ARTIFICIAL INTELLIGENCE AND THE GREEN TRANSITION FOR 2030. A EUROPEAN PERSPECTIVE

Inteligencia artificial y transición ecológica 2030. Una perspectiva europea

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Abstract

The United Nations have developed the 2030 Agenda for Sustainable Development as a global agreement aiming to eradicate extreme poverty, fight inequality and injustice and leave no one behind. Agreed by world leaders at the UN in 2015, the 17 Sustainable Development Goals (SDGs) succeed the well-known Millennium Development Goals (MDGs). Parts of the Goals directly address environmental issues. Other do indirectly. In response to this growing awareness, the European Union has enacted a number of policies targeting environmental issues, including lowering carbon emissions and water conservation. It can be argued that the EU is at the forefront of addressing the environmental issues outlined in the SDGs. These policies are mentioned in this Paper and they are to be considered strategic.

Artificial Intelligence has been having an impact in human activities for decades. Lately the impact is happening exponentially. The European Union is aware of such a fact and it implements policies towards increasing innovation in the public and private sector, including funding programmes and instruments to foster business development and efficiency in the Union and in the Member States. AI is also capable of having a profound impact in the environmental issues that the Agenda 2030 is bringing.

Las Naciones Unidas han desarrollado la Agenda 2030 para el Desarrollo Sostenible como un acuerdo global que pretende erradicar la pobreza extrema, luchar contra la desigualdad y la injusticia y no dejar a nadie atrás. Acordados por los líderes mundiales en la ONU en 2015, los 17 Objetivos de Desarrollo Sostenible (ODS) suceden a los conocidos Objetivos de Desarrollo del Milenio (ODM). Algunos objetivos abordan directamente cuestiones medioambientales. Otros lo hacen indirectamente. En respuesta a esta creciente sensibilización, la Unión Europea ha promulgado una serie de políticas dirigidas a cuestiones medioambientales, como la reducción de las emisiones de carbono y la conservación del agua. Se puede afirmar que la UE está a la vanguardia en el tratamiento de las cuestiones medioambientales señaladas en los ODS. Estas políticas se mencionan en este documento y deben considerarse estratégicas.

La inteligencia artificial lleva décadas teniendo un impacto en las actividades humanas. Últimamente el impacto se está produciendo de forma exponencial. La Unión Europea es consciente de ello y aplica políticas para aumentar la innovación en el sector público y privado, incluyendo programas e instrumentos de financiación para fomentar el desarrollo y la eficiencia empresa-

rial en la Unión y en los Estados miembros. La IA también es capaz de tener un profundo impacto en las cuestiones medioambientales que plantea la Agenda 2030.

1. Introduction

There is an ever-increasing awareness about climate change. The European Commission has positioned itself at the very core of the answer to such global problem. Ever since the first serious attempts to internationally tackle the issue in Rio, Kyoto, Copenhagen and Paris, the EU has always led the efforts.

Its latest attempts to curb the greenhouse gases emissions are reflected within the frame of the United Nations UN´s 2030 Agenda for Sustainable Development and the Sustainable Development Goals (SDGs). The Agenda set in 2015 deals with several issues and it focuses in particular on the planet, on the environmental factor, as one of its five key factors or key Ps: People, Planet, Prosperity, Peace, and Partnership. The UN states that (UN, 2015) "We are determined to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations".

This spirit of halting the planet´s degradation focuses on the environmental and climate change challenge we are facing. That is nothing new, as the previous UN´s effort, the eight Millennium Development Goals-MDGs, also displayed as its seventh Goal (MDG7) (World Health Organization, 2018) "to ensure environmental sustainability".

The MDGs have been a success story and as far as the MDG7 is concerned the UN inform us that several key factors were accomplished (MDG Monitor, 2016): "The virtual elimination of ozone-depleting substances since 1990. Consequently, the ozone layer is expected to recover by around the middle of the century. Substantial increase in marine and terrestrial protected areas in many areas since 1990. In Caribbean and Latin America, coverage of terrestrial protected areas increased from 8.8 percent in 1990 to 23.4 percent in 2014. The number of people using improved drinking water sources has increased from 76 percent in 1990 to 91 percent in 2015. 2.6 billion People have gained access to better drinking water since 1990. Of these, 1.9 billion have access to piped drinking water on premises, with 58 percent of the global population enjoying this level of service in 2015. 147 nations in the world have fulfilled the drinking water target; 95 nations have achieved the sanitation target; and 77 nations have met both. 2.1 billion people in the universe have gained access to improved sanitation. At the same time, the proportion of people practising open defecation has reduced by nearly 50 per-

cent since 1990. A reduction in the proportion of urban population in developing nations living in slums from 39.4 to 29.7 percent in the period between 2000 and 2014".

The MDGs have their own failures. One of the major MDG shortcomings is the fact that their success was not experienced equally across the globe. Organizations like the Borgen Project have gathered information that shows such uneven results. For instance, in the Extreme Poverty Fifty Percent Reduction Rate Goal, it is found that "South-eastern Asia exceeded the goal for extreme poverty reduction by 16 percent, Southern Asia exceeded the goal by 12.5 percent, and Northern Africa scraped by at about 1.2 percent. Sub-Saharan Africa was by far the most behind. It did not even meet the goal for extreme poverty reduction and was 12.5 percent away from doing so" (The Borgen Project, 2015). As far as environmental issues are concerned, the same source informs us that the numbers for global emissions of carbon dioxide as well as water scarcity are "disheartening. There has been a 50 percent increase in carbon dioxide emissions and water scarcity affects more than 40 percent of the world in comparison to 1990 statistics" (The Borgen Project, 2015). But they remain optimistic as they admit that the Sustainable Development Goals (SDGs) are bringing hope.

A more ambitious approach has been made and now there are several new targets for the Agenda 2030-SDGs. The momentum gained is such that out the seventeen proposed goals, seven directly approach environmental issues (UN, 2015).

Though it can be argued that the SDGs are vague in their approach it is also undeniable that they give a framework and help to raise awareness in the decision makers and to create recognition for the wider social, cultural, economic, political, institutional and normative elements of adaptation that can lead to the construction of multidimensional operational approaches on the ground (Sánchez Rodríguez et al., 2018). This approach has had some impact in the resolution and Treaties signed under the UNs auspices. Professor Ilan Kelman leads the opinion line that however, it is disappointing the scarce mention to those Goals at the main resolution on the matter taken on an international level in the last years: The Paris Agreement. They consider that references to climate change are poorly integrated in the SDGs and that they should be more explicitly outlined. They complain that the Paris Agreement makes only passing reference to the SDGs in the preamble and that no other mention of the SDGs or of the United Nations General Assembly UNGA conferences (2015) appears in the Paris Agreement (Kelman, 2015).

Furthermore, the main UN body specialized in climate change does not assess specific synergies and trade-offs between climate impacts, climate action and all one hundred and sixty-nine individual targets of the 2030 Agenda. However, a study of the one hundred and sixty-nine individual targets shows a very different picture as it is explained in the following figure (Fuso Nerini et al., 2019).

Figure 1. Synergies and trade-offs between climate action and the SDGs
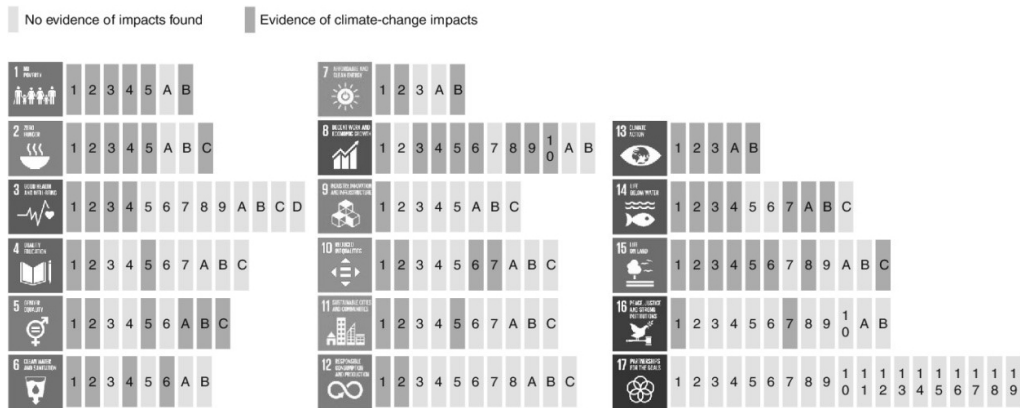
Source: Fuso Nerini et al. (2019) "Connecting climate action with other Sustainable Development Goals"

As it can be seen, seventy-five out of the one hundred and sixty-nine targets authors found published evidence of having an impact in environmental issues. They go even further when they admit that the lack of underlining merely shows the fact that no specific evidence is found but it does not mean that there is no impact.

The SDGs have brought international awareness and a legal framework that focuses international efforts and they have created a window of opportunity to be taken by the most proactive decisions makers. As in many other issues the EU is a leading voice in such matters and under this general framework practical decisions have been taken. The executive branch of the EU, the European Commission, has tasked itself to gather its efforts around organizing its work in terms of specific SDGs and targets, building as appropriate on the recent work of the United Nations body created to provide policymakers with regular scientific assessments on climate change, the Intergovernmental Panel on Climate Change, IPCC15 and the UN International Resource Panel. It is the European Commission's challenge to arrive to a harmonization on the climate action with broader SDGs. Within the Member States there is also a need to advance in a coordinated policy framework. Additionally, the European Commission acknowledges that the Paris Agreement and the UN 2030 Agenda on Sustainable Development are mutually reinforcing as there can be no sustainable development without climate action (European Commission, 2020).

2. The European transition to a low carbon emission Society

There is a fluid and strong cooperation between the EU and the UN system. The very Secretary General of the UN is European, Antonio Guterres. The cooperation includes the UN Secretariat and the various UN Agencies, Funds and Programmes, spanning across all policy areas. Since 2011, the EU is an observer member with enhanced status at the UN General Assembly. This allows the EU to present common positions, make interventions, present proposals, and participate in the general debate each September. The European Commission understands that there is an added value in coordinating among its 27 Member States to present a unified position. This also means coordinating its voting within the UN General Assembly's six main committees, as well as other bodies and agencies such as the Economic and Social

Council. Moreover, the Article 34 of the Lisbon Treaty[1] stipulates that EU State Members at the UN Security Council must act in concert and foster the interests of the EU.

Financially speaking, the EU and its Member States are the single largest financial contributor to the UN system. The contributions of the EU Member States amount to almost a quarter of the regular UN budget. The EU and its Member States also provide about a quarter of all the voluntary contributions to UN funds and programmes. The European Commission alone contributed over €3 billion to support UN external assistance programmes and projects in 2019 (European Union External Action Service, 2020). It is particularly relevant to notice that one of the six Priorities of the European Union at the UN is "Accelerating the global transition towards sustainable and climate-neutral future" (European Union External Action Service, 2020). Furthermore, the EU states its commitment with the implementation of the SDGs in all their policies and to encourage EU Member States in doing the same (European Commission, 2018). The European Commission's awareness is backed by the published numbers (European Commission, 2018): "In 2014-2017, the EU has allocated 20% of its budget to climate action and this share is likely to reach at least 25% as of 2021, which confirms the growing importance of climate action in the EU agenda. As regards development cooperation, the share of climate-related spending grew from 10.3% of total commitments in 2014 to 25.5% in 2017. After a step back in 2018, we plan to increase our climate-related spending again in 2019-2020".

On a practical basis, the EU is developing its own answers to tackle the environmental issues brought by the SDGs. Notably, the European Green Deal. It is a political project that directly targets such Goals. It provides an action plan with a middle point in 2030 and a final ambitious goal of the EU becoming carbon neutral by 2050. In order to achieve such goals, the European Green Deal encourages the transition to a clean circular economy that will restore biodiversity and cut pollution. This is not just some general statement as the EU presents a clear route and a truly relevant funding as the plan is to help mobilise at least €100 billion over the period 2021-2027 in the most affected regions with the Just Transition Mechanism. Those action have gained practical momentum in the last months as it is shown in the following figure.

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1 Article 34 of the Lisbon Treaty: "Article 34 (ex Article 19 TEU). 1. Member States shall coordinate their action in international organisations and at international conferences. They shall uphold the Union's positions in such forums. The High Representative of the Union for Foreign Affairs and Security Policy shall organise this coordination. In international organisations and at international conferences where not all the Member States participate, those which do take part shall uphold the Union's positions. 2. In accordance with Article 24(3), Member States represented in international organisations or international conferences where not all the Member States participate shall keep the other Member States and the High Representative informed of any matter of common interest. Member States which are also members of the United Nations Security Council will concert and keep the other Member States and the High Representative fully informed. Member States which are members of the Security Council will, in the execution of their functions, defend the positions and the interests of the Union, without prejudice to their responsibilities under the provisions of the United Nations Charter. When the Union has defined a position on a subject which is on the United Nations Security Council agenda, those Member States which sit on the Security Council shall request that the High Representative be invited to present the Union's position". https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2016:202:FULL&from=EN

Figure 2. EU´s Green Timeline (2019-2021)
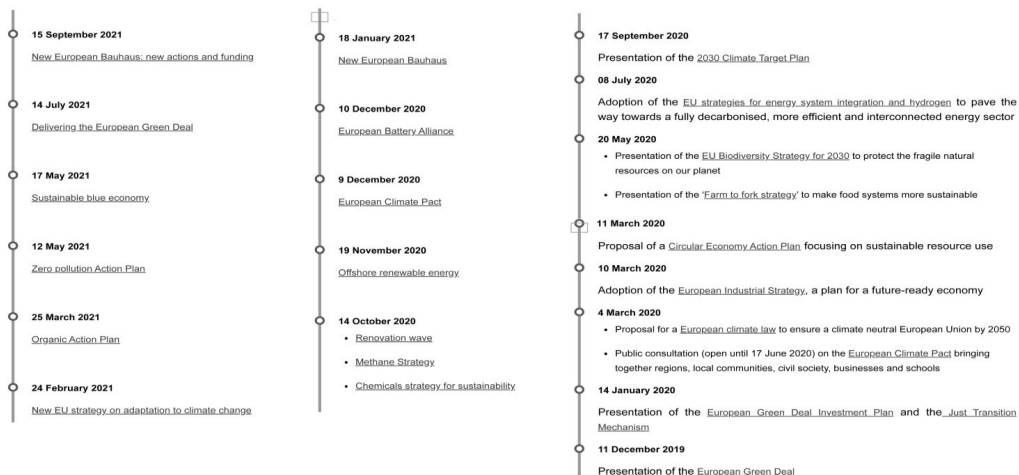
Source: European Commission (2021)

The European Commission has already set out a path of how to achieve carbon neutrality by 2050. The carbon neutrality strategy is aimed to become the basis for the long-term strategy that the EU submitted the EU's Green Timeline to the United Nations Framework Convention on Climate Change in early 2020. It displays a number of milestones. It is particularly relevant the action taken since March 2020 with the "European Climate Law" (Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999) that enshrines the 2050 carbon neutrality objective in legislation. The Climate Law will also ensure that all EU policies contribute to the climate neutrality objective. This will only be a further step in the efforts that the EU has already taken in order to transform the economy. We are informed by the European Union Commission in their progress made in cutting emissions. The information page shows that between 1990 and 2018 the EU reduced greenhouse gas emissions by 23%, while the economy grew by 61%. The Commission has presented an impact assessment plan to increase the EU's greenhouse gas emission reductions target for 2030 to at least 50% and towards 55% compared with 1990 levels in a responsible way. The Commission will, by June 2021, review all relevant climate-related policy instruments. The goals are clear: to arrive to a further decarbonising economy and an optimization of the energy systems. This is of the utmost importance to reach climate objectives in 2030 and 2050. The production and use of energy across economic sectors account for more than 75% of the EU's greenhouse gas emissions and Energy efficiency must be prioritised (European Commission, 2019).

The European Commission understands their limitations and it is vocal in the necessity of constructing trends. Thus, it is focusing on establishing the drivers and using its influence and expertise to create momentum. The EU is also vocal in taking a world leading role in such issues while maintaining its competitivity. Realizing that the EU is a relevant part but only a part of the international effort, the European Commission creates the Green Deal roadmap as part of an integral part of their strategy to implement the United Nation's 2030 Agenda and the Sustainable Development Goals. The Green Deal Roadmap will refocus (European Commission, 2019) "the process of macroeconomic coordination to integrate the United Nations' sustainable development goals, to put sustainability and the well-being of citizens at

the centre of economic policy, and the sustainable development goals at the heart of the EU's policymaking and action ".

The EU efforts are supported by very relevant social, economic and technological trends that are giving shape to the energy systems that are needed to arrive to neutral emissions economy of 2050. Several trends have been isolated and named by the Commission and different authors. These trends, that some authors have named as "megatrends" can be summarized as shown in the next table.

Table1. The 10 megatrends shaping tomorrow's energy systems

Item	Explanation
1. Decarbonization challenge	As climate change accelerates, societal pressure to act increases
2. Deflation of fossil fuel prices	Coal, oil and gas prices will remain low, but become more volatile
3. Decrease in costs	Clean-energy technologies are becoming cheaper than conventional and fossil technologies
4. Digitalization	Energy and transport systems are becoming smarter and better networked
5. Electrification	The power, transport and heating sectors are increasingly interconnected
6. Dominance of fixed costs	Future energy systems will be dominated by investment costs
7. Influential cities	More people in cities means that urban decisions are becoming more important for enabling low-carbon lifestyles
8. Demographic and economic change in rural areas	Many regions must cope with ageing and shrinking populations and face shifting economic opportunities
9. Decentralization	Small-scale solutions enable but also require proactive energy consumers
10. Interdependence	Progressive integration of European economies and energy systems is demanding more coordination between countries

Source: Buck R. et al. (2019) Agora Energiewende

Advancing the European clean-energy transition is a task that primarily falls to national and regional governments. No national energy transition will be exactly alike. Irrespective of these differences, all Member States must find solutions for pursuing the same set of objectives over the next decade. On the way, strong EU-level action will be needed to help resolve issues related to solidarity, to the security of energy supply and energy systems, to competitiveness, and to innovation (Buck et al., 2019). The European Commission is fully proactive in using technology for the transition to a low carbon emission economy. It recognized that "a full-fledged energy transition is becoming economically and technically feasible, with most of the necessary technologies now available and technology costs declining " (Taglapietra et al., 2019).

3. A European approach to Artificial Intelligence

The relevance of Artificial Intelligence (AI) technologies is not a tale for tomorrow but for today. AI is already shaping our reality and having a huge economic impact on our economy, our law and in our environment. The European Union is well aware of it and as the Commission states (European Commission, 2021): "Artificial intelligence (AI) has become an area of strategic importance and a key driver of economic development. It can bring solutions to many societal challenges from treating diseases to minimising the environmental impact of farming". As explained in the previous chapter, the EU is fully aware of the environmental challenges ahead. The EU is also fully responsible of the necessity of staying at the vanguard of the AI revolution to ensure the competitiveness of the Union and of the Member States as well as of the European values.

From the legal point of view, the European Institutions have been aware of the relevance of such technologies earlier than any other decision maker in the world. It is relevant to note it was as early as 2017 that the European Parliament launched the resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (European Parliament, 2017). References to the Asimov's Law of Robotic that used to dwell in science fiction books now find reflection in a legal resolution by the European Parliament[2]. Advanced concepts as the concept of an electronic person with duties and rights, as physical persons or companies do, can also be found[3]. They are not the only exploratory lines of the European Parliament as it also encourages the Commission to create a European Agency for Robotics and Artificial Intelligence[4]. Such an agency would improve the current state of affairs of the Commission that currently deals with the issue at a very high level with the Robotics and Artificial Intelligence Unit A.1 and the High Level Panel of experts but lacks a specific Agency for the time being. The Resolution also deals with the environmental impact of robotics and AI in the Points 47 and 48 aimed to the incorporation of the principles of a circular economy into any Union policy on robotics and stressing that the (European Commission, Unit A-1, 2021) "Environmental impact will lead to the creation of energy and infrastructure systems that are able to control the flow of electricity from producer to consumer, and will also result in the creation of energy 'prosumers', who both produce and consume energy; thus allowing for major environmental benefits".

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2 The European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics: "General principles. Point T. whereas Asimov's Laws(3) must be regarded as being directed at the designers, producers and operators of robots, including robots assigned with built-in autonomy and self-learning, since those laws cannot be converted into machine code".

3 The European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics: "Point 59.f.f) creating a specific legal status for robots in the long run, so that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently".

4 The European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics: "Point16. Asks the Commission to consider the designation of a European Agency for Robotics and Artificial Intelligence in order to provide the technical, ethical and regulatory expertise needed to support the relevant public actors, at both Union and Member State level, in their efforts to ensure a timely, ethical and well-informed response to the new opportunities and challenges, in particular those of a cross-border nature, arising from technological developments in robotics, such as in the transport sector".

The fact that there is no specific Agency yet does not mean that the Commission is not proving its commitment with specific funds. Through the H2020 Funding Programme (2014-2020), the largest public funding project in the world, the Commission has spent €700 million euros on robotics and AI. This has also meant an additional €2,100 million euros from the Industry. Other relevant points of funding are the Future and Emerging Technologies such as the Human Brain Project with €120 million euros, the Big data, data analytics program with €250 million euros, the Internet of Things (IoT) pilot on Autonomous Vehicle project with €20 million euros or the AI-on-Demand Platform with €20 million euros (OECD, 2020).

The European Commission aims to create an "Ecosystem of Excellence" that will (European Commission, 2020) "build an ecosystem of excellence that can support the development and uptake of AI across the EU economy and public administration, there is a need to step up action at multiple levels". Having in mind the challenge it means for several factors, including in a specific manner the environmental challenge. "This is a chance for Europe, given its strong attachment to values and the rule of law as well as its proven capacity to build safe, reliable and sophisticated products and services from aeronautics to energy, automotive and medical equipment…, safer and cleaner transport systems, better public services… the green and circular economy, healthcare and high-value added sectors like fashion and tourism); and for services of public interest, for example by reducing the costs of providing services (transport, education, energy and waste management)".

The Commission set out an AI strategy on 25th April 2018 aiming to address the economic, social, research and investments issues within the Union and the Member States. As mentioned, a High-Level Expert Group was established in April 2019 and the Commission took as its own the seven Principles identified by the High-Level Expert Group (European Commission, 2020): "Human agency and oversight, Technical robustness and safety, Privacy and data governance, Transparency, Diversity, non-discrimination and fairness, Societal and Environmental wellbeing, and Accountability".

It is forecasted that AI will be able to perform a large number of tasks that previously could only be done by humans. Furthermore, AI increases the possibilities to track and analyse big amounts of data and using algorithm that can predict behaviours and trends. It is very clear in the eyes of the Commission the disruptive nature of AI and the opportunities and threats it may bring. In order to prevent abuse, the Commission is already pitching a route that will tackle any negative aspects and it is encouraging the creation a legislative framework that will be able to address potential risks and situations. This framework will be mainly aimed to the effective application and enforcement of existing EU and Member States Laws in order to avoid any lack of transparency coming from the AI application. This body of legislation will also address the current limitations of scope of existing EU legislation regarding its current application to products and not to services, including services based on AI. The supply chain of services provided by AI is also beyond the boundaries of the current EU laws and this is a worrying factor weighed in by the Commission, as it creates uncertainty for the allocation of responsibilities between different economic operators in the supply chain. As a matter of fact, the Commission is both aware of the advent of AI and aware of the current lack of a legislative body that is making the law maker lagging behind the breakthrough changes AI is bringing.

4. Artificial Intelligence and the Environment

Several authors do not hesitate to define AI as a Game Changer for the Environment and recent statistic show the AI has helped researchers to improve in their accuracy in identifying extreme climate events to an 89-99% rate (University Columbia, 2018). The real meaning of this is that in a world facing its most severe manmade climate change challenge we can count on a new tool to help us: AI. AI is spearheading the Fourth Industrial Revolution, when "Technology is also becoming increasingly connected; in particular we are seeing a merging of digital, physical and biological realms. New technologies are enabling societal shifts by having an effect on economics, values, identities and possibilities for future generations". As in other pieces of work, the Report made by the World Economic Forum takes as a starting point the reference of the United Nations Sustainable Development Goals and goals and challenges it provides (World Economic Forum, 2018) "six of the 17 goals apply directly to the environment and humans' influence over it: combating climate change, using ocean and marine resources wisely, managing forests, combating desertification, reversing land degradation, developing sustainable cities and providing clean affordable energy".

AI systems can create a positive impact on environmental challenges. AI can help renovate traditional sectors to address climate change, deliver food and water security, protect biodiversity, improve energy production and delivery, recycle and many other environmental issues that are now aligned with humankind future. It is actually considered that for AI systems to remain a positive driver in human evolution it will need to incorporate the health of the natural environment as their core dimension.

The impact of positive environmentally driven AI is enormous and encompasses a vast number of industries and services. From robots learning how to sort recycled household materials to AI software reviewing data and finding patterns for weather prediction. Techniques such as deep learning, and AI-enabled simulators will accelerate the way we examine scenarios involving climate policy and greenhouse gas emissions as Professor Sterman stated (Sterman, 2001): "Accelerating change is transforming our world, from the prosaic (such as the effect of information technology on the way we use the telephone) to the profound (such as the effect of greenhouse gases on the global climate)". The help AI can bring in does not stop in the macro but it can go to the micromanagement of the transition to a low carbon emission economy. AI systems that can identify patterns of high demand and high cost in home heating, adapting usage automatically.

The fast introduction on the AI and big data technologies will make them more prevalent and they will promote and enhance many environmentally oriented technologies. In the short term, it is previewed it will be affecting currently running projects such as autonomous and connected electric vehicles (EVs), distributed energy grids, smart agriculture, weather forecasting and climate modelling, the use of "black box" AI models for high-risk, high-impact environmental domains, decentralised water management, AI-designed intelligent, connected cities, Oceans data platform, Earth bank of codes, and more. The forecasted introduction of other paradigmatical shift technologies is envisioned for 2030 onwards as PWC shows us in the following figure.

Figure 3. AI for the Earth game changers: Indicative timeline
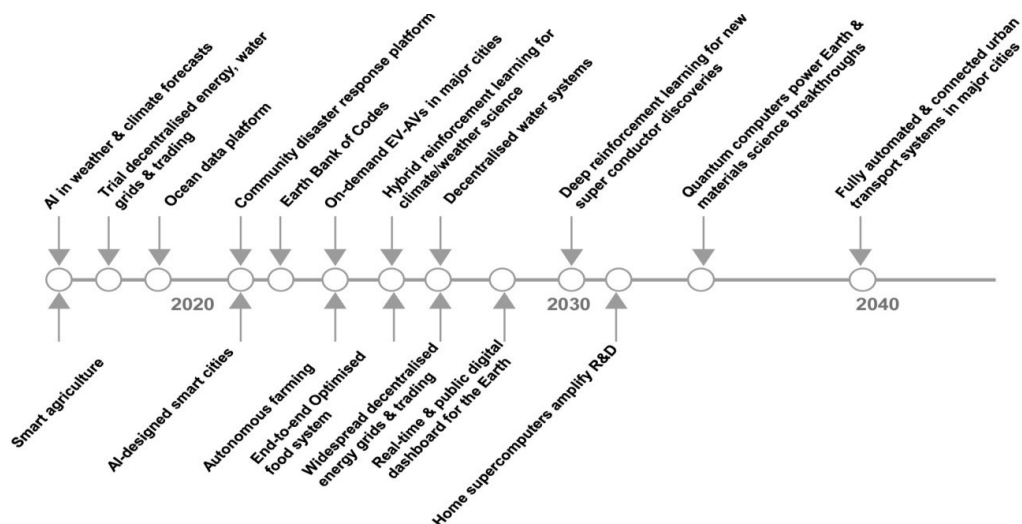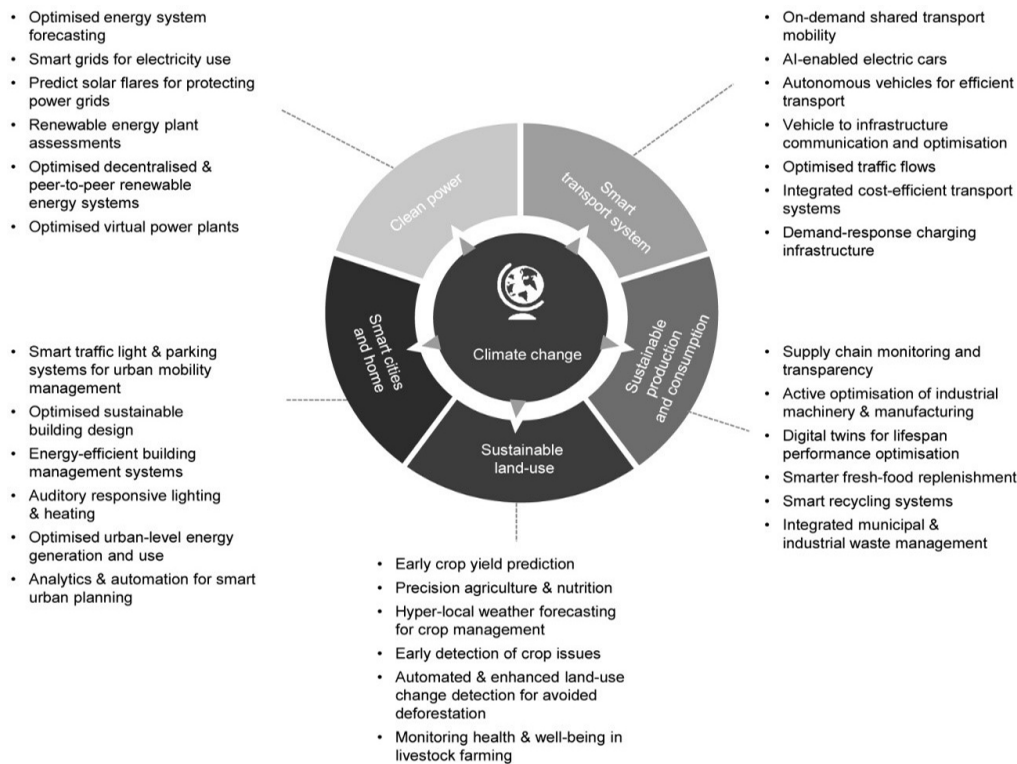

Source: Price Waterhouse Cooper (2018)

As the introduction of AI seems inevitable there are also raising voices regarding its safety and its ethical use. Those voices claim for responsible technology policies. Under such policies, the EU and other stakeholders aim to set clear and ethical parameters (PwC, 2018) to "ensure alignment with human values and international frameworks such as the Sustainable Development Goals". This would ensure that there are clear standards and red lines that will frame the body of any AI strategy and it will ensure accountability and respect for the ethical framework of the EU in the use of AI as it is incorporated to the social and environmental components of all national digital strategies. This concept links with the creation of AI algorithms that will be safe and transparent. The so-called "black boxes" are (Giannotti et al., 2020) "AI systems for automated decision making, often based on machine learning over big data". These black boxes will take automatic decisions in the fields where they are deployed, the environmental management field for instance. Authors also ask for a regulation that would also ensure that ethical and robust values are pondered in their core programming, so the automatic decisions fall into the general ethical frame stablished by the EU and other stakeholders.

This regulation will also prevent any AI bias and ensure a social safety net. It is emphasized the relevance of a technology capable of explaining the logic of black boxes and outlaw many applications of opaque AI decision making systems. This will prevent misuse from companies and other stakeholders in often in safety-critical industries such as self-driving cars, robotic assistants, and personalised medicine, or relevant automatic decision that can be taken for wider environmental problems like automatic cuts in polluting production lines or weather forecast and control.

That control seems wise, considering the scope of AI and the environment. From forecasting weather to the optimization of batteries for stabilizing and long term storing the energy produced from green sources, AI is extensively used. AI shows an enormous potential in adding crucial value to environmental problems. PwC has identified "more than 80 existing AI use cases for the environment" (PwC, 2018)

AI applications are opening a whole new world on how we can approach the protection and management of ecosystems, on how climate change is monitored and controlled, on optimizing energy production, storage and consumption, on how oceans are protected. AI can create simulations as to forecast changes in the weather or how to improve the way water is treated and found. AI is already helping the decision makers into making more informed decisions. Today, (PwC, 2018) "focus on automated and assisted intelligence to unlock value from large unstructured real-time datasets. Future applications will likely involve more systems propelled by autonomous decision-making where AI acts independently". Thus the need to create an organized legal and ethical model for a proper frame and clear red lines on AI acting in an independent manner from human control.

Figure 4. AI applications by challenge area

- Optimised energy system forecasting
- Smart grids for electricity use
- Predict solar flares for protecting power grids
- Renewable energy plant assessments
- Optimised decentralised & peer-to-peer renewable energy systems
- Optimised virtual power plants

- On-demand shared transport mobility
- AI-enabled electric cars
- Autonomous vehicles for efficient transport
- Vehicle to infrastructure communication and optimisation
- Optimised traffic flows
- Integrated cost-efficient transport systems
- Demand-response charging infrastructure

- Smart traffic light & parking systems for urban mobility management
- Optimised sustainable building design
- Energy-efficient building management systems
- Auditory responsive lighting & heating
- Optimised urban-level energy generation and use
- Analytics & automation for smart urban planning

- Supply chain monitoring and transparency
- Active optimisation of industrial machinery & manufacturing
- Digital twins for lifespan performance optimisation
- Smarter fresh-food replenishment
- Smart recycling systems
- Integrated municipal & industrial waste management

- Early crop yield prediction
- Precision agriculture & nutrition
- Hyper-local weather forecasting for crop management
- Early detection of crop issues
- Automated & enhanced land-use change detection for avoided deforestation
- Monitoring health & well-being in livestock farming

Source: Price Waterhouse Cooper (2018)

However AI and AI related companies are also great CO_2 emissions producers. A study by the University of Massachusetts scrutinised through several AIs uses and the energy consumed. The energy was translated into carbon emission and electricity cost. They found that training an AI into a language-processing system generates an astounding 635 kg of CO_2 equivalent emission and that it could reach up to over 35,000 kg depending on the scale of the AI experiment and the source of power used. The study remarks that this would be comparable to 125 round trip flights between New York and Beijing (Strubell et al., 2019).

In a similar way, it has been found that the main computing providers in the world are also relevant polluters. As it can be seen in the following table, Amazon, Google and Microsoft

also use considerable percentages of energy of fossil origin. Actually their percentages are in cases worse than the USA ones and overall worse than Germany's.

Table 2. Percent energy sourced from: Renewable sources, natural gas, coal and nuclear for the top 3 cloud compute providers compared to the United States, China and Germany

Consumer	Renewable	Gas	Coal	Nuclear
China	22%	3%	65%	4%
Germany	40%	7%	38%	13%
USA	17%	35%	27%	19%
Amazon-AWS	17%	24%	30%	26%
Google	56%	14%	15%	10%
Microsoft	32%	23%	31%	10%

Source: Cook et al., (2017) and Burger (2019)

Finally, we cannot be oblivious to the risks around AI. There are performance and control risks and social, economic and ethical risk that need to be considered. Several authors have stablished a protocol as to identify the main risk that an AI can bring. The hurdles are set so as to prevent a negative AI deployment. Though the concept of a protocol is there and the steps to mitigate the risks are set, it is up to the legislator, as previously stated, to provide for clear guidelines. Green relevant players around the world have varying standards and laws regarding AI risks. As mentioned, the EU is once again exercising its soft power by leading the way with the guidelines published by the Commission in 2018.

Figure 5. Identifying AI risks
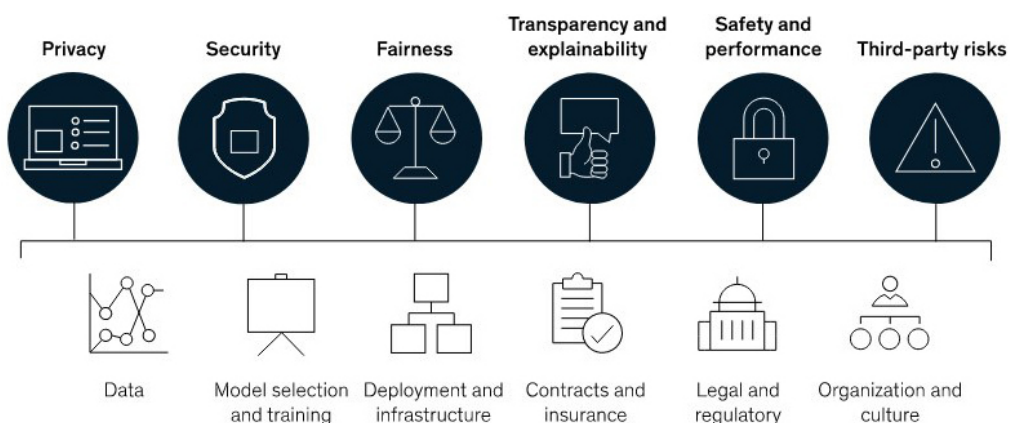
Source: Mckinsey (2021)

5. Conclusions

Humankind is facing an increasing number of worldwide problems that the UN has framed in the SDGs. The potential disruptive of those challenges is putting the decision makers into a state of alarm. Notably, the European Union is spearheading the global efforts.

Despite of what some authors are describing, it is a fact that the SDGs do target environmental issues. As explained, there are 167 mentions to specific environmental issues in the SDGs targets. They are part of the general UN's efforts to curve Green House Gases emissions alongside the Intergovernmental Panel on Climate Change (IPCC), the Conference of the Parties (COPs), the Kyoto Protocol, the Paris Agreement and more. It is not a single effort. It is a multi-angled approach that is giving the essential frame needed so that local Government can implement and coordinate their policies.

AI is a reality. The European Union is well aware of the importance of connecting industrial, academic and government research agencies so that the Union and the State Member do not lag behind in the current revolution. AI is not apart from the core technologies like Blockchain/Digital Ledger Technologies, 5G communications, Big Data, Internet of Things (IoT), that are giving birth to a complete radical new way to approach all the issues of our day in day out lives. The creation of new agencies and of new concepts, like the legal electronic person beyond the traditional natural or legal person concepts. The very fact that such concepts are in the mind and legal work produced by decisive decision makers like the European Parliament or the Commission show up to what point AI is now in the European Agenda.

Since the Kyoto Protocol, the leading position of the EU in the environmental agenda developed over decades has been clear. The EU has some of the world's highest standards regarding air pollution, climate change, litter, waste, and soil contamination. In response to this growing awareness, the EU has enacted a number of policies aimed at a number of environmental issues, including lowering carbon emissions and water conservation. As a result of these increased demands the EU is always looking for innovative and creative ways to keep the positive results that it has been shown so far. It is relevant to consider that as mentioned the SDGs are part of the EU strategy in their different policies.

The EU is subsidising developing of responsible technology policies such as the ones explained in the EU's Green Timeline. This will ensure a set of clear parameters for technology innovators. It will also make certain that the EU is aligned with human values and international frameworks such as the Sustainable Development Goals. This will ensure that social and environmental considerations are incorporated into Member States national strategies The EU is implementing policies aimed to boost the international attractiveness of the Union in the field of AI for both foreign talented researchers and leading industries. It is swiftly creating new agencies and bodies and promoting funds to attract talent in such domain.

Unmistakably, the ethical aspect of the AI possibilities is at the core of the EU decision makers. To build trust for the usage, adoption and development of AI across society, the EU is putting in place the development of ethical guidelines for a sustainable, transparent, replicable use of AI with clear definitions for data-driven AIs on responsibilities, liabilities, and data protection issues.

Two of the main challenges that the EU is facing are coming together. AI and climate change. How we tailor solutions and standards will dictate the reality of the incoming generations. Accountability is a key word here. We have to be hold to account on the parameters set for

the AI so it becomes our greatest ally in tackling the challenges of the Anthropocene. The UN is setting a frame and the EU is leading the path in setting those parameters.

This path is set, and it is clear. Can the AI technologies help in the common effort? More efficient and innovative solutions in AI are being stimulated. As explained in the mentioned examples the application of such solution to different environmental problem is already happening and it is gaining momentum. The opportunity for AI to be channelled to benefit humankind and the environment crisis is significant. AI solutions will deliver a revolution in solving society's most pressing environmental challenges: climate change, biodiversity, ocean health, water management, air pollution, resilience, and more.

References

Buck, R., Graf, A. & Graichen, P. (2019). European Energy Transition 2030: The Big Picture. Ten Priorities for the next European Commission to meet the EU's 2030 targets and accelerate towards 2050. *Agora Energiewende*.

Buehler, K., Dooley, R., Grennan, L. & Singla, A. (2021, May 3). Getting to know—and manage—your biggest AI risks. *Mckinsey and Company*. https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/getting-to-know-and-manage-your-biggest-ai-risks

Burger, B. (2019). *Net Public Electricity Generation in Germany in 2018*. Technical report. Fraunhofer Institute for Solar Energy Systems ISE.

Cho, R. (2018, june 5). Artificial Intelligence—A Game Changer for Climate Change and the Environment. *Columbia Climate School. Climate, Earth, and Society*. https://news.climate.columbia.edu/2018/06/05/artificial-intelligence-climate-environment/

Cook, G. et al (2017). *Clicking Clean: Who is winning the race to build?*. Technical report. Greenpeace.

European Comision. (n. d.). Climate Action. https://ec.europa.eu/international-partnerships/sdg/climate-action_en

European Comision. (n. d.). Sustainable Development Goals. https://ec.europa.eu/international-partnerships/sustainable-development-goals_en

European Comision. (n. d.). A European Green Deal. Striving to be the first climate-natural continent. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

European Comision. (n. d.). A European approach to artificial intelligence. https://ec.europa.eu/digital-single-market/en/artificial-intelligence

European Comision. (n. d.). https://ec.europa.eu/digital-single-market/en/content/robotics-and-artificial-intelligence-unit-a1

European Comision. (2019, june 26). Policy and investment recommendations for trustworthy Artificial Intelligence. https://digital-strategy.ec.europa.eu/en/library/policy-and-investment-recommendations-trustworthy-artificial-intelligence

European Comision. (2019, december 11). https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52019DC0640&from=ENThe European Green Deal [Communication].

European Comision. (2020). White Paper on Artificial Intelligence. A European approach to excellence and trust. https://ec.europa.eu/info/sites/default/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf

European Parliament. (2017, february 16). European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics. https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html

Fuso Nerini, F., Sovacool, B., Hughes, N., Cozzi, L., Cosgrave, E., Howells, M., Tavoni, M., Tomei, J., Zerriffi, H. & Milligan, B. (2019). Connecting climate action with other Sustainable Development Goals. *Nature Sustainability*, *2*, 674-680. https://doi.org/10.1038/s41893-019-0334-y

Giannotti, F., Rauber, A. & Trasarti, R. (2020). *The AI Black Box Explanation Problem*. University of Pisa.

Kelman, I. (2015). *Linking disaster risk reduction, climate change, and the sustainable development goals*. University College London.

MGD Monitor. (2016). MDG 7: Ensure environmental sustainability. https://www.mdgmonitor.org/mdg-7-ensure-environmental-sustainability/

Organisation for Economic Co-operation and Development. (n. d.). European Commission's Initiatives in Artificial Intelligence. https://www.oecd.org/going-digital/ai-intelligent-machines-smart-policies/conference-agenda/ai-intelligent-machines-smart-policies-huet.pdf

Price Waterhouse Coopers. (2018). *Fourth Industrial Revolution for the Earth*. PWC-PriceWaterhouseCoopers.

Sánchez Rodríguez, R., Ürge-Vorsatz, D. & Barau, A. S. (2018). Sustainable Development Goals and climate change adaptation in cities. *Nature Climate Change*, *8*, 181-183. https://doi.org/10.1038/s41558-018-0098-9

Sterman, J. (2001). *System Dynamics Modelling: tools for learning in a complex world*. University of California.

Strubell, E. (2019). *Energy and Policy Considerations for Deep Learning in NLP. College of Information and Computer Sciences*. University of Massachusetts Amherst.

Taglapietra, S., Zachmann, G., Edenhofer, O., Glachant, J. M., Linares, P. & Loeschele, A. (2019). The European Union Energy Transition: Key Priorities for the Next Five Years. *Energy Policy*, *132*, 950-954. https://doi.org/10.1016/j.enpol.2019.06.060

The Borgen Project. (2015, november 19). MDG Failures. https://borgenproject.org/mdg-failures/

United Nations. (n. d.). Sustainable Development Goals. https://www.un.org/sustainabledevelopment/sustainable-development-goals

United Nations. (2015). Resolution adopted by the General Assembly on 25 September 2015. https://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E

World Economic Forum. (2018). Harnessing Artificial Intelligence for the Earth. https://www.kdnuggets.com/2019/03/ai-black-box-explanation-problem.html

World Health Organization. (2018). Millennium Development Goals (MDGs). https://www.who.int/topics/millennium_development_goals/about/en/

Legislation

Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community (OJ C 306, 17.12.2007). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:C:2016:202:FULL&from=EN

The European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics. Points 47 and 48. https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html

Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999. https://eur-lex.europa.eu/eli/reg/2021/1119/oj