (NSSD), adopted by CIPE Resolution 108 of 2017, which is the framework for the adoption, implementation, monitoring and evaluation of the policies contained in the UN 2030 Agenda.

¹⁴ The concept environmental sustainability, applied to the national production context includes the following actions: installation of plants and machinery to reduce energy consumption, thermal insulation of buildings, installation of plants using renewable energy, use of electric vehicles, installation of plants using energy from renewable sources, plants with self-generated energy, containment of water consumption, treatment and reuse of wastewater, use of used materials and raw-second materials, collection and management of waste to reduce pollution, containment of emissions, use of suppliers who adopt systems and processes to reduce negative impacts on the environment and resources (ISTAT, 2023).

The graph below provides a snapshot relative to the year 2022 of the percentage of companies active in implementing individual initiatives and programs with a focus on sustainability. Taking into account the different sizes of companies, the graph distinguished between: 1) *small-sized brand*; 2) *medium-sized brand*; 3) *big brand*.



Source: ISTAT, *Sustainable business practices in 2022 and outlook 2023-2025 (Apr 2023)*¹⁵

Looking at individual environmental protection initiatives, it can be seen that large enterprises are systematically the most active, because they implement sustainability strategies in higher percentages than small and medium-sized enterprises.

It is possible to say that although the entire national manufacturing sector is pursuing a plurality of programs and projects on circularity and sustainability, large enterprises are the ones that, to date, have made the most interventions on innovation paths to actually implement circularity measures.

As noted in the course of this examination, the transition to circularity is not a simple objective: it involves high levels of investment by companies to implement more innovative and environmentally friendly technologies and production facilities, and at the same

¹⁵ The item "other" includes additional environmental protection activities and initiatives, such as separate collection of waste, waste management to reduce pollutants, containment of emissions, and the use of suppliers who have already adopted practices to reduce impacts on the environment, although these are not recorded in a timely manner precisely because they are residual items.

time, it also requires targeted interventions by the national legislature, which is called upon to issue regulations and legislative measures that facilitate the transition from the linear to the circular model.

As will be discussed in more detail in the following paragraphs, within the national manufacturing sector, large enterprises show a greater ability to implement long-term strategies than SMEs and to place themselves in line with the pursuit of circular economy goals.

The reason for this adaptability is easier access to the credit market and the availability of capital to invest in research and development activities.

1.1 Small and medium-sized enterprises

Small and medium-sized enterprises (SMEs) make up almost all of the enterprises residing in the Italian territory and the most dynamic part of the national production system.

Although most SMEs consider the transition to the circular economy to be a fundamental tool for implementing the competitiveness of *Italian-made products* within the global market, their high specialization and limited financial and organizational resources are a hindrance to the process of implementing their *business*, as they are mainly domestic market-oriented companies¹⁶.

Add to this the fact that most SMEs-particularly *family firms*-don't have an organizational structure and *managerial leadership* capable of effectively anticipating market changes and, consequently, developing appropriate medium- to long-term strategies that make the company capable of smoothly confronting new market demands (Pandolfini 2021).

Investment in the transition to the circular model is, in fact, very high and sometimes risky; at the same time, the funding made available to facilitate the transition from the linear to the circular model is, to date, still insufficient.

Nevertheless, the production capacity of SMEs is basically in line with that of firms in the main European *partes* (France and Germany), despite the negative impacts from the concatenation of two close crises, the Covid-19 and the Russian-Ukrainian crises.

Confindustria recently noted that SMEs possess a high organizational potential that,

¹⁶ *Open innovation* encompasses a range of research, development and open external collaboration activities that companies implement in order to involve as many of the *stakeholders* with whom they have relationships in their sphere of operations as possible, such as suppliers, manufacturers, distributors, industrial organizations, research and development institutes, public administrations, local and national government bodies and agencies, and consumers.

properly harnessed, enables them to operate smoothly within value chains and support Italian excellence globally. In fact, SMEs make a decisive contribution to the resilience of employment and the positive results recorded by *exports*.

A recent snapshot taken by ISTAT and focusing on the performance of SMEs over the last three years shows a rather strong manufacturing sector, marginally downsized in terms of number of units compared to 2019; at the same time, the level of overall employment within SMEs shows a slight increase compared to pre-pandemic levels.

These achievements are due, primarily, to economic policy interventions and business and trade support, which have greatly limited the deterioration of SMEs' economic and financial conditions caused by the Covid-19 pandemic and the Russia-Ukraine crisis.

These interventions have benefited crucially for those SMEs that have presented greater income problems in terms of liquidity and assets.

For SMEs to orient their *mission* toward circular models in a long-term horizon, without losing their competitive ability, they can act along two dimensions: "micro" and "meso."

At the "micro" level, as each *supply chain* has its own specificity, SMEs can leverage their level of specialization to direct actions toward recycling within their production process, reducing the use of energy from fossil sources, and increasing the use of energy from renewable sources;

At the "meso" level, SMEs can enter into collaboration and *joint-venture* agreements with other companies of equal or larger size located in the same geographical area (or contiguous geographical areas) in order to enhance joint efforts in the practices of recycling and recovery of production residual waste.

In fact, entering into agreements and *joint ventures* with other companies allows SMEs to concentrate their supply capacity and, at the same time, implement the capacity to recycle and valorize production waste, transforming it into new *inputs* to be reintroduced into production processes.

Within the scope of collaboration between small and medium-sized companies is "industrial symbiosis," which is an effective strategy for optimizing the use of resources by multiple companies operating within the same territory, with the aim of achieving common benefits.

"Industrial symbiosis" is based on the concept of sharing and transferring resources (by-products or production residues) and involves *outputs* produced by one company being able to be reused as *inputs* by another company within its own production process.

By increasing efforts in various environmental protection practices, SMEs also

improve their competitiveness and, at the same time, are able to effectively balance the adoption of the circular model with the pursuit of their corporate *mission*.

Given that the economic value of an enterprise is not only expressed by its ability to produce goods or provide services, but also by its "overall impact" on the social, economic and environmental context in which it operates, SMEs' implementation of the circular model constitutes "added value" in terms of business *performace*.

1.2 Large enterprises

Large-scale enterprises play a strategic role in the transition to the circular economic model.

Compared to SMEs, larger firms have a greater ability to implement long-term strategies and respond more effectively to threats and opportunities from the market due to easier access to the credit market.

Large enterprises tend to show a high level of propensity to innovate and project themselves into international markets, due to their high ability to make investments aimed at implementing their organizational structure and transforming their production capacity to enhance competitiveness within the international market (ISMEA, 2021)¹⁷.

In terms of the circularity of production processes, empirical evidence has shown that large enterprises are the most active in implementing environmental sustainability plans and programs and carry out the most activities in the areas of material recycling, reuse of production residues, waste management, use of secondary raw materials, and containment of emissions in order to reduce impacts on the environment (ISTAT, 2023).

2. The applicability of the circular economy model to the domestic manufacturing sector: some *case studies*

The national production system is characterized by a high level of dependence on raw materials from abroad.

¹⁷ A study conducted by ISMEA (Jul. 2021) found that the use of multichannel, *social media*, *chat*, and online sales have changed the way companies communicate to the public and approach consumers. In www.ismea.it

The rise in commodity prices in international markets in recent years, caused by the Covid-19 pandemic and the crisis between Russia and Ukraine, has made it necessary to implement an acceleration toward circular economic models. The goal is to increase strategic autonomy and security of supply.

It is, therefore, essential, to implement a transition to circular economic models, in order to enable the entire system-Country to reduce its dependence on foreign countries and strengthen its industrial and strategic autonomy.

A recent survey of a sample of businesses on the benefits of adopting the circular model confirmed that Italian entrepreneurs are aware that sustainability is a necessary goal to pursue in order to implement their *business* over a long-term time horizon¹⁸.

In fact, the application of the circular economy model to the national production sector is an indispensable tool in order to effectively fulfill the goals contained in the UN Agenda 2030 and the Circular Economy Action Plans promoted by the European Commission.

On the topic of business circularity, the PNRR presented by Italy in 2021 identified the two main "*focus areas*" where action needs to be taken to facilitate the transition of the national production system to circularity:

- 1) The optimal management of waste through the establishment of facilities that enable its recovery;
- 2) The strengthening of recycling and reuse activities within supply chains in order to enhance the value of production waste, transforming it into new resources to be reintroduced within the production cycle.

However, the concrete implementation of initiatives toward circularity within the national manufacturing sector encounters a number of structural gaps that need to be addressed:

- 1) shortage of facilities to ensure optimal waste cycle management;
- 2) Need to upgrade existing treatment facilities;
- 3) Inadequacy of separate waste collection systems.

A number of *Case Studies dealing with the* adoption of circular *business* models by domestic enterprises within the above-mentioned two "focus areas" are examined below.

Although the survey does not fully meet the criteria of statistical representativeness, it describes the opportunities and critical issues encountered by domestic enterprises in the transition from the linear to the circular *business* model.

The first *case study* concerns the Italian company *Orange Fiber* based in Catania,

¹⁸ The survey was conducted by the CleanTech Observatory on a sample of 450 companies, including both SMEs and large enterprises.

Italy, which designs, develops and produces circular fabrics using citrus waste grown in Italy.

The company, founded in 2014, specializes in creating innovative and sustainable "circular fabrics" for the apparel industry. The fabrics are made using by-products from the citrus juice industry through innovative and patented processes. In this way, the *Orange Fiber* company assures all its stakeholders-especially consumers-that it operates according to transparency throughout the production chain. In this way, the *Orange Fiber* company guarantees high levels of *Made in Italy* quality, contributing to the realization of a luxury concept based on an ethical and sustainable lifestyle.

The company also carries out collaboration and *partnership* activities with leading *brands* in the fashion industry, such as Salvatore Ferragamo, H&M, Marinella.

A further example of the applicability of the circular model to the national production sector is the project called *Symbiosis Users Network* (SUN), a national network promoted in 2017 by ENEA that involves companies, public bodies, research institutions, and nongovernmental organizations working together to implement industrial symbiosis in Italy.

Industrial symbiosis involves the transfer of redundant or underutilized waste resources from one industry to another, allowing for economic and environmental benefits from not disposing of waste and minimizing the consumption of primary resources. It is a "win-win" strategy in which all stakeholders can benefit from each other's interactions.

Enea has developed 4 tools for implementing industry symbiosis: the *Symbiosis Platform*, the *Network*, the *Methodology*, and the projects containing guidelines for implementing symbiosis.

The *Symbiosis Platform* enables companies and other operators within a given geographic area to share materials, energy by-products, know-how, *best practices*, etc¹⁹.

The *Network* enables companies to jointly address the challenges of sustainability and the transition from the traditional linear economic model to the circular model by promoting joint initiatives and projects to reuse, recover, and recycle waste materials from production processes.

The *Methodology* includes a *database* available to all *stakeholders* that collects and makes available a plurality of information regarding the "input" resources that companies need for their production processes and the "output" resources that companies can share.

Projects are carried out by "working groups" in which all stakeholders who can provide possible industrial symbiosis solutions participate. Each "working group" pursues

¹⁹ The Platform includes a structure that contains possible industrial symbiosis solutions; a structure that describes the area, its facilities, *stakeholders*, and available resources; a *network* that connects different *stakeholders*

specific goals in the area of industrial symbiosis:

- 1) Continuous update of the *status of* the industrial symbiosis (success cases, failure cases, *benchmarks*, etc.) in order to identify and take possible intervention measures;
- 2) Adoption of proposals for implementation of national and regional policies on industrial symbiosis (initiatives, plans, programs, projects, national and regional laws, etc.);
- 3) Analysis and evaluation of the economic and social effects arising from industrial symbiosis and the consequences for the national production system;
- 4) Systems monitoring for measurement, certification and standardization of industrial symbiosis;
- 5) Evaluation of legislative measures and policy documents at the European and national levels to foster the implementation of the circular model, with particular reference to industrial symbiosis pathways and waste and by-product optimization.

The industrial symbiosis promoted by ENEA is a viable and effective strategy for the implementation of resource cycles because it is based on the collaboration and synergies among different *stakeholders* in the national political, industrial and scientific landscape and on the advantages derived from their geographical and economic proximity.

3. The prospects for growth and development

The transition from the linear to the circular economic model constitutes, for the Italy-system, an unavoidable opportunity to create new business models that are capable of producing goods and offering services in accordance with the sustainability objectives that are contained in the main guidelines identified at the international and European level.

For quite some time, Italy has been pursuing its concrete commitment to the efficient, sustainable and circular use of resources.

Consider, for example, that Italy is the leading member country of the European Union in recycling activities, particularly of special waste, accounting for 79.4 percent of total waste treated, almost double the average of European countries.

In addition, the prospects for growth and development in the near future outline a strategic "common vision" involving various stakeholders-both public and private-in the implementation of ambitious plans, programs, and projects to support innovation, ecological design to ensure durability, reparability, reuse, and recycling, and to support the realization of

sustainable and inclusive *supply chains*.

However, empirical data show greater involvement by large enterprises, compared to small and medium-sized enterprises, in implementing long-term strategies geared toward circular models.

Given that economic operators are required to implement a clear and careful assessment of the operational costs and investments to be incurred, as well as the opportunities and risks that need to be addressed in order to move from the linear to the circular model, a recent survey conducted by ISTAT (April 2023) showed that large enterprises are the most active in implementing circularity-oriented plans and programs compared to SMEs.

This different approach is part of a broader economic-productive scenario, which is characterized by the presence of a plurality of factors "outside the business organization" that condition the effective transition from the linear to the circular model:

1. some supply chains, particularly that related to "secondary raw materials," have weaknesses because they are still underdeveloped;
2. there are clear territorial gaps between the North and South of the country with regard to the presence of plants and supply chains for recycling and energy recovery from waste. In fact, regions in the South-Central are less "virtuous" than those in the North;
3. reliance on landfill continues to be a high component within the life cycle of products.

Such a scenario highlights the need for a profound transformation of both society and the national productive sector according to a "holistic" and multi-sectoral approach that will slow down the process of climate and environmental degradation and, at the same time, promote sustainable economic growth, the creation of new jobs and the improvement of citizens' quality of life.

CONCLUSIONS

In the course of the paper, it was noted that in a global context characterized by a growing sensitivity to environmental and social issues, the circular economy is a great opportunity for growth and development and, at the same time, for reducing the environmental impact resulting from production and economic activities.

At the same time, the circular economy is an effective policy tool that can ensure prosperity and high levels of employment. Indeed, the benefits achievable by companies include improved resource management through the recycling and reuse of raw materials and the reduction of environmentally harmful waste generation.

The current snapshot of the system-Country shows that, within the European Union, Italy is among the nations most committed to the transition to sustainable and circular economic models. Italy is, in fact, pursuing the goal of conforming to the guidelines emanating from the main international organizations and the European Union institutions in compliance with the planned timetables and, at the same time, is implementing Plans and Strategies to reduce the dependence from abroad of the raw materials necessary for the functioning of the domestic market and support the competitiveness of the production sector at the international level.

From this perspective, the effective implementation of circular models within the Italy-system makes it necessary to realize, in practice, lasting synergies between the main players in the transformation: the national government, the industrial sector and citizens.

The public decision maker, businesses and citizens are in fact, responsible, each at their own level, in facilitating the transition from the linear to the circular model.

The national government is responsible for adopting regulatory measures to strengthen financial and fiscal incentive mechanisms and facilitating access to grants for the implementation of research projects dedicated to sustainability and circularity.

The national manufacturing sector, in cooperation with universities and research centers, is required to implement initiatives in the field of environmental protection in the areas of material recycling, reuse, sharing and collaboration, use of "secondary raw materials," and reduction in the use of fossil fuels.

Finally, citizens, once they become more aware of the finite nature of available resources, are invited to change their behaviors and lifestyles, orienting them toward active participation in product life-cycle optimization processes and waste and waste reduction.

The success of the transition to the circular model depends, in fact, on the

willingness and ability of the public administration, businesses and citizens to work in harmony in compliance with rules and procedures-simpler and more efficient-that are geared toward sustainability and the full protection of the environment and resources.

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