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### The green transition in Europe and Italy

Focus on the production sector

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#### INTRODUCTION

This work aims to illustrate the characteristics of the "green transition" that characterizes the current economic and productive scenario, and the importance of investments in sustainable technologies, with particular regard to the initiatives of the European Union and the choices of member states. To this end, the wide-ranging project of the so-called "European Green New Deal" is first illustrated, with reference to the various EU intervention programs for recovery and sustainable growth. The financial and legal instruments used to promote the green transition in the Member States are illustrated, and the role of environmental technologies as value drivers within the various economic behaviors is highlighted. In particular, the contribution of new environmental technologies to the improvement of processes and products is highlighted.

As will be illustrated, in recent times, the affirmation of green sensitivity in the sensibility in the Italian population nor the unconditional acceptance of technology to think that the European funds of the PNRR will fall on fertile ground and can bear fruit. The huge investment will have the effect foreseen only if there are professionals capable of investing them correctly. Technical and

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specialist skills are required ad needed to be able to use these technologies and to make to participate Italy to the occupational benefits that the diffusion of information technology in the industry and the advent of the green revolution will guarantee to the productive system. In the second part, the focus is on the concept of eco-innovation in industrial production and the impact of new policies on the environment and productivity. New technological developments of ecoinnovation in industrial processes are described, with regard to the themes of efficient use of environmental resources and reduction of impact on the ecosystem. With reference to the impact on productivity, are analyzed the problems related to technological innovation and performance improvement, improvement in the management of waste and industrial waste, and energy upgrading of production facilities: the case of chemical industries. In the third part, finally, the characteristics of the Italian production system and its specificity in the transition to green technologies are illustrated. The main indicators of economic sustainability of the Italian production system are recalled with regard to the trend of the last ten years. In this scenario, the strategic value of investment in green tech and green products for the Italian manufacturing industry is illustrated. Finally, we analyze the problems related to the employment impact of investments in environmental

technologies in Italy, and the link between traditional innovation and environmental innovation, especially with regard to the possible impact of new sustainable processes on labor productivity.

#### **CHAPTER ONE**

The green transition and the importance of investments in sustainable technologies: the initiatives of the European Union and the choices of the Member States

## 1.1. European Green New Deal: Community intervention programs for sustainable recovery and growth

The need to trigger global change processes to curb climate change seems to be one of the priorities in the economic and political planning of states at the international level. However, although climate change and its consequences - including pandemics - are devastating, profit and the desire for immediate economic benefits overshadow the good intentions that the international community periodically sets itself as necessary to limit almost irreversible damage to the ecosystem. This began in Kyoto, where the signing of the now famous Kyoto Protocol set legally binding limits on greenhouse gas emissions. In particular, it required industrialised countries and countries with economies in transition to commit to reducing polluting emissions. Commitments that have always been renewed during the climate conferences that periodically follow one another, but which in practice have brought very little benefit to our planet. Rising temperatures everywhere, uncontrollable and unpredictable climatic phenomena are occurring with increasing frequency, and nations wishing to pursue economic interests with little vision of the future are the main thrust of national policies which, once the agreements have been signed, take roads and directions that have little to do with the agreements made. There is now a greater awareness of environmental issues among the general public than at the end of the last century. However, the road ahead is definitely difficult. In the European Union, at least from a programmatic point of view, the climate issue has been placed at the forefront and framed within a framework of growth and development. Precisely during the harshest period represented by the economic and social blockades imposed by the circulation of the virus, the Member States and the Community institutions placed environmental renaissance at the forefront, so much so that they called for a Green New Deal. In order to fully understand the context in which the Green Deal developed, it is not enough to retrace, as we have done so far, the history of the EU's commitment to the environment or to outline a list of points that need to be addressed in the implementation of European energy and climate policies. The genesis of the Green Deal and its action programme are in fact intimately linked to the clearly expressed desire of President Von der Leyen to propose a new ambitious and provocative political agenda. An agenda that can respond both to the criticism of stagnation often levelled at the European institutions, and to the doubts expressed by several members of the European Parliament when the Council proposed the names of the candidates for the presidency of the Commission. We refer here to the showdown played by the Member States against the European Parliament, when the heads of government finally reached agreement on the name of Ursula Von der Leven as candidate for President of the Commission and Charles Michel as President of the European Council. A difficult decision, a compromise, arrived after several days of negotiations<sup>1</sup>. The highlight of the new European institutional cycle is the willingness of the President of the Commission, Ursula Von der Leyen, to surprise and respond pragmatically to an institutional and political deadlock in the EU. This is the main ingredient in the genesis of an innovative policy programme, such as the one the President presented to Members of the European Parliament on 16 July 2019. An extensive action plan, built around several pillars<sup>2</sup>. The first, the "European Climate Pact", is intended to be a transformational journey for the European economy and society that aims to confirm the EU's role as a global leader in the

<sup>&</sup>lt;sup>1</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279., p. 196

<sup>&</sup>lt;sup>2</sup> See MASTINI, R, KALLIS, G., HICKEL, J., "A Green New Deal without growth?" in Ecological Economics, Elsevier, 2021, vol. 179, p. 85

fight against climate change by ensuring compliance with the 2015 Paris Agreements, while at the same time providing a great opportunity for green growth for the continent. The second, "An economy at the service of people", includes a new industrial policy strategy for SMEs and also the completion of the Banking and Monetary Union. The third, "A Europe ready for the digital age", is an action plan aiming to achieve Europe's technological sovereignty in key areas such as artificial intelligence, the data economy and 5G. Of the three remaining pillars, we will keep, as far as it is useful for this work, the fourth one ("A stronger Europe in the world") which shows the will to relaunch multilateralism, the reform of the World Trade Organisation and the building of a European defence capability. Among these lines of action, the commitment to green and sustainable growth is the first in order of importance as the Commission - during its election on 27 November 2019 - promised to publish concrete proposals related to the Green Deal in the first hundred days of its mandate<sup>3</sup>. First of all, it should be clarified that the expression "Green Pact for Europe" identifies a field of action rather than a specific act, regulation or directive because - as explained in the European Commission Communication published on 11 December 2019 - several of the actions planned by the EU are spread

<sup>&</sup>lt;sup>3</sup> See CARAVELLA S., MENGHINI M., "Race against the Machine. Gli effetti della quarta rivoluzione industriale sulle professioni e sul mercato del lavoro", L'industria, Rivista di economia e politica industriale, 1/2018, p. 196 e ss.

over a period of about two years. There are three key concepts: climate transition, energy transition, industrial and social transition. Each has its own action programme. And there are three possible perspectives for analysing them: the policies to be implemented, the new European legislation to be proposed or the revision of existing legislation, and finally the financial resources needed to support the transition. The "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions" of 11 December 2019 states that: "The European Green Deal is the answer to these challenges. It is a new growth strategy aimed at transforming the EU into a fair and prosperous society with a modern, resource-efficient and competitive economy that generates no net greenhouse gas emissions in 2050 and where economic growth is decoupled from resource use.

It also aims to protect, conserve and enhance the EU's natural capital and to protect the health and well-being of its citizens from environmental risks and their consequences".

The climate component is undoubtedly the real core of the proposal, because the common thread linking all the actions envisaged by the Brussels executive is the achievement of the goal of climate neutrality in Europe by 2050. A difficult trajectory that follows in the wake of the international agreements signed by the EU, first of all at the Conference of the Parties (COP 21) to the Convention on Climate Change, held in Paris in December 2015 and attended by 195 states along with many international organisations, and aimed at limiting the increase in the planet's temperature to one and a half degrees compared to preindustrial levels<sup>4</sup>. There are two main instruments to achieve this: the 'Climate Act' and the 'Climate Pact' to involve as many actors as possible: regions and cities, civil society organisations, citizens. The Communication recognises that achieving further emission reductions will not be easy and that, due to the complexity of the challenges, the measures to be taken will have to be bold. Closely associated with this pillar are also all measures aimed at protecting the environment, biodiversity and promoting sustainable food<sup>5</sup>. The main objective is to perform a great task to limit the increase in global warming, which according to the estimates of the UN's Intergovernmental Panel on Climate Change (IPCC) must remain within 1.5 °C compared to preindustrial times, in order not to cause enormous damage to the planet and therefore to the human species. To comply with this limit, established by the Paris Accords of 2015, the European Union has committed to zero its net pollutant emissions by 2050, and to meet intermediate targets for 2030 and 2040. From this main goal, cascading,

<sup>&</sup>lt;sup>4</sup> See RIFKIN J., The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, and the Bold Economic Plan to Save Life on Earth, EBOOK, 2020, p . 116 <sup>5</sup>See DALY, H.E., Oltre la crescita. L'economia dello sviluppo sostenibile, Torino, Edizioni di Comunità, 2001

come other more specific ones. The first and most important will be to make cleaner the production of electricity, which at the moment is responsible for 75% of greenhouse gas emissions within the European Union (the most famous of which is carbon dioxide, the so-called CO2). Above all, it means increasing the diffusion of renewable energies and at the same time stopping incentives for the use of fossil fuels: this will be a problem especially for Eastern European countries, where the diffusion of renewable energies is still limited. Poland, for example, still obtains 80% of its electricity from coal, one of the most polluting fuels still in circulation: for this reason it is the only country that has not yet officially agreed to reduce its net emissions to zero by 2050. In all Eastern countries the construction of solar or wind power plants is practically nil, unlike what happens in Central Europe<sup>6</sup>. In its initial proposal, presented in January 2020, half of this mobilization would come from the EU's own resources. Currently, 20% of the 2014-2020 budget is considered green and, under the Green Deal, the Commission intends to increase this to 25% for the 2021-2027 period. To this end, it proposes, among other measures, that 40% and 30% of the Common Agricultural Policy and European Maritime and Fisheries Fund budgets, respectively, contribute to the fight against the climate emergency. In this sense, the new EU taxonomy will help to ensure that

<sup>&</sup>lt;sup>6</sup> See RIFKIN J., The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, and the Bold Economic Plan to Save Life on Earth, EBOOK, 2020, p. 116

this 25% of the budget is truly green, since it details the requirements for considering an investment or asset as such. In addition, the Commission estimates that the Member States will co-finance with 114 billion euros some of the green projects included in the EU budget. On the other hand, the EU will deploy the Just Transition Facility, to which it initially wanted to contribute 7.5 billion euros, which would mobilize more than 143 billion over 10 years to help the regions most affected by the transition (e.g. those with a high share of employment in the fossil fuel extraction and production sector or energy-intensive industries). The second largest contribution to the Green Deal investment plan is the €279 billion from private investments made through the EIB's InvestEU program, the successor to the so-called Juncker Plan. This program would work in much the same way as the Juncker Plan did: the EIB would provide guarantees for projects contributing to the fight against the climate emergency, thus encouraging private investment in this direction. 25 billion were raised through the auctioning of GHG emission permits. In addition, the EC proposes to create a border carbon tax to prevent companies from relocating their production sites to regions with less stringent environmental regulations (known as carbon leakage). Thus, of the billion euros initially announced by the EC, the real increase in EU spending on combating the climate emergency would correspond only to the 5 p. p. increase in the EU

budget (from 20% to 25%) earmarked for combating the climate emergency and the 7.5 billion within the Just Transition Fund. The rest corresponds to the "mobilization" of private and public investments, an expression used by the institution to refer to investments, especially private ones, that are made thanks to the guarantees offered by the EU<sup>7</sup>. In April 2020, the European Council has adopted the regulation establishing at EU level a unified system for classifying investments according to sustainable development criteria, the so-called taxonomy. The regulation will provide companies and investors with a common definition for identifying sustainable economic activities, making greenwashing - the practice of marketing financial products as "green" or "sustainable" when in fact they do not meet basic environmental standards - more difficult. The taxonomy will allow investors to redirect investments towards more sustainable technologies and businesses, ensuring access to EU subsidies, and will be instrumental in making the EU climate neutral by 2050 and achieving the 2030 targets set by the Paris Agreement. Currently, there is no common classification system at the EU or global level that provides a definition of environmentally sustainable economic activity. The taxonomy will be applied to the six EU environmental goals:

1) climate change mitigation

<sup>&</sup>lt;sup>7</sup>See https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\_en , URL accessed november2021

- 2) climate change adaptation
- 3) sustainable use and protection of water and marine resources
- 4) the transition towards a circular economy
- 5) the prevention and reduction of pollution
- 6) the protection and restoration of biodiversity and ecosystems.

Now it will be up to the Europarliament to examine and approve the decision so that it can enter into force<sup>8</sup>.

<sup>&</sup>lt;sup>8</sup>See https://www.consilium.europa.eu/it/press/press-releases/2020/04/15/sustainable-finance-council-adopts-a-unified-eu-classification-system/, URL accessed november2021

# 1.2. The financial and legal instruments used to promote the green transition within the Member States

The Commission estimates a need for additional investment of EUR 260 billion per year to finance the current climate and energy targets with a 2030 horizon. To this end, it is carrying out a major operation to facilitate the convergence of several sources of funding towards the Green Deal objectives. The financing plan proposed by the Commission has a total volume of EUR 1 trillion. 503 billions of euros are destined to climate and environment<sup>9</sup>. These resources come from the EU budget, and 25% of the total resources of the 2021-2027 Multiannual Financial Framework will be used to finance projects with environmental objectives. A significant contribution will also be made by the InvestEU Fund, a mechanism governed by the European Investment Bank that aims to attract private investment, with the help of a public guarantee<sup>10</sup>. Another EUR 25 billion will come from the proceeds of the Emissions Trading Scheme (ETS), which will finance the Innovation Fund and the Fund for the Modernisation of Economic Sectors in Transition. The European Union has been working for several months to establish a

<sup>9</sup> See The European Green Deal Investment Plan and JTM explained (europa.eu)

<sup>&</sup>lt;sup>10</sup> See <u>https://ec.europa.eu/commission/presscorner/detail/en/qanda\_20\_24</u>, The European Green Deal Investment Plan and Just Transition Mechanism explained, URL accessed november2021

favourable regulatory framework to channel available private resources into financing the green transition. For their part, the Member States will also have to provide a test of consistency, aligning their national budgets with European priorities: a renewed European Semester will promote such discipline. A potential weakness of this innovative project is the mismatch between ambition and available financial resources. This is an issue related to the current state of negotiations for the EU's Multiannual Financial Framework (MFF) for the period 2021-2027<sup>11</sup>. On the one hand, we have the European Commission which, in May 2018, proposed a budget of 1.114% of European GNI and a distribution in one third to the Common Agricultural Policy, one third to Cohesion Policy, and one third to the financing of new priorities for EU action. The Commission has introduced a new mechanism to strengthen the coherence between cohesion policy and the energy, economic and territorial transition policies of the Green Deal: the Mechanism for a Just Transition (MTJ) and the Fund for a Just Transition (FTJ), two instruments that we will analyse in more detail here<sup>12</sup>.

The objective of the Mechanism is to facilitate the transition of the

<sup>&</sup>lt;sup>11</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279

<sup>&</sup>lt;sup>12</sup> See <u>https://ec.europa.eu/commission/presscorner/detail/en/qanda\_20\_24</u>, The European Green Deal Investment Plan and Just Transition Mechanism explained, URL accessed november2021

territories most affected by the energy transition process, such as those hosting energy-intensive industries or coal mines, and to support the restructuring of their economies, encouraging the creation of new green businesses, tackling job losses and promoting training and retraining initiatives for workers.

The focus of this change at European level moves from an exclusively economic and financial dimension to the production of common goods with a European dimension, such as environmental protection and the fight against climate change. These are challenges on a global scale that no state can tackle alone: here is a case study for which action at European level is not only desirable but absolutely necessary. The cycle of the European Semester, which has now become the real driving force behind the institutionalised dialogue between the Commission, the European Council and the Member States, is of fundamental importance, because the Member States' budget laws are linked to the Semester, and also because the European Commission can sanction States that deviate from the measures recommended to them<sup>13</sup>.

This cycle, which is repeated annually, involves the Commission analysing the macroeconomic situation of each country in January and drawing up country reports in March. Then, in May, the Commission

<sup>&</sup>lt;sup>13</sup> See RIFKIN J., The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, and the Bold Economic Plan to Save Life on Earth, EBOOK, 2020, p. 132

and then the Council issue country-specific recommendations with which the countries try to comply when they draw up their national reform programmes and send their budget accounts to Brussels. The Commission analyses them and prepares the country reports the following year. That said, incorporating the UN Sustainable Development Goals into the regular analyses carried out as part of the European Semester means that the Commission will take them into account when preparing country-specific recommendations and that countries will receive targeted guidance in this area<sup>14</sup>. The same can be said for the integration into the European Semester of the analysis of national trajectories towards the Green Deal targets. Such a mechanism can only strengthen the European institutions' control over Member States' actions. In addition, as we have seen, the 2020 Country Report contains for each country a list of the territories most affected by the climate transition and therefore possible beneficiaries of the resources of the Fund for a Just Transition. Finally, the top priority given to climate in the new Commission's actions is reflected in the financial and budgetary field. In this vein, the European Investment Bank will become the 'climate bank', as advocated by the. European Commission and subsequently confirmed by the EIB Executive Committee. This

<sup>&</sup>lt;sup>14</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279

change is instrumental in increasing the volume of public financial resources (public guarantee) useful for attracting private capital to support the green transition and also in expanding the financial instruments offered by the EIB on the market with a focus on financing sustainable projects. (investments in digital and climate transition technologies, energy efficiency or renewable energy projects, etc.). In addition, the EIB will phase out its support for fossil fuels from 2022, with the transition process not being well received by Member States that still rely heavily on carbon<sup>15</sup>.

From a point of view that we can define empirical, it must be emphasized that at the global level the European Union has long been committed to a concrete path of reduction of CO2 emissions and greenhouse gases (GHG) that puts it in a more advanced position than other economically developed areas as well as compared to many of the so-called emerging economies, starting with China and India. Specifically, the European Union achieved a 21.6% decrease in CO2 emissions in 2018 compared to 1990 levels against a 61% increase in GDP<sup>16</sup>. In the European Union, the share of total global emissions decreased from 9.6% to 9.1% between 2015 and 2018. Among EU28

<sup>&</sup>lt;sup>15</sup> See DURANTE A., Il green new deal. Rischi e vantaggi di un nuovo interventismo pubblico in economia, Albatros, 2020, p. 156 e ss.

<sup>&</sup>lt;sup>16</sup> See CHOMSKY N., Minuti contati. Crisi climatica e Green New, Ponte alle grazie, 2020, p. 240 e ss.

countries, the largest contributor to CO2 emissions in 2018 was Germany with 21.8%, followed by the United Kingdom (10.8%), Italy (10%), Poland (9.7%), France (9.4%) and Spain (8%). In order to reduce emissions and promote a major environmental change, the European Commission has set aside a total of 1,000 billion euros. In the o Multiannual Financial Framework (MFF) 2021-2027 proposed by the European Commission plans to allocate 25% of the total budget for climate and environment through multiple programs, including: European Agricultural Fund for Rural Development, European Agricultural Guarantee Fund (hence Common Agricultural Policy): 40% of the total envelope to support projects that contribute to climaterelated objectives; European Regional Development Fund and Cohesion Fund: should invest more than 30% of the total envelope in climate and environment-related projects; Horizon Europe: at least 35% of the envelope should be allocated to the achievement of climate-related objectives; LIFE funds: more than 60% of the envelope should be allocated to the achievement of climate-related objectives Connecting Europe Facility: at least 60% of the budget (support for transport, energy and digital infrastructure) should be allocated to the achievement of climate-related objectives. In addition to these funds, there are those coming from the Invest Eu Program, which is a program proposed by the European Commission to succeed the European Fund

for Strategic Investments (EuSEF) with the aim of mobilizing 650 billion euros of investment over the period 2021-2027. It is part of the MFF 2021-2027 and, therefore, negotiations between the European institutions are still ongoing on it as well. However, the European Commission has proposed a climate target for InvestEU of at least 30 percent, which, if confirmed, would mobilize about €195 billion of public and private investment earmarked for climate and the environment between 2021 and 2027, or almost €28 billion per year, and about €279 billion over a decade. In addition, the European Investment Bank (EIB) and other international and national financial institutions are also expected to play an increasingly important role in financing the sustainable transition. It should be noted that an additional Fund, defined as a Just Transition Fund, has also been established within this allocation. This fund is aimed at providing support to territories facing serious socio-economic challenges resulting from the transition process towards a climate neutral Union economy by 2050. The legal framework consists of a proposal for a Regulation establishing the Fund for a Just Transition (COM(2020)22) and the amendments to be made accordingly to the proposal for a Regulation on common provisions for the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the European Maritime and Fisheries Fund and the financial rules applicable to these Funds and the Asylum and Migration Fund, the Internal Security Fund and the Borders and Visa Instrument in order to integrate the Fund for a Just Transition (Amended proposal for a Regulation<sup>17</sup>.

Eventually, addressing the issue of the effects of public subsidies to green innovation from an empirical point of view, it could be useful to recall those studies that have evaluated the impact of this type of subsidy on environmental sustainability in the Italian case. Within the complex Italian legislative panorama, contradictions are very frequent and, in this sense, the system of subsidies, incentives and financing is no exception.

In this regard, the contents of the Catalogue of environmentally harmful subsidies and environmentally favorable subsidies is very interesting. It is a document drawn up at the request of the Ministry of the Environment and the protection of the territory and the sea in order to analyze the relationships established between the incentives bestowed by the Italian State and environmental health. It is a real compendium of the consequences of incentives, subsidies, facilities of various kinds and nature to the detriment of the ecosystem. The analysis of data dating back to 2018 shows results rather discouraging and contradictory. In fact, the study has shown that a part of public incentives amounting to 19.3 billion euros has harmful effects on the

<sup>&</sup>lt;sup>17</sup>See AMERIGHI, O., FELICI, B., "Sviluppo sostenibile e green economy: oltre il PIL", in Energia, ambiente e innovazione, 2011, 3, pp. 43-48

environment and, of this sum, 16.8 billion are intended to finance the fossil fuel market. As a counterbalance to these figures we find the "only" 15.2 billion euros allocated to all those facilities that have a beneficial effect on the ecosystem. The disparity is evident and clear and perhaps even more so is the anachronism of certain benefits that despite still are granted today, everything. Some examples can be found in the transport sector where situations emerge for which employees of companies are granted the opportunity to benefit from a company car of their own taste, a benefit that encourages the choice of high-end vehicles, large displacement and therefore higher consumption and emissions. In order to remain aligned with policies to reduce consumption and emissions, it would be more appropriate to facilitate employees, for example, to purchase season tickets for public transport<sup>18</sup>.

<sup>&</sup>lt;sup>18</sup>See https://www.mite.gov.it/pagina/catalogo-dei-sussidi-ambientalmente-dannosi-edei-sussidi-ambientalmente-favorevoli URL accessed november2021

## **1.3.** Environmental technologies as value drivers within different economic behaviors

In his work, Theory of Economic Development, Schumpeter defines innovation as "a creative response" of the market. The famous economist had in fact considered innovation as a solution to a request, to a need, to a demand of the economic market; in other words he claimed that "a result that occurs whenever the economy, a sector or some companies of a sector, offer something different, something that is outside the existing practice".<sup>19</sup>. In his analysis of the capitalist system, innovation is the result of an "enlightened" process of entrepreneurs who boldly challenge the state of things and economic tradition, renouncing the routine of traditional models and tools; in short, new productive possibilities are identified and activated. We can consider that in Schumpeterian theory, the ability to innovate is linked to particular leadership qualities that in some cases anticipate and address consumer needs. This reference to the concept of innovation is necessary within the discussion that we are carrying out, because at an

<sup>&</sup>lt;sup>19</sup>See SCHUMPETER J. A., Teoria dello Sviluppo Economico, edizione italiana Sansoni (1977), Nuova Biblioteca, Firenze.

environmental level it is appropriate to take into consideration that innovation in sustainable terms of one's own business model can certainly generate value and arrive at contributing to a new vision of economic and productive dynamics. From a regulatory point of view, as mentioned in the course of this work, much has been done, although international agreements and specific regulations of individual countries have not always been followed by a real change in terms of sustainability. Finding a meeting point between digital innovation and environmental sustainability is now considered a crucial objective and, at the same time, a challenge that cannot be postponed and will continue even after the end of the current health emergency.

In general, and especially in Italy, governments have often used command and control administrative tools, setting rules for pollution reduction, targeting specific sectors of activity and/or types of emissions, then using procedures for control and finally applying sanctions to non-compliant operators. It must be said that the path of imposing regulations that can materially generate some sort of change within the economic scenario in terms of sustainability is definitely to be considered only one of the options and paths to follow. However, adequate levels of innovation can certainly guarantee the achievement of better competitiveness and certainly favor the ecological transition. For 2021, companies say they will invest in research and innovation, an area that is confirmed as fundamental to react to the crisis. Analyzing in detail the technologies on which we are most oriented, in first place is cybersecurity (22%), followed by collaborative robotics (19%), additive manufacturing (17%), Internet of Things (16%), cloud computing (13%), simulation and Artificial Intelligence (10%), Big Data (9%) and augmented/virtual reality and intelligent materials (8%).<sup>20</sup>.

In a particular context, the digital revolution and the current climate crisis move on parallel tracks, since both are now irreversible, deep and transversal phenomena. Precisely for this reason, both should be addressed with a synergistic and systemic approach, which invests technology with a key role in achieving not only environmental sustainability, but also social and economic sustainability. For example, to return to the topics that characterized the beginning of this chapter, on the energy efficiency front, the plan calls for the EU and member states to launch a "renovation wave" of public and private buildings<sup>21</sup>. In order to reduce transport emissions by 90% by 2050, it will be necessary to completely overhaul road, rail, air and waterway transport, focusing on electrification and alternative fuels. More generally, digital technologies are considered a key factor in achieving the sustainability

<sup>&</sup>lt;sup>20</sup> See MECSPE, Osservatorio Mecspe nazionale, primo trimestre 2021, https://www.mecspe.com/it/osservatori/mecspe-nazionale-i-trimestre2021/

<sup>&</sup>lt;sup>21</sup> See AMERIGHI, O., FELICI, B., "Sviluppo sostenibile e green economy: oltre il PIL", in Energia, ambiente e innovazione, 2011, 3, pp. 43-48

goals of the Green Deal<sup>22</sup>.

It is precisely sustainability and innovation that should be considered the main variables in a process of change that should lead the European Union to a major environmental renaissance. It should also be pointed out that the design of a Green Deal is only feasible when it exploits the potential offered by innovation processes that are now closely linked to the digitalisation of production activities. Think, for example, of the ecological transition that is affecting the car market. It has happened that, in fact, the car market is being materially disrupted. The electric transition would never have happened without the advent of digital technologies that are now very advanced. This is to say that innovation processes are to be considered closely linked to environmental sustainability as they bring a new logic of cost structure efficiency. The higher cost of implementing new technologies is very often associated with savings in terms of emissions and therefore a lower environmental impact, which is certainly significant.

In this way the achievement of the objectives set by the Green Deal depends on the degree of ambition shown by the other European institutions, first and foremost the Parliament and the Council of Europe. The complexity of the decision-making process, a sometimes

<sup>&</sup>lt;sup>22</sup> See RIFKIN J., The Green New Deal: Why the Fossil Fuel Civilization Will Collapse by 2028, and the Bold Economic Plan to Save Life on Earth, EBOOK, 2020, p. 118

obsolete institutional architecture and the divergence of interests manifested by the different actors deserve to be explored in depth, in order to understand the starting positions of each of them, the role of internal dialogue and also the interactions between the political and budgetary aspects of the Green Deal. The European Parliament, the body elected by the citizens, is the institution that has often expressed and demanded more ambition from other decision-makers. We see this with regard to the Green Deal, but it also applies to the debate on the future of Europe and the negotiations on the EU's multiannual budget for 2021-2027. With regard to climate policy, in their resolution of 15 January 2020, MEPs declared themselves in favour of increasing the Union's climate ambition for 2030 and 2050, seeing this as a decisive commitment by the EU to achieve carbon neutrality by 2050. MEPs also strongly emphasised that the transition is a joint effort by all member and that each member state must contribute to states the implementation of climate neutrality in the Union by 2050 at the latest. The resolution does not fail to support the EU's role as a global leader in protecting the planet: "The European Parliament stresses that, as the world's largest single market, the EU has the ability to set standards that apply to the entire supply chain. Global value and believes that the Union should strengthen its political action on the basis of Green Deal

diplomacy as well as climate diplomacy<sup>"23</sup>. With reference to technological innovation, it should be noted that the IT industry is responsible for 3% of global CO2 emissions and consumes monumental amounts of electricity. We also know that the technological devices that are now part of our daily lives require the use of rare materials, which produce significant waste of resources and generate safety risks in the workplace, as well as contributing to the production of what will one day become electronic waste recyclable only in small part<sup>24</sup>.

There is, however, also an extremely sustainable aspect linked to digital innovation, and it can transform it into a means towards a world that is truly less polluting and more sustainable: think, for example, of smart cities, or of startups in the agrifood sector that use technology to reduce waste or to adopt virtuous models of circular economy. In this sense, we can even speak of digital sustainability, understood as the set of methods and technological solutions that contribute to a more virtuous society, environment and economy<sup>25</sup>.

<sup>&</sup>lt;sup>23</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279

<sup>&</sup>lt;sup>24</sup> See JORIZZO M., La dimensione economica delle tecnologie ambientali nell'ambito della green economy, EAI Speciale I-2012, 896

<sup>&</sup>lt;sup>25</sup> See KESIDOU, D., On the drivers of eco-innovations: empirical evidence from the UK, Research Policy n. 41, pg 862-870, ELSEVIER, London, 2012

# 1.4. The contribution of new environmental technologies for the improvement of processes and products

One of the objectives of the European Green New Deal is certainly to make more sustainable a whole series of human activities that currently consume a large amount of energy, or produce an excessive amount of pollution: it means introducing new rules for building or renovating houses and industries around Europe, making production processes less polluting, increasing public and rail transport, promoting biodiversity - i.e. materially protecting forests and animal species from extinction - making the circular economy even more widespread, and reserving a set share of European funds for sustainable initiatives<sup>26</sup>. The current model of production and management of resources, goods and services that seeks to increase short-term consumption is progressively leading the planet to an environmentally unsustainable situation. The current economic system is clearly not in consonance with the life cycle of nature and is opposed to the idea of sustainable development, which focuses on a long-term organisation of the relationship between

<sup>&</sup>lt;sup>26</sup> See SPEZZANO P., Eco – innovazione dei processi industriali, Sistemi produttivo e tecnologie, EAI Speciale I-2012 Verso la green economy

production and resources. In nature, there is no such thing as waste or landfill: all elements perform a function continuously and are reused for use in different stages. The concept of sustainability is daily on the agenda within the social, communicative and political dynamics of European countries. Europe, especially the countries located in the north of the Old Continent, continue to attach great importance to the concept of sustainability, to the concept of sustainable development and in general to a "green" change in industrial development policies<sup>27</sup>. This attention is unequal within the Member States of the Union, almost absent in some countries that are not part of the European Union, but geographically are part of the European continent, just as it is scarcely taken into account in the United States of America or within developing countries such as China, for example. It could be argued, more precisely and clearly, that at a social level the world's population - especially those strata of the world's population residing in the richest countries feel the problem of the environmental impact of human action<sup>28</sup>. At a political level, this issue is then exploited and even exalted with praiseworthy commitments, but in practice the actions taken at home and abroad by states are reduced to mere stances that are not followed

<sup>&</sup>lt;sup>27</sup> See KESIDOU, D., On the drivers of eco-innovations: empirical evidence from the UK, Research Policy n. 41, pg 862-870, ELSEVIER, London, 2012

<sup>&</sup>lt;sup>28</sup> See TAMMA, P; SCHAART, E.; GURZU, A., "Europe's Green Deal plan unveiled", in Politico, 2019, online https://www.politico.eu/article/the-commissions-green-deal-plan-unveiled/ consultazione nel febbraio 2021.

by adequate measures that can cut and reduce the environmental impact of an economic dynamic that is now decidedly unable to meet the needs of the population, but which pursues certain objectives in the name of profit that are clearly at odds with the course of events<sup>29</sup>. For years now, China itself has shown a good inclination towards the concept of sustainability, even if concrete measures to reduce emissions are scarcely favoured in public policies in the name of international competitiveness, which would be penalised precisely by the adoption of considerable investments and thus constraints on the production of goods and services<sup>30</sup>.

The concept of sustainability pervades all aspects of daily life. Imagining sustainable development and a sustainable future clearly means considering a radical change in lifestyles, and this clearly involves a large-scale rethink. The same circular response to the crisis of the current model rethinks consumption as a function of reuse with considerable social, educational and moral benefits. Added to this is a new way of doing business that does not reject profit but rethinks it. In particular, it is possible to produce wealth and improve the conditions of the individual even beyond the Paretian equilibrium, i.e. by

<sup>&</sup>lt;sup>29</sup> See SPEZZANO P., Eco – innovazione dei processi industriali, Sistemi produttivo e tecnologie, EAI Speciale I-2012 Verso la green economy

<sup>&</sup>lt;sup>30</sup> See CASTELLANI V., SALA S., "Atlante dell'eco-innovazione: metodi, strumenti ed esperienze per l'innovazione, la competitività ambientale d'impresa e lo sviluppo sostenibile", Franco Angeli, Milano 2011, p. 189 e ss.

improving the conditions of several subjects at the same time with increases in utility for the various economic actors. Achieving fewer emissions, less waste and a healthy environment is certainly a good thing even with a certain relevance from a point of view that we can define as purely economic. Sustainability means, therefore, opening the economic and other minds to new horizons, revising the very concept of efficiency<sup>31</sup>.

From a point of view that we can define more empirically, companies could aim to reduce costs precisely through a continuous improvement of internal processes to be sought both inside and outside the value chain and company boundaries. It would involve reducing the use of raw materials through a continuous improvement of internal processes, such as reducing the energy used, adopting ecological practices, reducing the waste produced, reducing atmospheric emissions, using more efficient logistics. Of course, it is also essential to re-organize and optimize organizational and production processes, as well as logistics, for example by investing in new machinery and bringing in eco-design solutions that could reformulate a rethink of the offer<sup>32</sup>. Porter has

<sup>&</sup>lt;sup>31</sup> See TAMMA, P; SCHAART, E.; GURZU, A., "Europe's Green Deal plan unveiled", in Politico, 2019, online https://www.politico.eu/article/the-commissions-green-deal-plan-unveiled/ consultazione nel febbraio 2021.

<sup>&</sup>lt;sup>32</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279

always acknowledged that the productivity of production processes is the key element of competitiveness for a company. Organizations should be able to turn costs into profits by identifying hidden opportunities innovation, thus ensuring efficient for more organizational systems. While there is immense potential in ecoinnovations, this potential is highly dependent on the context in which the company is embedded and its internal capabilities. Added to this is the need to go out and create value especially for customers through eco-branding strategies. The eco-branding strategy is the simplest of the four, precisely because it is based on marketing differentiation based on tangible or intangible environmental attributes. These differentiating advantages lead to a premium price and a redevelopment of the company in niche markets. The eco-branding strategy places great emphasis on eco-design, brand communication, to make consumers aware of environmental benefits and to protect the company itself from imitation. Environmental sustainability is thus seen as an added value for the customer, a kind of quality of safety, healthiness or design. If "being green" costs more, the differentiation strategy is the only way for the company to pay for the environmental investments made. This system is acceptable when niche markets are willing to pay a premium price, but when referring to the majority of markets, where they compete through price strategies, the company will never be able to compensate for the "green investments" it has made. For example, among the important aspects of technological progress in the service of sustainability is waste. Waste is waste not because of any intrinsic quality, but because it cannot be used in another process. because it cannot find any use for it in another process (it must be stressed, however, that this is not always recognised by the regulations in force in the EU and therefore in Italy)<sup>33</sup>. The waste is destined to accumulate in the environment, representing a waste. This is especially true if nonrenewable raw materials were used in the process that led to its production. Finding a use for every kind of potential waste produced, through integration, is one way of eliminating it. The other, more radical, way is to actually eliminate the waste generated in the production phase, through a change of use or through a modification or change or process change<sup>34</sup>.

<sup>&</sup>lt;sup>33</sup> See SPEZZANO P., Eco – innovazione dei processi industriali, Sistemi produttivo e tecnologie, EAI Speciale I-2012 Verso la green economy

<sup>&</sup>lt;sup>34</sup> See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279
#### **CHAPTER TWO**

*Eco-innovation in industrial production:* 

the impact on the environment and productivity

### 2.1 Technological developments and eco innovation in industrial processes

In recent decades, the term Innovation has radiated unprecedented prominence worldwide. As globalization advanced by leaps and bounds over every corner of the planet, this much-invoked concept developed special attention. Companies, governments, scientists, managers, etc. want to innovate their productive and organizational tools. We can define it as the process of translating an idea into a product or service that creates value for someone willing to pay for it<sup>35</sup>. The idea must be replicable and satisfy a specific need. In business, it results when it is applied by companies to meet customer needs and expectations. In social contexts, innovation helps to improve the living conditions of each human being, and the social collective. Producing actions aimed at improving life in general is one of today's priority tasks, both for governments and public and private institutions. The main objective was to reduce the environmental impact, avoiding the

<sup>&</sup>lt;sup>35</sup>See SMULDERS S., BRETSCHGER L., Explaining Environmental Kuznets Curves: How Pollution Induces Policy and New Technologies, Discussion Paper n. 95, Centre for Economic Research, Tilburg University, 2001

deep consequences left by the development of industry and the advance of technology, but at the same time, to change a habit and favor public health in an innovative way. One of the ways to encourage innovation is by economically financing different projects through the management of policies by the State, as well as the business or private sector<sup>36</sup>.

But producing innovation today, without taking care of the environment, is counterproductive. Therefore, it has become imperative to disseminate the benefits of highly sustainable innovative projects. Making known positive impacts and results, in counterbalance to what would have been, if a conventional alternative not healthy for the planet earth had been chosen, is a crucial part of the story to crystallize the trend, or what is more, to promote a culture of innovation. It is very important to generate awareness in society that vital resources are limited, and are running out. The planet is the most precious object that humanity possesses, and it must be cared for. It provides us with all the essentials for life, and without nature - needless to say - we cannot live. It is time then for companies and governments to be extremely careful and creative, and to carry out projects that allow us to achieve sustainable economic growth and development while preserving the environment.

<sup>&</sup>lt;sup>36</sup>See SCHIEDERIG T, TIETZE F, HERSTATT C, What is Green innovation? A quantitative literature review (2011) [https://tubdok.tub.tuhh.de/bitstream/11420/1004/1/What\_is\_Green\_Innovation\_ISPI M\_PAP ER.pdf

It is important to remember that a country without industry is unlikely to have a promising future, so it is essential to implement innovative initiatives that provide a platform for social and economic development, with a high degree of sustainability, so as not to affect the natural environment.

Today, the most developed countries in the world are betting on innovative policies that will enable them to become strong and competent nations in the face of the increasingly demanding international market. But they will do so with the understanding that the main factor by which they will be scrutinized by global citizens is their ability to protect and improve the health<sup>37</sup>.

<sup>&</sup>lt;sup>37</sup>See SMULDERS S., BRETSCHGER L., Explaining Environmental Kuznets Curves: How Pollution Induces Policy and New Technologies, Discussion Paper n. 95, Centre for Economic Research, Tilburg University, 2001

### 2.2 Efficient use of environmental resources and reduced impact on the ecosystem

It is common practice for the industry to carry out risk analysis studies in order to understand the consequences of possible projects or activities to be implemented based on the probability of occurrence of the associated risks and the magnitude of the effects derived from them. Under this scheme, projects with high risks and low impact are unacceptable and consequently discarded<sup>38</sup>.

The risks associated with mitigating climate change, which already exist and which are expected to increase over the next twenty years, include: taxes on Co2 emissions, limits on Co2 emissions, audits by shareholders and financiers, public relations and damage to corporate image. In terms of mitigation of climate change, organizations should anticipate risks associated with changes in weather patterns that have been published under different models and simulators<sup>39</sup>.

Production processes, regardless of their nature (chemical, biological or

<sup>&</sup>lt;sup>38</sup>See INNOVATION MANAGEMENT, 2010, "Saving the climate is saving the business aligning sustainable and open innovation" [http://www.innovationmanagement.se/2010/04/12/saving-theclimate-is-saving-the-business-aligning-sustainable-and-open-innovation/]

<sup>&</sup>lt;sup>39</sup>See FEDERICO T., Lo stato della green economy in Italia e nel mondo. Il Rapporto e le proposte degli Stati generali della green economy 2018, Alleanza Italiana, Sviluppo Sostenibile, disponibile https://asvis.it/goal7/articoli/405-3579/lo-stato-della-greeneconomy-in-italia-e-nel-mondo-il-rapporto-e-le-proposte-degli-stati-generali-dellagreen-economy-2018

biotechnological), generate appreciable quantities of waste, the final disposal of which is the source of serious environmental and economic problems. Due to the need to improve process efficiency, reduce pollutant loads and reuse all that is usable, recycling schemes have been proposed, and a reconversion and use of process wastes as raw materials for other processes<sup>40</sup>.

Critical materials are necessary for humanity. Renewable energy, mobility, new technologies based on electronics, robotics, health and the food of the future depend on them. There are problems of geological scarcity, supply, price, environmental impact in the form of water shortages, energy, pollution, destruction of ecosystems, social and geopolitical tensions. Recycling has obviously a key role for achieving the goals of sustainability and reduction of industrial impact. Humanity cannot depend only on its mining extraction because demand is growing exponentially. Use and throw away is not the solution, because the problems associated with heavy metal contamination and high recycling costs due to an enormous increase in the entropy of mixing the waste generated are added to the previous problems.

It is necessary to make a global accounting of the loss of natural capital

<sup>&</sup>lt;sup>40</sup>See DE MARCHI V., DI MARIA E., MICELLI S.,, "Environmental Strategies, Upgrading and Competitive Advantage in Global Value Chains", Business Strategy and the Environmen, 2012

of these critical metals. It is necessary to analyze the recyclability of the different products on the market and propose eco-design solutions based on their disassembly, their collection and to evaluate the energy and environmental impact of their recycling, reuse and lifetime. Unfortunately, more work is done on producing new materials with fascinating properties than on studying how to desalinate, unmix, decontaminate or recover the basic elements to reintegrate them into the production chain. Recovery is neither scientifically attractive nor as economically profitable as creating new materials and happily launching them onto the market<sup>41</sup>.

In this fast-changing technological environment, where time is the critical variable, it is the innovative industries that make the difference, which have the necessary flexibility to adapt to the new environment. The ability to innovate is, in itself, seen as a competitive advantage. Innovation is currently the most effective business weapon, only competitive production can ensure a competitive economy in the long term. In order to achieve competitive production, there is only one way: maintaining an indigenous capacity for technological innovation. When we talk about innovation, we often think of cutting-edge sectors, such as pharmaceuticals, food and beverage such as pharmaceuticals and the ICT sector, but it must not be forgotten that, for instance, the food and

<sup>&</sup>lt;sup>41</sup>See SMULDERS S., BRETSCHGER L., Explaining Environmental Kuznets Curves: How Pollution Induces Policy and New Technologies, Discussion Paper n. 95, Centre for Economic Research, Tilburg University, 2001

beverage sector is the most important sector in Europe in terms of production value and the second most important in terms of employment<sup>42</sup>.

<sup>&</sup>lt;sup>42</sup>See SCHIEDERIG T, TIETZE F, HERSTATT C, What is Green innovation? A quantitative literature review (2011) [https://tubdok.tub.tuhh.de/bitstream/11420/1004/1/What\_is\_Green\_Innovation\_ISPI M\_PAP ER.pdf

# 2.3 The impact on productivity: technological innovation and performance improvement

Before delving into the nexus between innovation and sustainability, it is appropriate to clarify more precisely what the meaning of the concept of "innovation" is in relation to the issue of production, and then to take a closer look at the link between technological innovation and environmental and social protection.

As is well known, innovation represents a powerful stimulus to production performance and therefore of productivity in every field. Not only, of course, innovation linked to the efficient use of resources in terms of sustainability. Think of innovation in the internal organization and in managerial sphere, a sphere that is anything but foreign to the demands of sustainability<sup>43</sup>.

By innovation of internal organization we refer to the mechanisms used internally by the company to achieve the objective of innovation. Some of these may be: maintaining a technology management or committee, having a plan of innovation activities, developing performance indicators for the innovation obtained or evaluating the alternative technologies that exist for the company. The objective is not only to

<sup>&</sup>lt;sup>43</sup> See WOOLTHUIS, R., LANKHUIZEN, M. and GILSING, V. (2005) A system failure framework for innovation policy design. Technovation, 25(6), pp. 609–619.

determine whether companies have such activities, but also to study whether they have a positive influence on productivity growth<sup>44</sup>. At present, one of the determinants of innovation that is considered to be most likely to stimulate innovation is organizational culture. This is because by influencing the behavior of employees, it can make them accept innovation as a fundamental value in the organization and commit to it. Innovative companies need in their internal organization a high level of education and qualification of the technical staff, as well as their experience in the development of their work. The accumulated experience and the qualification of the company's human capital are two key factors for improving the company's productivity. The time to diffuse and adapt the technology is reduced with adequate training of workers and with changes in the internal organization of companies aimed at a more efficient use of the new machinery. Studies referring to the importance of organizational changes promoted by the adoption of information and communication technologies (ICT) empirically show the importance of accompanying any technological adoption in a company with a change in work organization if a positive impact on productivity is to be obtained<sup>45</sup>.

<sup>&</sup>lt;sup>44</sup>See INNOVATION MANAGEMENT, 2010, "Saving the climate is saving the business aligning sustainable and open innovation" [http://www.innovationmanagement.se/2010/04/12/saving-theclimate-is-saving-thebusiness-aligning-sustainable-and-open-innovation/] <sup>45</sup>See DE MARCHI V., DI MARIA E., MICELLI S.,, "Environmental Strategies,

<sup>&</sup>lt;sup>4</sup><sup>3</sup>See DE MARCHI V., DI MARIA E., MICELLI S.,, "Environmental Strategies, Upgrading and Competitive Advantage in Global Value Chains", Business Strategy

The literature finds relationships between process innovation and productivity growth. Process innovations reduce production costs by increasing the productivity of labor and/or capital. An active learning model, the relationship between R&D activities and productivity growth is through the achievement and application of process innovations<sup>46</sup>. Generally speaking, companies that implement innovation processes enjoy higher productivity than those that do not. This increase in productivity also depends on the size of the company; small companies see their productivity increase as soon as they implement the innovation process. Process innovation clearly influences additional productivity growth at any point in the life cycle of a company at which it occurs<sup>47</sup>. Generally speaking, we can define innovation as the introduction of a new product or service that represents a significant improvement, a process, a new marketing method or an organizational method in the internal practices of the company or organization. The industrial promotion and innovation policy's priority is to detonate innovation in the productive sectors and, in particular, in companies to generate greater wealth; that is, to

and the Environmen, 2012

<sup>&</sup>lt;sup>46</sup> See WROŃSKI, M. (2019) The productivity growth slowdown in advanced economies: causes and policy recommendations. International Journal of Management and Economics, 55(4), pp. 391–406.

<sup>&</sup>lt;sup>47</sup>See SCHIEDERIG T, TIETZE F, HERSTATT C, What is Green innovation? A quantitative literature review (2011) [https://tubdok.tub.tuhh.de/bitstream/11420/1004/1/What\_is\_Green\_Innovation\_ISPI M\_PAP ER.pdf

provide greater economic value to the productive process and to the component or product that is produced in the economy. Innovation can be reflected in: the introduction of a new product that satisfies new consumer needs; the improvement of its quality, presentation and service, making it more attractive in the market; the use of a new production method; the use of new technologies such as ICTs or a scientific discovery that increases the value of production. Innovation includes the opening of a new market with alternative logistics and marketing strategies; the use of new sources of supply of inputs; and making changes in the organization or operation of the market<sup>48</sup>. In a knowledge-based economy, innovation and skills have become the new capital of countries. According to the Organisation for Economic Cooperation and Development (OECD), in recent decades the competitiveness and prosperity of the most developed countries has been based on their capacity to innovate. The way to comprehensively determine, both in the short and long term, whether the activities carried out generate quality deficiencies and added costs, is through the "continuous analysis of processes", in that sense, it is necessary that the business organization be able to release the full potential of its employees. Based on these analyses, internal actions can be defined to

<sup>&</sup>lt;sup>48</sup>See FEDERICO T., Lo stato della green economy in Italia e nel mondo. Il Rapporto e le proposte degli Stati generali della green economy 2018, Alleanza Italiana, Sviluppo Sostenibile, disponibile https://asvis.it/goal7/articoli/405-3579/lo-stato-della-greeneconomy-in-italia-e-nel-mondo-il-rapporto-e-le-proposte-degli-stati-generali-dellagreen-economy-2018

eliminate activities that do not add value, simplify tasks that generate excessive costs, allocate resources more efficiently, adapt internal quality standards to those demanded by the market, and release synergies from the entire production organization to enable continuous improvement of innovation, design, production and after-sales processes<sup>49</sup>. These last innovations have made the biggest difference between the most technologically advanced countries and developing countries, as they have enabled the former to take the initiative in product design and in improving technical and economic productivity very quickly, covering both the technological and human aspects<sup>50</sup>.

<sup>&</sup>lt;sup>49</sup>See INNOVATION MANAGEMENT, 2010, "Saving the climate is saving the business aligning sustainable and open innovation" [http://www.innovationmanagement.se/2010/04/12/saving-theclimate-is-saving-the-business-aligning-sustainable-and-open-innovation/]

<sup>&</sup>lt;sup>50</sup>See DE MARCHI V., DI MARIA E., MICELLI S.,, "Environmental Strategies, Upgrading and Competitive Advantage in Global Value Chains", Business Strategy and the Environmen, 2012

#### 2.4. Improving waste and industrial waste management

The operation of industrial activity generates a wide variety of wastes depending on the characteristics of the materials and processes used in the production systems. The prevention of the environmental impact of these wastes has generated different standards that regulate their production, management and disposal. Compliance with legislation on safe disposal is not the only cost of industrial waste. Its generation can be an indicator of opportunities for improvement in the industrial process. Therefore, a management focused on the reduction of waste generated can result in the optimization of manufacturing processes and a reduction in the overall costs of the organization.

A good characterization of waste, knowing its properties and the hazardous substances it contains, allows management to be adapted and optimal solutions to be sought, identifying the most advantageous management options for the environment and, above all, for the profit and loss account of the company that generates it. Thus, the management of industrial waste requires knowledge of the legislation applicable to them, the requirements on hazardous substances whose use generates hazardous waste, the regulations on storage of chemicals and the transport of dangerous goods, so that, with an overview of the requirements of hazardous waste in industry can achieve optimal management of them. It's necessary to be aware of the need for professionals specialized in waste management and the regulations applied. As industry has become an essential part of modern society, waste production is an inevitable result of development activities. Industries release large quantities of waste into the environment in the form of solids, liquids and gases. Fortunately, the negative impacts on our environment are decreasing due to the significant investment and innovation that the waste and recycling industry is developing. From collection to processing to disposal, waste management plants are restructuring waste management, increasing efficiency and improving environmental protection<sup>51</sup>.

And that is because waste treatment companies have a gigantic task: to dispose of millions of tons of waste per year or to recycle it. The waste treatment hierarchy gives priority to recycling over disposal or energy recovery of waste, and this translates into different types of treatment depending on the type of waste. Industrial waste treatment therefore encompasses a wide range of environmental, technical and regulatory considerations. Regardless of the type of plant and selection of waste treatment technologies, the objective of minimizing the toxicity and

<sup>&</sup>lt;sup>51</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

volume of waste must be met<sup>52</sup>.

If we analyze the contemporary production model, we can approximate that the problem of unsustainability from a technical approach is due to the excessive use of materials and energy extracted from the earth's crust as a result of the overexploitation of ecosystems, which inevitably, according to the second law of thermodynamics, will produce waste. These uses generate ecological deterioration due to the space required to obtain resources and/or dispose of waste, which exacerbates the problem of scarcity of resources and excess waste. The problem is such that annually between 7 and 10 billion wastes are produced in the world, of which more than 20% approximately corresponds to industrial wastes. Moreover, considering that these can be divided into biodegradable and non-biodegradable, into numerous chemicals in solid, liquid and gaseous aggregates that can be toxic, flammable, corrosive, heavy metals, pesticides, etc. and whose treatment depends on their complexity and nature, it is not surprising that decisions on how to manage waste are very complicated<sup>53</sup>.

Faced with this problem, the first actions were oriented towards the

<sup>&</sup>lt;sup>52</sup>See FEDERICO T., Lo stato della green economy in Italia e nel mondo. Il Rapporto e le proposte degli Stati generali della green economy 2018, Alleanza Italiana, Sviluppo Sostenibile, disponibile https://asvis.it/goal7/articoli/405-3579/lo-stato-della-greeneconomy-in-italia-e-nel-mondo-il-rapporto-e-le-proposte-degli-stati-generali-dellagreen-economy-2018

<sup>&</sup>lt;sup>53</sup>See AMERIGHI, O., FELICI, B., "Sviluppo sostenibile e green economy: oltre il PIL", in Energia, ambiente e innovazione, 2011, 3, pp. 43-48.

search for more efficient technologies, but given contemporary consumption patterns and the incorporation of many developing countries into industrial production models, while the more developed ones have not stopped growing, the present situation demands moving towards awareness, education and participation of society in environmental aspects and the valorization of waste, closing material cycles to reconvert waste into resources in accordance with technological limitations. Faced with this difficulty, coherent development policies must be drawn up that take into account technical-economic, social and environmental factors in order to achieve robust solutions that balance human and natural needs. Although various methods have been developed for modeling the impacts of anthropogenic activities, each one has its limitations, so that the consideration of more than one indicator is adequate to analyze the complexity of the phenomenon. Therefore, in their integration, multicriteria decision techniques have received special attention since they can simultaneously address more than one objective and have proven to be efficient for modeling conflicting objectives<sup>54</sup>.

We could speak of three large blocks of industrial waste:

• Inert waste. These are wastes that do not present major risks to

<sup>&</sup>lt;sup>54</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

human health or to the environment. They can be deposited, dumped or stored without prior treatment.

- Waste assimilable to urban waste. They usually have a degradable organic composition and their treatment is similar to that used for urban waste management.
- Special or hazardous waste. These have a high polluting potential and can pose a serious risk to human health and the environment. They require special treatment and must be well identified and stored differently from the rest<sup>55</sup>. Companies that carry out good waste management manage to save costs and reduce management expenses. industrial companies are the ones that can achieve greater savings and better utilization. To achieve this, it is necessary to have good environmental advice. On the one hand, the waste-producing company may not be aware of the nature of the waste and it is necessary to correctly identify it in order to treat it appropriately.

In addition, this environmental advice should promote waste segregation in an efficient way, focus on sustainability, looking for treatment alternatives and seek ways to generate less waste or use it in other manufacturing processes<sup>56</sup>.

<sup>&</sup>lt;sup>55</sup>See AMERIGHI, O., FELICI, B., "Sviluppo sostenibile e green economy: oltre il PIL", in Energia, ambiente e innovazione, 2011, 3, pp. 43-48.

<sup>&</sup>lt;sup>56</sup>See KESIDOU, D., On the drivers of eco-innovations: empirical evidence from the

### 2.5 Energy requalification of productive structures: the case of chemical industries

It is recognized that industry, through the variety of manufacturing processes, raw materials and energy sources (fuels) used, poses complex pollution problems which, however, cannot be dissociated from a perspective of productivity and income imperatives.

The technical solutions are, however, multiple: recycling of pollutants, use of devices which eliminate or reduce pollution, mutation of manufacturing processes (with the use of clean technologies), change of raw materials and energy sources. In fact, the problem of industrial pollution is moving interests from different spheres of action: economic, social and cultural, political, administrative and technical.

Most of the large industrial groups are campaigning for environmental protection, often using the ecological argument as a factor of competition. This is a strategy that has not been very popular with SMEs.

Meanwhile, since the end of the 1980s, efforts have been made worldwide to coordinate industry and research and development of

UK, Research Policy n. 41, pg 862-870, ELSEVIER, London, 2012

clean technologies. At the same time, a new image of the industry is being projected. In addition, the environmental protection industry has a positive balance sheet. Among the major polluters are industrial parks and a number of large and multinational factories with high water consumption and effluent emissions. Meanwhile, multinational companies are currently trying to convey an image of total quality and environmentalism, and therefore adopt attitudes focused on the use of clean technologies, both in the production process and in the treatment of effluents. However, the results already obtained reveal that the treatment systems installed are insufficient to obtain acceptable final quality levels. Regarding gaseous effluents, the situation is even more deficient. However, the companies which do not respect the limits imposed by the legislation are sanctioned (but paying the fine compensates, if they are compared with the revenues required to combat pollution), converted or closed, without prejudice to their relocation to other regions, where environmental monitoring is less stringent.

The costs of industrial waste treatment must be internalized by the company, according to the logic that the emission of waste reveals deficiencies in the production process. Companies should strive to use clean technologies that aim to reduce environmental risks without changing the quality of the product and even using this decision as a

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competitive advantage.

The United Nations Environment Assembly is responsible for promoting important challenges regarding the preservation and rehabilitation of our environment, defining specific goals through the 2030 Agenda for Sustainable Development with its 17 elements.

To this end, the Assembly will meet every two years to establish global environmental priorities that contribute to the Agenda's objectives. During 2019, the Assembly presented the overall theme "Innovative Solutions to Environmental Challenges and Sustainable Consumption and Production" addressing three relevant topics, within which are 1) life cycle for resource efficiency, 2) energy and 3) chemicals and waste management<sup>57</sup>.

The chemical industry plays a key role in ensuring progress and evolution towards a sustainable society, contributing to achieving the Sustainable Development Goals (SDG's) and now facilitating the transition to a circular rather than a linear, low-carbon economy giving evidence of its commitment to the well-being of people and the planet itself.

The chemical industry is a relevant actor for the fulfillment of the Sustainable Development Goals (SDGs) of the 2030 Agenda, among which promoting appropriate production and management of

<sup>&</sup>lt;sup>57</sup>See KESIDOU, D., On the drivers of eco-innovations: empirical evidence from the UK, Research Policy n. 41, pg 862-870, ELSEVIER, London, 2012

chemicals to protect human safety and health through risk assessment of processes and products<sup>58</sup>.

The energy requalification of productive structures in the case of chemical industries, will include efforts to promote learning opportunities through community support programs, and to promote gender equality in chemical companies by providing equal development opportunities for women.

To promote sustainable management of process water and services, including the integration of products and processes for water treatment to ensure availability for all, will be necessary boost process optimization and the use of energy from renewable sources, and promote decent employment based on ensuring the safety and health of all those who work in chemical sector companies while fostering economic growth under circular economy principles.

Improving investment in research, development and innovation of more sustainable processes and products, will be make it possible to promote the conservation and protection of our natural resources, using materials efficiently, minimizing waste generation. Manage products more safely and share information in an open and transparent manner with all members of the value chain. Finally, the centrality of the effort

<sup>&</sup>lt;sup>58</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

to optimize organizational and managerial processes must not be forgotten, since they represent, as we have seen, a key in the general implementation of processes and a fundamental driver of productivity Efficient management of electrical energy and combustion processes will furthermore optimize processes to minimize Greenhouse Gas (GHG) emissions<sup>59</sup>.

<sup>&</sup>lt;sup>59</sup>See AMERIGHI, O., FELICI, B., "Sviluppo sostenibile e green economy: oltre il PIL", in Energia, ambiente e innovazione, 2011, 3, pp. 43-48.

### **CHAPTER THREE**

The Italian production system and the transition to green

technologies

# 3.1. The indicators of economic sustainability of the Italian productive system: the trend in the last ten years.

During the second half of the twentieth century, the effectiveness of development policies is mainly measured by gross domestic product (GDP). This standardized index, which quantifies the production of wealth (or added value), responded favorably to the priorities of postwar reconstruction, then to the emergence of developing countries.

However, the use of GDP as the sole indicator of development is increasingly criticized. Other indicators are now available or under development to guide decision-making affecting the development of our societies. The main criticism of GDP is that it does not account for the loss of wealth, whether material, social or natural<sup>60</sup>. Thus, the GDP

<sup>&</sup>lt;sup>60</sup> See TALBERTH, J. A. BOHARA (2006). "Economic openness and green GDP." Ecological Economics 58: 743-758.

takes into account the wealth produced by the automobile industry, but not its health cost. Health spending is even a factor in increasing GDP. In addition, the index does not take into account the production of nonmarket wealth (natural heritage, intra-family services, associative activities, etc.) which are nevertheless really useful to society. These weaknesses help to send the wrong signals on the development methods to be favored. For several years, economists have therefore been developing alternative economic indicators, often referred to as "green GDP", in order to take better account of the real production of wealth and well-being<sup>61</sup>.

A commission headed by economist Joseph Stiglitz in fact submitted its recommendations in 2009, which now feed the work of the National Institute for Statistics and Economic Studies. The HDI is an index created by the United Nations Development Program (UNDP) in 1990 to measure the level of human development on criteria other than just economic production (education rate, life expectancy, standard of living, etc.). It is now the main indicator used to measure individual and collective well-being in a given region. The ecological footprint makes it possible to quantify human needs, measured in "global hectares", in relation to the Earth's capacity to meet them in the long

<sup>&</sup>lt;sup>61</sup> See BECKERMAN W. (1994). *Sustainable Development: Is It a Useful concept?* Environmental Values, 3, n.3, p.195.

term, measured in "available global hectares". When the needs of humanity exceed the earth's capacity, ecosystems and natural resources are no longer able to fully regenerate themselves, leading to their degradation, scarcity or even disappearance. Humanity therefore draws on reserves that will no longer be available to future generations.

Today, it is estimated that the needs of humanity exceed this capacity for renewal by 50%, hence the idea that we "consume 1.5 Earths" or that we live "on credit".

Sustainable development is not a generic principle but is a process of implementing integrated economic, social and environmental policies, marked by precise commitments and deadlines. The international negotiation has brought to the fore the need and also the opportunity to anchor sustainability to certain quantitative elements, capable of correctly interpreting the programmatic design, the Agenda 21 processes, the Plans for sustainable development and the verification of the progress actually achieved<sup>62</sup>.

There is a difference between the last decade and the current one in the negotiations for sustainable development: declarations and assumptions of commitments accompanied by quantitative objectives and certain deadlines are now preferred to pleadings that are often only

<sup>&</sup>lt;sup>62</sup> See BROWN B. Et Al. (1987). *Global Sustainability: Toward Definition*. Environmental Management, 11, n.6, p. 714.

in principle. We cannot really say whether this trend, assumed to counter the emptiness of certain yet important declarations of intent, has given rise to an effective greater concreteness. What is certain is that at least we know how things stand and how they should change in the name of sustainability<sup>63</sup>.

The indicators and index systems associated with a given program therefore take on a new role. Just to mention the most important ones, the system of structural indicators and related targets was associated with the Lisbon process and in the Millennium Assembly, in the same year, the so-called Millennium Development Goals were associated with quantitative indices and targets and commissioned and financed the task of monitoring all indices<sup>64</sup>.

The maintenance of a system of even minimal complexity indexes can only be ensured through the use of information systems based on suitably structured technological architectures. A project of this kind must be based on a shared vision of the development model and sustainability and must take into account the vast and varied elaboration of lists and methodological approaches that was produced

<sup>&</sup>lt;sup>63</sup> See ALBERTI M., PARKER J. (1993), "Gli indicatori di sostenibilita` ambientale", in Conte G., Melandri G.(a cura di), *Ambiente Italia 1993*, Koine' Edizioni, Roma.

<sup>&</sup>lt;sup>64</sup> See LEVETT R. (1998). Sustainability indicators – integrating quality of life and environmental protection. Journal of the Royal Statistical Society A, 161, part 3, pp. 291-302.

in the second five-year period between Rio and Johannesburg. It must also equip itself with a formal mathematical-statistical methodology capable of dealing with a systemic, complex problem characterized by the multiplicity of phenomena that determine it and by the multidisciplinary of the knowledge necessary to cope with it, such as that of sustainable development. A program of indicators must be developed on an efficient, shared and accessible informational and communicational basis<sup>65</sup>.

Using indicators is now part of everyday life, so much so that the mass media system has learned to manipulate data to guide consumption, preferences and also the visions of the world of citizens. This does not always happen correctly.

If there is a link between the values we measure and the values we create, then the same interest moves our observations and our beliefs about the world. Stock market indices, created to satisfy the interests of some subjects, are now increasingly commonly interpreted as indicators of the health of the economy only because we care about the state of our economy. If this is true, however, there can be no doubt that it is different to classify nations on the basis of per capita GDP rather than on the equity ratio of income distribution. If an economy is managed to

<sup>&</sup>lt;sup>65</sup> See EHRENFELD J.R. (2008), Sustainability needs to be attained, not managed. *Sustainability: Science, Practice and Policy*, vol 4, p 1-3.

maximize GDP it is possible for this to happen. There is a delicate relationship between information and knowledge. Ensuring access to the first to guarantee the second is a delicate matter, full of difficulties and pitfalls. It is certain that decision-makers greatly desire to have the correct values of all indicators, at least as much as it is uncertain that they are willing to communicate those data to the public. This highlights another aspect, linked to the competitive advantage of information, which can be an obstacle to its correct dissemination and therefore, finally, to the development of a collective, balanced and reliable knowledge of problems.

It is equally delicate to manage information correctly and therefore to choose and disseminate good indicators. It is easy to make mistakes and sometimes mistakes are made even in perfect good faith. The most common and most dangerous errors derive from the functionalization of information to one's beliefs, purposes or desires, if not to ideologies and false models. It is very common that if an index brings negative news, it is tempting to alter it, change its definitions, suspend funds from those who produce it. In some countries, only those looking for work are defined as "unemployed", not those who have stopped looking for it. In others, a job occupied for a few weeks is also defined as an "occupation". Most of the city administrations do not communicate data on air pollution for fear of chaotic and uncontrolled reactions of the population.

Indicators can confuse the public with numbers, making them lose the correct view of reality. In no case are the indicators the reality, at most they represent some partial data. Other times we measure what is measurable rather than what is important; it can happen out of opportunism but also, often, out of the difficulty of measuring things. Think of the biodiversity indices. Think of training and education measured with expense ratios rather than real learning. What matters is therefore always knowledge, which is impossible without information.

An indicator captures a partial aspect of a process and cannot necessarily interpret the various interconnected aspects, the economic, social or environmental. The interpretation of information requires knowledge, so the reading of an indicator can only be done by having a cognitive model, in which all informal knowledge, the theoreticalphilosophical aggregate we have, and formal, expressed through structured languages converge of scientific knowledge, mathematics, physics, statistics etc. Such models are in themselves imperfect and uncertain. A model can master uncertainty with adequate scientific tools but not its own uncertainty<sup>66</sup>.

<sup>&</sup>lt;sup>66</sup> See HANSEN M. T., BIRKINSHAW J., (2007) "The Innovation Value Chain",

The depletion of resources and the impetuous growth of the world population now confront humanity for the first time with his chances of survival, just a few years after the narrow escape of a generalized nuclear conflict. Our models, very powerful for analyzing and interpreting, are weak in predicting. Sustainable development questions the survival of the species in the long term and in conditions of equilibrium: many of the factors that will determine these probabilities of success are actually beyond the limits of our knowledge. Sustainable development indicators are asked to represent the state of our systems, but they are also asked to guide the changes necessary to ensure the success of our actions. This is far more difficult.

What we need to attempt the path of sustainable development is not an indicator rather than another, but an information governance system based on an ethics of information and on an action program made explicit in terms of objectives and timing. The indicators controlled by the system may be many or even very many, because there are many purposes that we want to pursue and we want to try to do so in many different ways<sup>67</sup>. Part of the system must be dedicated to preserving the common goods, the global commons, the atmosphere, oceans, forests,

Harvard Business Review.

<sup>&</sup>lt;sup>67</sup> See KIRON D., KRUSCHWITZ N., RUBEL H., REEVES M., FUISZ-KEHRBACH S., (2013)*Sustainability's next Frontier – Walking the talk on the sustainability issues that matter most*, MIT Sloan Management Review & Boston Consulting Group.

natural stocks, the climate. But the other party will observe the phenomena at a territorial level by privileging the local dimension in which infinite diversity of social and cultural nature and infinite different skills have developed in treating and transforming food, raw materials and products of nature.

The production of the Agenda 21 implementation plans, not linked to a precise definition of the indicators and to the association of specific targets with them, often ended up being an unrealistic goal. In those years, on the other hand, the production of indicators by study groups, universities and environmental associations flourished. The contribution that came from many initiatives, often certainly vitiated by subjectivity and unilateral visions of the development problem, was the extraordinary focus of the problems and the unequivocal postponement of the need to change current trends in order to reach precise objectives and quickly. International negotiations close to the turn of the century finally began to internalize this way of dealing with problems. Starting from the Montreal and Kyoto Protocols, passing through Lisbon, the Millennium Assembly and Johannesburg<sup>68</sup>, it can now be said that no plan and no strategy are put in place without a clear indication of the

<sup>&</sup>lt;sup>68</sup>See Report of the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August-4 September 2002 (https://digitallibrary.un.org/record/478154 retrieved in november 2021)

path to be taken and the time required. The advancement of the issue of sustainability at a global level simplifies national and local initiatives in many respects, since they can easily relate to what is done elsewhere and, since the projects are in many respects similar, it is easier to specialize a project for the its territory or for its sector. The same acquisition of consensus in forums and stakeholder meetings is generally facilitated by the driving effect that comes from the numerous parallel initiatives. This also applies to the compilation of the lists of indicators and the choice of key themes and sub-themes. The lists are normally compiled having on the one hand the choices of the major reference projects and on the other the territorial or sectoral peculiarities that must be quantified and controlled. The real problem of projects of sustainable development indicators becomes more often that of the availability, quality and reliability of data and their particularization at local levels. Along the way of correct information on environmental phenomena, not much less than on social and economic phenomena, much remains to be done.

Great emphasis was already given at the 1992 Rio Summit to the inadequacy, waste, lack of prospects that characterized the economic growth model of developed countries and the total lack of rules for safeguarding the environment and conserving natural resources, in

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particular fossil sources then as now indispensable to support the enormous and growing energy needs. In those same years the OECD PSR conceptual model was developed which highlighted the existence of anthropogenic pressure factors as the cause of the environmental degradation in progress.

After Rio, the definition of the delicate exchange relationship that is determined at the interface between economy and environment and between society and environment was deepened and a series of more sophisticated models were put in place, such as the DPSR of the UN CSD and the DPSIR of the European agency of the Environment, which had above all the merit of introducing the concept of factors which, inherent in human activities, determine the pressures on the environment. In the meantime, the concepts of sustainable development had made it clear that such development entailed not only the rebalancing of pressures on the environment but also the reestablishment of conditions for which the world economy and human society itself can have the prospect of maintaining a sufficient balance in the future. These factors had to be evaluated not only as potential producers of environmental degradation but also as causes of internal imbalance of the economy and social order<sup>69</sup>.

<sup>&</sup>lt;sup>69</sup> See STOCKHAMMER, E., H. HOCHREITER, et al. (1997). "The index of sustainable

It is therefore understood that in this light a rigorous reconsideration of the functional modalities and internal dynamics of the economy and society is needed, from which a new perspective of lasting equilibrium arises and capable of maintaining the necessary conditions for welfare, a concept that is not easy to define but certainly made with economic balances and social development, and at the same time capable of reducing the pressures on the environment and natural resources within limits that do not damage the former, depriving humanity of what today are called environmental services, indispensable for life, and restore the conditions for the correct use of the latter, the territorial, water, energy and biological resources, below the reconstitution rates of renewable stocks and the balance between the consumption of nonrenewable resources and the rates of technological replacements with new resources<sup>70</sup>.

The real core of sustainability lies here, The Johannesburg Conference on Sustainable Development has hit the mark by placing the Models of production and consumption as the first priority among the needs for change for sustainability Production and consumption are a large part of the economy and part imported the social assets of a community.

economic welfare (ISEW) as an alternative to GDP in measuring economic welfare: the results of the Austrian (revised) ISEW calculation 1955-1992." Ecological Economics 21, pp. 19-34. <sup>70</sup>See OECD (2011), *Verso una crescita verde*. Disponibile al link

<sup>&</sup>lt;sup>70</sup>See OECD (2011), *Verso una crescita verde*. Disponibile al link http://www.oecd.org/greengrowth/48536972.pdf retrieved november 2021

Over the years, starting from the important European Community Sustainability Plan known as V EAP, but also from the 1993 Italian Sustainability Plan, it has been highlighted that the Driving Forces relevant to developed countries must be identified in Energy, Transport, Agriculture and Industry. In countries such as Italy, two key themes were added such as Tourism (Italy holds 40% of the cultural and archaeological heritage of humanity) and Waste. More recently, the themes of dematerialization that we can briefly recall here in function of the concepts of eco-efficiency and sufficiency that underline how economic development is possible without an increase in the erosion of natural and material resources and how this progress is well represented by the flow of matter entering any under economic, business or social system, community and the quantities of material required for the production of a single unit of service to the consumer (goods or services). These flows must decline and development must decouple from the amount of matter and natural resources consumed<sup>71</sup>.

The commitments undertaken in Europe speak of 20% of electricity production from renewable sources and the Italian government itself has committed for such a target in 2020. The ENEA and Eurostat series show that Italy has overperformed in 2020 with a percentage of

<sup>&</sup>lt;sup>71</sup> See BLEYS, B. (2008). "Proposed Changes to the Index of Sustainable Economic Welfare: An Application to Belgium." Ecological Economics 64(4), pp. 741-751.

electricity production from renewable sources above the 20% and this is confirmed by an ENI research which shows that in 2019 the 35% was reached by Italy. The percentage was composed of hydroelectric power accounting for the 40%, Solar for the 21%, Bioenergy for the 17%, Wind for the 17% and Geothermal for the 5%  $^{72}$ .

Another indicator measures the per capita production of urban waste calculated on an annual basis by APAT in collaboration with the National Waste Observatory (ONR). The Urban Waste category includes both household waste and that produced by commercial activities, and finally some categories of special waste similar to urban waste. This last parameter is subject to variations connected to the evolution of the regulatory system both at national, regional and local level. As Castellani et al. argued, "the MNEs can positively impact on regions' specialisation in environmental technologies, when their Foreign Direct Investments (FDIs) occur in industries with a green technological footprint". The authors also underline that "the relatedness of environmental technologies to pre-existing regional specialisations exerts a negative moderating effect on the role of green R&D FDIs in shaping patterns of specialisation"<sup>73</sup>.

<sup>&</sup>lt;sup>72</sup> See Eni school and environment, Italy's renewable sources, https://www.eniscuola.net/en/2021/07/14/italys-renewable-sources/.

<sup>&</sup>lt;sup>73</sup> See CASTELLANI, D., ET AL., Foreign Direct Investments and Regional
Each year Europe produces about 1.3 billion tons of waste. Of these, only 14% is classified as Urban Waste: most of the community waste is generated by mining (29%), manufacturing industry (26%) and construction and demolition activities (22%). In Europe <sup>74</sup>, average per capita production was 510 kg in 2019, with the two extremes represented by Romania (280) and Denmark (844). Italy is still below the Community average with 504 kg per capita.

Another indicator, the percentage of separate waste collection, in an efficient and integrated system, measures the effective availability for the recovery operations of constant and homogeneous flows of material and is configured as one of the conditions for the closure of the input cycle. output and therefore for sustainability. If on the one hand the recycling of waste, with the production of secondary raw materials, makes it possible to replace a portion of the raw materials in the production cycles, on the other hand it allows to subtract a fraction of waste from disposal, thus avoiding the related environmental impacts, in terms of gaseous emissions (air pollutants and greenhouse gases), water contamination (production of leachate), consumption and loss of

Specialization in Environmental Technologies, in SEEDS Working Paper 04/2020 April 2020

By Davide Castellani, Giovanni Marin, Sandro Montresor, Antonello Zanfei <sup>74</sup>See Statista, Per capita waste generation in the European Union in 2019, https://www.statista.com/statistics/789638/production-waste-tons-by-inhabitantunion-european/?msclkid=84b672c1a7a511ec8b171942ab91003f.

value of soils, as well as limiting the related social conflicts.

# 3.2. The strategic value of the investment in green tech and green products for the Italian manufacturing industry.

With the transition to the digital factory paradigm, a process accelerated by the Covid-19 pandemic and the consequent health emergency, green innovations are one of the most important and powerful levers that business leaders must consider updating their offer, guaranteeing innovative approaches<sup>75</sup>.

These are shares that affect strategic sectors of our country, already affected by a positive trend. The Italian manufacturing sector, in fact, is looking with confidence at the economic recovery: the European Commission has estimated + 5% of the Italian GDP in 2021. A key factor is represented by sustainability; a well-established aspect for the companies of the 1920s, with the consequent use of low energy consumption devices, the purchase of new generation efficient machinery and / or systems, the installation of systems for the

<sup>&</sup>lt;sup>75</sup>See United Nations, Transforming our world: the 2030 Agenda for Sustainable Devlopment, 2015.

production of electrical and thermal energy from renewables. Moreover, there are real environmental, social and governance criteria that define the new virtuous behavior of companies. They can be summarized in the acronym ESG (Environment, Social, Governance), they represent the parameters through which to evaluate the impact of an entrepreneurial activity and will be increasingly decisive in attracting investments and improving the company's reputation.

In recent years, the attention of companies to sustainable production processes has spontaneously grown due to a greater environmental awareness of consumers, especially if characterized by high spending capacity. As seen, this has affected the level of green investments to the point of making environmental efficiency one of the most important communication factors in the marketing phase of products, especially if they are directed to foreign markets.

The strategic importance of the green contribution to corporate competitiveness and the repercussions on society of an entrepreneurial system capable of increasing its environmental efficiency therefore make it necessary to continuously monitor the impact and recent evolutionary trends that the production processes of companies generate on the territory.

The links between process and environment, furthermore, have been

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examined taking into account the ability of manufacturing systems to manage and recover waste deriving from the production cycle while, as regards the output, the level of environmental pressure was measured through the use of two indicators:

1) the production in tons of waste deriving from company activity;

2) the emission of the main atmospheric agents co-responsible for the so-called greenhouse effect (methane, carbon dioxide and nitrous oxide), converted into tons of CO2 equivalent according to the guidelines codified by the Intergovernmental Panel on Climate Change (IPCC)<sup>76</sup>.

In overall terms, it is clear that, also thanks to the introduction of increasingly stringent or so-called "environment friendly" regulations, a growing number of companies seem positively oriented.

In Italy, over 432 thousand industrial and service companies with their own employees have invested in green products and technologies between 2015 and 2019. A large part of the investments of green companies is dedicated to energy efficiency and renewable sources. According to a survey carried out by Unioncamere in October 2020<sup>77</sup>,

<sup>&</sup>lt;sup>76</sup> See PERRINI, F., TENCATI, A. (2008). Corporate Social Responsibility: Un nuovo approccio strategico alla gestione d'impresa, Milan, EGEA.
<sup>77</sup>See

https://www.unioncamere.gov.it/uploaded/Generale/Comunicazione/Dicono%20di%2 0noi/2020/ottobre/sole30ottobre.pdf retrieved november 2021.

those who converted to the green philosophy have become more resilient than others. Of the companies that invested in sustainability, 16% managed to increase their turnover, against 9% of non-green companies. They also use or plan to use 4.0 technologies to an ever more prevalent extent. Green and digital together strengthen the competitive capacity of Italian companies. Those oriented to 4.0 in 2020 saw an increase in turnover in 20% of cases. Italy is also the first European country for the number of farms engaged in organic farming, where the operators involved rose to 80,000 in 2019. The most interesting record assigned by Greenitaly<sup>78</sup>, however, is in the field of green chemistry and bioplastics, especially for regarding research and innovation. The products of this new chemistry are used by an everincreasing number of companies in the supply chain, from agri-food to textiles<sup>79</sup>.

As often pointed out, the impulse deriving from consumer behavior facilitates the transposition towards more sustainable production processes. The dual direction of markets and regulations therefore certainly had positive effects in all types of manufacturing.

In terms of eco-efficiency, the mechanical industry stands out,

<sup>&</sup>lt;sup>78</sup>See: https://www.symbola.net/collana/greenitaly/ retrieved november 2021.

<sup>&</sup>lt;sup>79</sup> See: Commissione Europea (2018), Finanza sostenibile: rendere i mercati finanziari un incisivo strumento di contrasto dei cambiamenti climatici, Bruxelles 2018.

characterized by positive environmental performance from all points of view; electronics, automotive and tanning are also positioned at the top of the division into classes, confirming the spread of a culture of sustainability already highlighted in the previous edition of the Report.

The wood and paper sectors also respond positively to the environmental challenge, especially with reference to the capacity to recover waste, which passes through a wide use of production waste. The shades of textiles appear in chiaroscuro (pun intended), in which particularly positive eco-efficiency data are recorded in terms of energy input levels and waste production, which are associated with less exciting levels with regard to emissions and waste recovery<sup>80</sup>.

As already pointed out, the differentials in the levels of eco-efficiency between sectors are affected by everything that distinguishes production processes. In other words, in terms of environmental impact, many sectors cannot be compared, as they are characterized by very different processes from each other from multiple points of view.

Textiles and clothing improve in terms of the use of energy inputs (previously it was placed in second class); paper the same but starting from the lowest eco-efficiency class; manufacturing activities that

<sup>&</sup>lt;sup>80</sup> See IBIKUNLE, G. E STEFFEN, T. (2017), "European Green Mutual Fund Performance: A Comparative Analysis with their Conventional and Black Peers", Journal of Business Ethics, 145, pp. 337-355.

deteriorate as regards the same environmental sphere; rubber and plastics, which show an improvement in waste recovery balanced by a worsening in the use of energy inputs. According to what has been stated so far, it is certainly useful to associate the changes that the latter registers in the short and medium term with the analysis of ecoefficiency levels. This is made possible by the use of the so-called ecotrend, which precisely measures the dynamics that eco-efficiency offers and on the basis of which it is possible to grasp the path that our industrial system is experiencing in terms of progressive attention to environment. The eco-trend (or green trend) that has been affecting the Italian manufacturing industry as a whole for years now seems to be widespread in all or almost all of the sectors specifically analyzed here. Only in the case of petroleum products and manufacturing activities, in fact, is there an average negative trend. In the first case, this positioning is to be associated above all with the contribution offered by environmental emissions; in the second, it is the waste recovery trend that determines a worsening of the overall level of eco-efficiency. On the contrary, the sector is characterized by positive dynamics

of tanning, with "four stars" in each of the environmental areas observed, as well as paper, mechanics and electronics, which, although not always ranking in the first of their respective classes, offer a

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tendential evaluation in any case in the name of decisive improvement.

Positive, even if on lower values, are the results of food (in particular in the field of waste recovery), textiles and clothing (energy inputs and waste production), wood (atmospheric emissions), chemicals (emissions and production waste, with a "red dot" for recovery), rubber, non-metallic minerals and means of transport (in all three cases with average positive values for all observed flow components)<sup>81</sup>.

Having examined efficiency and green trend distinctly within the manufacturing sector, it is natural to conclude the analysis with a crossreading that relates both observed aspects, again starting with the adoption of four intensity classes.

In overall terms, it is immediately clear an overall behavior that only recently seems to emerge with evidence. The sectors of manufacturing activity that show favorable dynamics in terms of improving ecoefficiency are those that most of all suffer from the worst structural levels of the same. In other words, we are faced with a phenomenon that we could define as eco-convergence which seems to summarize the behavior of the manufacturing system during the years of the crisis.

Particularly emblematic in this sense is the paper sector, characterized

<sup>&</sup>lt;sup>81</sup>See PwC. (2019). Finanza Sostenibile L'evoluzione del quadro normativo europeo per favorire la transizione alla green economy e gli impatti per gli Intermediari Finanziari. https://www.pwc.com/it/it/industries/banking-capital-markets/fs-top-trends/docs/toptrends-finanza-sostenibile.pdf retrieved november 2021.

by intrinsic low levels in terms of eco-efficiency, which registers a particular dynamism in the direction of the green, proving to be among the most eco-converging. Equally significant are the cases of metallurgy and chemistry, which unlike petroleum products, associate values below the average as regards the levels of eco-efficiency, contrasted by positive results in terms of short and medium-term dynamics.

Other eco-converging sectors appear to be the processing of nonmetallic minerals (think of the attention to environmental sustainability in the world of ceramics), rubber and plastics and wood and wood products, a sector in which the environmental challenge is progressively becoming a important factor of competitiveness<sup>82</sup>.

Mechanics, on the other hand, is the only sector that, with a general connotation of high eco-efficiency, has also associated extremely positive dynamics in terms of trends. It is therefore no coincidence that these activities have represented and increasingly represent the real engine of Italian exports during the years of the crisis. Those who invest in green (mechanics, as we have seen, are one of the sectors with the greatest diffusion of "green" investments) often have a better chance of emerging in international markets where quality decides the

<sup>&</sup>lt;sup>82</sup>See Forum per la finanza sostenibile (2016), Finanza sostenibile e cambiamento climatico, disponibile a http://finanzasostenibile.it/attivita/finanza-sostenibile-cambiamento- climatico/ retrieved november 2021.

competitive fate, and the data seem to confirm this finding.

The electronics and tanning and footwear activities also show a combination of eco-efficiency and eco-trend, even though they are unable to fully replicate what has just been mentioned for mechanics.

This classification is closed by the sector of other manufacturing activities (which range a lot, contextually concerning jewelry, sporting goods, etc.) whose high levels of eco-efficiency (probably dictated by lower levels of environmental impact) are associated with negative green trends in recent years.

## 3.3 The employment impact of investments in environmental technologies in Italy

The shift towards an environmentally sustainable economy has given rise to the so called "green jobs", a new type of job that plays a vital role in the greening of companies and economic sectors. The definition and measurement of "green jobs" plays a critical role in understanding the interrelationship between environmental sustainability and labor markets<sup>83</sup>.

An important element of this definition of "green jobs" is the fact that jobs must be not only green but also decent, i.e., they must be productive, provide sufficient income and adequate social protection, respect workers' rights and provide them with the possibility to participate in decisions that will affect their lives. This definition incorporates the three dimensions of sustainable development. Green employment is decent work that significantly reduces the negative effects of economic activity on the environment, ultimately leading to

<sup>&</sup>lt;sup>83</sup>See Comunicazione della commissione al parlamento europeo, al consiglio, al comitato economico e sociale europeo e al comitato delle regioni. Un'europa sociale forte per transizioni giuste" online alla pagina https://eurlex.europa.eu/resource.html?uri=cellar:e8c76c67-37a0-11ea-ba6e-01aa75ed71a1.0012.02/DOC\_1&format=PDF URL accessed february 2021.

the establishment of sustainable enterprises and economies. To better understand the impact of a greener economy on labor markets and to assess the effectiveness of policy measures, a more specific definition is needed to allow for the systematic data collection and measurement<sup>84</sup>.

In a growing number of countries, operational definitions have already been devised and applied, and efforts are now underway to formulate a more specific definition that will allow for systematic data collection and measurement. The measurement of green jobs needs to take into account employment in the economic and social sectors and industries from the production perspective, as well as environmental occupations and job functions in all sectors from a process perspective. These two concepts are complementary and shed light on different ways of greening businesses and economies and offer different avenues for policy introduction<sup>85</sup>. On the one hand, green jobs are an important part of the employment gains linked to a "greener", more environmentally sustainable economy. On the other, they are crucial to making change technically feasible and economically viable. Without skilled and motivated workers in new green growth sectors and in key occupations

<sup>&</sup>lt;sup>84</sup>See CARAVELLA S., MENGHINI M., "Race against the Machine. Gli effetti della quarta rivoluzione industriale sulle professioni e sul mercato del lavoro", L'industria, Rivista di economia e politica industriale, 1/2018

<sup>&</sup>lt;sup>85</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

across all economic sectors, the investments made and technologies used will not generate the benefits expected to achieve sustainable development. On the positive side, increased demand for and investment in greener products and services, as well as in the equipment and infrastructure needed to produce them, will lead to the expansion of certain industries and companies. This will result in an increased demand for labor and job creation (direct jobs), primarily in green sectors. In addition, due to the cross-sectoral relationships of the expanding industries, other segments of the economy that supply inputs to the growing green sectors also benefit, with the consequent creation of additional jobs (indirect jobs), even in non-green sectors such as green manufacturing of highly insulated glass and cement for green buildings, or steel and carbon fiber for turbine blades and towers. The revenues generated by this additional economic activity are redistributed through spending on higher consumption and investment in all sectors of the economy, thus leading to the creation of more jobs (induced effects), in addition to direct and indirect employment<sup>86</sup>. The

of the size of demand and investment, trade (whether products or

number of jobs created at all stages of the greening process is a function

<sup>&</sup>lt;sup>86</sup>See CARAVELLA S., MENGHINI M., "Race against the Machine. Gli effetti della quarta rivoluzione industriale sulle professioni e sul mercato del lavoro", L'industria, Rivista di economia e politica industriale, 1/2018

inputs are imported, and therefore subtracted from domestic demand, or exported, which increases domestic demand and related employment), and the employment elasticity (jobs created or retained per unit of demand)<sup>87</sup>.

Another determining factor is "budget effects". If green products and services are more expensive than their substitutes, businesses and households will have fewer resources to spend on other goods and services. A negative budget effect can be associated, for example, with the introduction of renewable energy sources. Although there has been an accelerated decline in the cost of generating electricity from renewable energy sources, which has made it increasingly competitive, the use of renewable energy sources has initially made their use more costly for consumers, even though, for the first time, it is true that, because of the consumers, albeit for a short time. Conversely, there are positive budget effects resulting, for example, from cost-effective investments in energy efficiency and more efficient use of resources.

The resulting benefits shift demand away from energy consumption, which has a low employment elasticity, in favor of goods and services

<sup>&</sup>lt;sup>87</sup>See Comunicazione della commissione al parlamento europeo, al consiglio, al comitato economico e sociale europeo e al comitato delle regioni. Un'europa sociale forte per transizioni giuste" online alla pagina https://eurlex.europa.eu/resource.html?uri=cellar:e8c76c67-37a0-11ea-ba6e-01aa75ed71a1.0012.02/DOC\_1&format=PDF URL accessed february 2021.

with a higher degree of elasticity<sup>88</sup>. An important issue here is that the benefits are cumulative over time. Thus, the possibilities for job creation are not limited to certain industries but can be realized in all sectors of the economy and produce some important spillover effects. The result of all of these make up the gross gains in employment.

However, this mechanism also has a disadvantage in that, for every job lost, employment (and incomes) in other segments of the economy will be adversely affected<sup>89</sup>, because a given job will have a negative impact on employment and economy, because a particular green product or service takes the place of a less green one. Increased use of renewable sources of energy, for example, can reduce the demand for energy, for conventional fossil fuels and, consequently, for power plants that use them, as well as having an impact on supply sectors such as coal mining and coal mining. The result of direct, indirect and induced losses make up the gross employment losses<sup>90</sup>.

In recent times, the affirmation of green sensitivity in the sensibility in the Italian population nor the unconditional acceptance of technology

<sup>&</sup>lt;sup>88</sup>See CHARVERIAT C, BODIN E, "Delivering the Green Deal: the role of a reformed Semester within a new sustainable growth strategy for the EU", in IEEP EU Green Deal Series, 2019/2.

<sup>&</sup>lt;sup>89</sup>See CARAVELLA S., MENGHINI M., "Race against the Machine. Gli effetti della quarta rivoluzione industriale sulle professioni e sul mercato del lavoro", L'industria, Rivista di economia e politica industriale, 1/2018

<sup>&</sup>lt;sup>90</sup>See European Environment Agency (2010), The European Environment. State and Outlook 2010. Natural Resources and Waste, EEA, Copenhagen. http://www.eea. europa.eu/soer.

to think that the European funds of the PNRR will fall on fertile ground and can bear fruit. The 191.5 billion of euro will have the effect foreseen by the MEF only if there are professionals capable of investing them correctly. Technical and specialist skills are required ad needed to be able to use these technologies and to make to participate Italy to the occupational benefits that the diffusion of information technology in the industry and the advent of the green revolution will guarantee to the productive system<sup>91</sup>.

Here is the reason for which also the world of education is starting to explore increasingly green paths: in 2019, between master and university courses, there were 37 post-diploma paths focused on sustainability. Italy is now facing a crossroads: if it does not implement policies to give women, men and young people the cognitive tools necessary to face the rebirth of the country, PNRR risks being a lost opportunity for workers, businesses and, consequently, for the businesses and, consequently, for the entire country.

On the contrary, if policy makers realize that skills are needed before funds, 2021 could be remembered as the year of the structural change in

<sup>&</sup>lt;sup>91</sup>See Comunicazione della commissione al parlamento europeo, al consiglio, al comitato economico e sociale europeo e al comitato delle regioni. Un'europa sociale forte per transizioni giuste" online alla pagina https://eurlex.europa.eu/resource.html?uri=cellar:e8c76c67-37a0-11ea-ba6e-01aa75ed71a1.0012.02/DOC\_1&format=PDF URL accessed february 2021.

Italy. Green economy could be even better than the digital one, seen from the emploiment point of view. At least at the work level. According to the report "Smart&Green, the economy that generates the future" by *Focus Censis* and *ConfCooperative*, in the next decade green jobs will create more jobs than the digital world. According to the figures reported in the research, 20% of the jobs created in Italy between now and 2023 will have a green footprint, creating a total of 481,000 new jobs. Eco-industries will therefore be the driving force of the economy over the next five years, creating hundreds of thousands of jobs<sup>92</sup>.

New labor contracts in green economy companies accounted for 35.7% in Italy in 2020, and even in the year of the pandemic, the green sector of the economy confirmed the performance of 2019, both in investment and employment. This is the most significant data that emerges from GreenItaly Symbola the annual report by Foundation and Unioncamere<sup>93</sup>. The green economy in Italy employs 3 million 141 thousand people, 13.7% of employees. There are 441,000 companies that in the last 5 years have invested in the green economy, 31.9%. The report confirms that Italy is a leader in Europe for the circular economy,

<sup>&</sup>lt;sup>92</sup>See http://www.confcooperativepd.coop/smart-green-leconomia-che-genera-futuro/, URL accessed november 2021

<sup>&</sup>lt;sup>93</sup>See https://www.unioncamere.gov.it/P42A4592C189S123/i-dati-del-rapporto-greenitaly-2020-di-fondazione-symbola-e-unioncamere.htm URL accessed 2021.

with 79.4% of total waste recycling, twice the European average. Renewable sources in our country meet 37% of electricity consumption.

The year 2020 showed new records of renewable electrical power installed in the world, equal to 83% of the growth of the entire electricity sector in the year. In Italy - in 2020 - 37% of electricity consumption was met by renewable sources, with a production of about 116 TWh. However, installed power is still far from the climate neutrality targets set for 2030. At the end of 2020, around 950,000 plants producing electricity from renewable sources were in operation in Italy, with a total capacity of over 56 GW. Of these plants, almost 936,000 are photovoltaic, about 5,700 wind, while the remainder are powered by other sources (hydraulic, geothermal, bioenergy).

There are over 441 thousand companies that in the five-year period 2016-2020 have decided to invest in green technologies and products:31.9% of companies in industry and services have invested, despite the crisis caused by the pandemic, in green technologies and products, a value that rises to 36.3% in manufacturing. These companies have a higher dynamism on foreign markets than the rest of the Italian production system, they innovate more and produce more jobs: with specific reference to manufacturing companies (5-499 employees), in eco-investors the share of exporters is 31% in 2021, against a smaller

20% of those who have not invested. Also on the turnover front, 14% of investing companies expect an increase in turnover for 2021, against 9% of the others<sup>94</sup>.

Contracts related to green jobs - with 2020 activation - represent 35.7% of the new contracts expected in the year. Italy is the leader country in the circular economy with a recycling on the totality of waste - urban and special - of 79.4% (2018): a result well above the European average (49%) and that of other major countries such as Germany (69%), France (66%) and the United Kingdom (57%) with annual savings of 23 million tons of oil equivalent and 63 million tons of CO2 equivalent in emissions (2018) thanks to the replacement of second matter in the economy.

On green jobs, jobs in the green economy, however, we have a very serious problem with training. The preparation of young people must become a fundamental work in schools. In the technical sector of renewables and energy, 15,000 operators are missing. As a researcher I can say that in research and development in Italy we have 30-35,000 less than other countries like us. The battle of the ecological transition is won on skills, and both public and private investments are needed<sup>95</sup>.

<sup>&</sup>lt;sup>94</sup>See https://www.unioncamere.gov.it/P42A4592C189S123/i-dati-del-rapporto-greenitaly-2020-di-fondazione-symbola-e-unioncamere.htm URL accessed 2021.

<sup>&</sup>lt;sup>95</sup>See https://www.unioncamere.gov.it/P42A4592C189S123/i-dati-del-rapporto-greenitaly-

The new Ministry of Ecological Transition, introduced by the current government, is a clear sign of the direction in which it is increasingly necessary to move not only on a national but also on a global level. The Covid-19 emergency has laid bare all the critical aspects of our cities and our lifestyle, where fine dust pollution has actually facilitated the spread of the epidemic. The reduction of environmental impact is now a must for everyone; for any company to invest in sustainability means today more than ever to obtain a positive return measurable in environmental, social and economic terms. According to the data contained in the already mentionend Focus Censis - Confcooperative "Smart & Green, the economy that generates the future", by 2023 the green sector, which is already worth 2.4% of GDP, will generate half a million new jobs, more than twice as many as the digital sector; for every 5 new jobs created by companies in Italy, one will be generated by eco-sustainable companies. From architecture to the materials used, from lighting to the rules of conduct at work: there are many ways to create sustainable companies in the office, favouring the occupants wellbeing and their productivity. The most important areas of intervention are related to air conditioning, lighting, ventilation, the construction of high-efficiency plumbing systems and the use of

<sup>2020-</sup>di-fondazione-symbola-e-unioncamere.htm URL accessed november 2021.

recyclable materials.<sup>96</sup>

## 3.4 Traditional innovation and environmental innovation for the Italian production context: the possible impact on labor productivity

The green economy as a model of economic growth was not born today: it has been discussed for decades. During this time, various measures and public and private initiatives have tried to transform the world of production in order to reduce its impact on the environment. Furthermore, with the shift to the digital factory paradigm, a process accelerated by the Covid-19 pandemic and the resulting health emergency, 4.0 technologies are one of the most important and powerful levers that business leaders must consider updating their offerings, ensuring innovative and future-oriented approaches. These are actions that invest strategic sectors of our country, already touched by a positive trend. The Italian manufacturing sector, in fact, looks forward to economic recovery: the European Commission has estimated a +5% of Italian GDP in 2021. And the *Mecspe Observatory*<sup>97</sup> on the second quarter of the year still in progress confirms how, after the shock

<sup>&</sup>lt;sup>96</sup>See http://www.confcooperativepd.coop/smart-green-leconomia-che-genera-futuro/, URL accessed november 2021

<sup>&</sup>lt;sup>97</sup>See https://www.mecspe.com/it/, URL accessed november 2021

impact of the pandemic, there is a concrete desire to restart. Digitalization, sustainability, training; these are the three pillars that will accompany the new start of manufacturing. 74% of companies believe in a boom in the sector in the next 3 years. But the general level of confidence in the manufacturing industry is also growing, judged high by 54% of respondents (compared to 39% last February)<sup>98</sup>.

Digital transformation, after all, represents a real opportunity for growth and competitiveness on the market. Investment in digital technologies increases the innovative capacity of the manufacturing company, ensuring the production of customized tools. In fact, new technologies allow to improve efficiency and productivity, and, at same time, to increase market share and customer loyalty<sup>99</sup>.

In particular, we are talking about technologies such as laser cutting, robotics, 3D scanners and printers, as well as the increasing use of augmented reality. Infrastructure, on the other hand, invests plans such as the move to the Cloud and Big Data governance. Industry 4.0, more generally, asks companies to be open and connected both internally and to other players in the supply chain, exchanging sensitive information

<sup>&</sup>lt;sup>98</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

<sup>&</sup>lt;sup>99</sup>See CHARVERIAT C, BODIN E, "Delivering the Green Deal: the role of a reformed Semester within a new sustainable growth strategy for the EU", in IEEP EU Green Deal Series, 2019/2.

on products, customers and suppliers. Simple antivirus systems are no longer sufficient to monitor all access points to the company's system, but it is necessary to provide specific strategies for the management of digital security at 360 degrees.

The use of digital technology can increase company productivity by as much as 64%. But it can also make a decisive contribution to wellbeing and social inclusion: thanks to collaboration and smart working tools, which for 63.7% of companies represent a crucial lever for development<sup>100</sup>. Not only. On a global level, it will be the use of digital tools that will give a turning point to the impact of humanity on the planet: it is estimated that new technologies will contribute to reducing CO2 emissions by 10% in ten years, from 2020 to 2030.

In the global effort in the direction of sustainable development, it is now clear: the tools of digitalization are proving to be successful and revolutionary on all fronts, from the economic to the social, up to the environmental. This is confirmed by the study "Digitization and sustainability for the recovery of Italy", prepared by *The european house* -*Ambrosetti* in collaboration with Microsoft Italy<sup>101</sup>. The research aims to

<sup>&</sup>lt;sup>100</sup>See https://news.microsoft.com/it-it/2021/09/03/il-digitale-a-supporto-della-sostenibilita-theeuropean-house-ambrosetti-e-microsoft-italia-rilasciano-uno-studio-sullimpatto-deldigitale-nello-sviluppo-sostenibile-del-nostro-paese/, URL accessed november2021

<sup>&</sup>lt;sup>101</sup>See https://news.microsoft.com/it-it/2021/09/03/il-digitale-a-supporto-dellasostenibilita-the-european-house-ambrosetti-e-microsoft-italia-rilasciano-unostudio-sullimpatto-del-digitale-nello-sviluppo-sostenibile-del-nostro-paese/, URL

investigate the contribution of digital technology to sustainable development, identifying the areas of application and quantifying the impact on its various components for Italy in the context of the post-Covid-19 recovery. The study identifies the synergies between digital transformation and the different components of sustainable development. From the point of view of economic sustainability, the study shows how digitized companies obtain an important benefit on labor productivity compared to companies that have not yet implemented paths of digital transformation (+64% for Italian companies, compared to +49% for European companies)<sup>102</sup>.

Sustainability is, as can been seen, a key factor: an aspect now well established for businesses in the 2020s, with the consequent recourse to low energy consumption devices, the purchase of efficient new generation machinery and/or systems, and the installation of systems for the production of electrical and thermal energy from renewable sources. Moreover, there are real environmental, social and governance criteria that define the new virtuous behavior of companies. They can be summarized in the acronym ESG (Environment, Social, Governance), they represent the parameters through which to evaluate the impact of

accessed november2021

<sup>&</sup>lt;sup>102</sup>See https://news.microsoft.com/it-it/2021/09/03/il-digitale-a-supporto-dellasostenibilita-the-european-house-ambrosetti-e-microsoft-italia-rilasciano-unostudio-sullimpatto-del-digitale-nello-sviluppo-sostenibile-del-nostro-paese/, URL accessed november2021

an entrepreneurial activity and will be increasingly decisive in order to attract investments and improve the reputation of the company.

Still according to the indications of the Mecspe Observatory<sup>103</sup>, the transformations of the last year and a half led to a reflection on Industrial Smart Working, a work method that allows the management and execution of production processes in the factory from remote. The first fact that stands out is that only a small part of the entrepreneurs (15%) does not consider ISW suitable for the industrial environment, indicating physical presence as the only way of working. Probably on this front, a first process of cultural change has begun, driven precisely by the effects of recent months. The majority (more than a third), in fact, consider ISW useful, but only as support and integration to physical presence in the factory. For many, on the other hand, it is interesting, but first a major reorganization of resources and industrial processes/tools is necessary. As far as the investments in competences and formation are concerned, the Italian enterprises are favorably orienting their own resources in this direction, updating the staff: the role of university and Istituti Tecnici Superiori, in this sense, becomes determinant. Linking young people and the world of work will, in fact, accelerate the restart of Italian manufacturing, along innovative and

<sup>&</sup>lt;sup>103</sup>See https://www.mecspe.com/it/, URL accessed november 2021

sustainable line<sup>104</sup>.

As said, with the approval of the European Green Deal and, later, the Next Generation EU, the issues related to the green economy become even more central. The new industrial strategy for Europe will drive forward the twin transitions of green and digital and produce greater global competitiveness. It will help industries reduce their carbon footprint by offering affordable and clean-tech solutions, developing new business models. We are talking here about a complex process. A transformation that requires substantial investments and a radical rethinking of the production model followed so far. A commitment and a risk, for which there are substantial incentives, but also an opportunity.

Environmental sustainability can be a good investment for companies of all sizes and sectors, and which tools can facilitate it. First and foremost, let's talk about those business management systems, such as new-generation ERPs, that improve control over ongoing processes and, therefore, optimize the use of resources<sup>105</sup>.

<sup>&</sup>lt;sup>104</sup>See BRODNY, J., MAGDALENA T.. "The analysis of similarities between the European Union countries in terms of the level and structure of the emissions of selected gases and air pollutants into the atmosphere." In Journal of cleaner production, 2021, vol. 279.

<sup>&</sup>lt;sup>105</sup>See CHARVERIAT C, BODIN E, "Delivering the Green Deal: the role of a reformed Semester within a new sustainable growth strategy for the EU", in IEEP EU Green Deal Series, 2019/2.

We are talking here about a complex process. A transformation that requires substantial investment and a radical rethink of the production model followed until now. A commitment and a risk, for which there are substantial incentives, but also an opportunity. Let's mention some reasons why environmental sustainability can be a good investment for companies of all sizes and sectors, and which tools can facilitate it. First and foremost, let's talk about those business management systems, such as new-generation ERPs, that improve control over ongoing processes and, therefore, optimize the use of resources. As said, the Covid-19 pandemic has triggered many changes, both organizational and operational, requiring, across the board, a renewed and energetic sense of responsibility, including environmental responsibility. Sustainability and prudence in the allocation of resources, as well as the preservation of natural capital, are concepts that are more relevant and urgent than ever. However, in order for a lasting change in consumption habits to take place, a change in the economic model to a green perspective is necessary. Businesses are fundamental: eco-sustainable production processes and products are in fact the first step towards an improvement in environmental quality. All this can also be started with new public, economic and fiscal policies and more active roles of institutions at different levels. How green are companies in Italy and

how much are they supported at the legislative level? In this sheet we try to make the point.

The green economy is not ascribable to a mere economic sector, but is rather a general model, capable of producing a better quality and more equitable well-being, improving the quality of the environment and safeguarding natural capital. While historically, entrepreneurial governance systems have aimed at satisfying the three criteria of economy (revenues that cover costs and generate added value), competitiveness (ability to sell goods and services on domestic and foreign markets) and profitability (optimizing the use of resources and increasing labor productivity), since the Rio Conference on Environment and Development (1992), a new and more sustainable development path has been launched, in which companies have also gradually pursued higher environmental performance, with an efficient and prudent use of natural resources, in order to meet a more conscious demand for goods and services. The criteria of economy, competitiveness and profitability have thus been integrated, enriched and addressed with new keywords, including eco-efficiency (better use of resources) and eco-innovation (improved product quality), also seeking new market outlets<sup>106</sup>.

<sup>&</sup>lt;sup>106</sup>See European Environment Agency (2010), The European Environment. State and

In this regard, considering the national performance in the key areas: production; consumption; waste management and material market; innovation; investments, Italy ranks first in the European ranking, our national strengths in the green field are mainly related to the productivity of resources: with the same purchasing power, in fact, for every kilogram of resource consumed here are generated 3.5 euros of GDP, against a European average of 2.24<sup>107</sup>. In addition, in Italy, the share of renewable energy used in relation to total energy consumption is higher than in other European countries (17.8 percent) and the Italian results in terms of total socio-economic benefits (exports, employment in eco-companies and turnover in eco-companies) are 12 points higher than the European average.

Overall, despite the good results, Italy still needs to take corrective action, especially with regard to the consumption of raw materials (500 million tons) and energy (116 Tons of Oil Equivalent) as well as innovation and investment, areas in which no progress has been made at the national level despite the improved performance of other countries, including Germany. In this regard, the most worrying Italian weakness is certainly the low number of patents filed: only 15 in one

Outlook 2010. Natural Resources and Waste, EEA, Copenhagen. http://www.eea. europa.eu/soer.

<sup>&</sup>lt;sup>107</sup>See https://www.istat.it/storage/rapporto-annuale/2020/Rapportoannuale2020.pdf, URL accessed november2021

year.

More in detail, 7 out of 10 companies adopt actions aimed at reducing the environmental impact of their activities, especially with initiatives to improve the wellbeing of personnel (68.9 percent) and the level of safety of the territory in which they operate (64.8 percent)<sup>108</sup>. Considering the various economic sectors, industry and construction are greener than services (with percentages of environmental commitment respectively equal to 71.6, 71.1 and 64.5 percent) and also lead the way in terms of attention to the safety of the areas in which they operate (74 percent compared with 61 percent). For understandable reasons linked to costs and spending possibilities, sustainable behaviours grow as the size of the company increases: in companies with over 250 employees, values are up to 20 percentage points higher than the national average and, when the number of employees exceeds 500, actions mainly concern the economic financing of sustainable initiatives on their own (90.7 percent). This trend helps explain why, for example, only Enel, Erg, Intesa Sanpaolo and Assicurazioni Generali appear in Italy in the latest Knights Global 100 ranking (which each year establishes the 100 greenest companies in the world).

<sup>&</sup>lt;sup>108</sup>See https://www.istat.it/storage/rapporto-annuale/2020/Rapportoannuale2020.pdf, URL accessed november2021

If the objective of improving corporate reputation is the prevailing motivation among companies that adopt green actions (32.1 percent), the Istat Annual Report certifies other advantages, including an increase in production efficiency of up to 15 percent and the opportunity to attribute a share of the 31 trillion dollars allocated globally for sustainable investments<sup>109</sup>.

<sup>&</sup>lt;sup>109</sup>See https://www.istat.it/storage/rapporto-annuale/2020/Rapportoannuale2020.pdf, URL accessed november2021

#### CONCLUSIONS

Avoiding the scenarios envisaged by scientists, of an immoderate and unsustainable consumption of the planet's resources, with irreversible consequences for the very existence of life, is the objective that must characterize the visions of economic policy in the coming decades.

The first step to achieve it is to change our model of production and consumption for a more sustainable one that leads to a positive environmental impact. The set of measures to achieve this change in economic model is what is called the green transition.

Today we are at the beginning of this transition, thanks to the action of governments, organizations, companies and individuals who are moving to achieve the goal of sustainability as quickly as possible.

Technological modernization, innovation and diversification must be placed firmly at the center of any business model. Governments and businesses in all sectors are therefore faced with the challenge of trying to link economic growth and environmental care, as well as responsible consumption of natural resources. It is equally necessary to promote the circular economy and the reuse of available resources to minimize the use of these resources.

Investment in research, development and innovation (R&D&I) must be focused on building new sustainable solutions that make an economy based on caring for the planet and people a reality, without forgetting economic viability. Much of the hope for the success of the green transition lies in R&D&I, so increasing private and public investment in this area is essential. The green economy revolution requires action to evolve toward a sustainable innovation model in line with the UN 2030 Sustainable Development Goals by increasing competitiveness, fostering an appropriate regulatory framework, generating cooperative ecosystems, and introducing policies that stimulate entrepreneurial activity and attract innovative companies. The benefit of green innovation will be twofold. On the one hand, the positive effect on the environment and protection of the planet. On the other hand, stimulating a green economy capable of producing wealth and wellbeing. The transition to a circular economy offers the opportunity to transform our economy, generate new competitive and sustainable advantages, promote research and innovation, attract foreign investment, and foster a business ecosystem supported by sectors such as the bioeconomy, biotechnology, agribusiness, renewable energy, etc. The economic opportunities and environmental benefits associated

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with the transition we are experiencing are undeniable, but as history has shown with all previous industrial revolutions, they require a constant updating of cultural and political resources to interpret the major transformations taking place.

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