

Rethinking Sustainable Development in the Age of Artificial Intelligence

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Abstract

Today, artificial intelligence is being applied in areas ranging from public institutions to people's everyday lives. Its pervasiveness makes it a protagonist of essential changes in society. In recent years, sustainable development has moved to the centre of public discourse and national and international planning. The UN defines sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” and has developed the 2030 Agenda to achieve this objective (UN, 2015). AI's ubiquity and relevance mean it can be either a facilitator or a barrier to sustainable development. In a paper published in *Nature*, Vinuesa and colleagues (2020) highlighted how AI can facilitate the achievement of Sustainable Development Goals but also pose a threat to their attainment. The importance of AI today requires a redefinition of the concept of sustainable development in order to protect areas that have become particularly sensitive to its proliferation. Therefore, reflection on how AI can contribute to achieving sustainable development should be in parallel with how AI redefines the dimensions of sustainable development. The dimensions worthy of attention identified in this work are Transparency, Autonomy, Democracy and Privacy.

Keywords: artificial intelligence, sustainable development, autonomy, democracy.

1. The context of digitalization

In the last decade, AI systems have been implemented in various economic, social, political, institutional, and private fields. Virtual assistants, image analysis software, search engines, facial and voice recognition systems or robots, autonomous vehicles, drones, and the Internet of Things (IoT) are

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becoming increasingly popular. AI is used in healthcare, public administration, transport, education, agricultural and food supply chains, factories, and smart cities (European Union, 2023). As a constituent element of contemporary society, AI has received considerable attention from national and supranational institutions, and regulatory proposals that regard it are a consequence of this attention. Given AI's significant role in society today, it is inevitable that we consider it when we imagine the kind of society we want to build. Therefore, it has recently begun to consider the relationship between AI and Sustainable Development. Reflection on the relationship between AI and sustainable development has followed the lines established in the framework of the 2030 Agenda, which is the United Nations' strategy for achieving sustainable societies. To this vital line of reflection must be added another, which deals with how AI is changing the sustainability needs of contemporary society. Thus, this paper aims to identify some areas worthy of inclusion in the sustainable development framework due to the spread of AI. To this end, the second and third sections will discuss the concepts of artificial intelligence and sustainable development. In contrast, the fourth section will discuss how the relationship between sustainable development and artificial intelligence has been analysed to date. The fifth section will discuss how artificial intelligence redefines sustainable development by identifying four focus areas; the final section will offer some concluding thoughts.

2. Artificial intelligence

In recent years, there has been increasing talk of artificial intelligence. However, the term is not so recent; it can be traced back to the Dartmouth proposal of 1955 (McCarthy et al., 2006), in which a group of researchers proposed a research program based on the idea that “every aspect of learning or any other feature of intelligence can, in principle, be described so precisely that a machine can be made to simulate it”. The proposal also outlined several application areas for AI, including neural networks, the theory of size calculation and creativity. Currently, interest in AI has increased significantly because of the changes that have affected contemporary society. Both the increased computational power of computing tools and the process of datafication (i.e. the production of vast amounts of data) support the development and training of AI. What is AI? There is no universally accepted definition of AI. Accordingly, the term “AI” has been used in different contexts with different interpretations” (Wang, 2019). The term “artificial intelligence” refers to a collection of technological devices with multiple capabilities. It generally pertains to programs involving hardware and software that learn and

perform tasks traditionally performed by humans (Manning, 2020). The group of experts who drew up the guidelines for the European Union's digital strategy distinguished between AI as a software system and AI as a scientific discipline (European Commission, 2019). The former refers to software or even hardware systems that, "given a complex objective, act in the physical or digital dimension by perceiving the environment through data acquisition, interpreting the data collected, processing information derived from this data, and deciding on the best actions to take to achieve the given objective". AI systems can use symbolic rules or learn numerical models, and they can also adapt their behaviour by analysing the effects of their previous actions on the environment. As a scientific discipline, AI "encompasses different approaches and techniques, such as machine learning algorithms (i.e. deep learning and reinforcement learning), mechanized reasoning algorithms (which includes planning, programming, knowledge representation and reasoning, search and optimization), and robotics (which includes control, perception, sensors and actuators, and the integration of all other techniques into cyber-physical systems)". AI is therefore a complex object that is constantly evolving. Currently, "narrow AI" is seen as the current goal. In contrast "broad AI" is seen as the ultimate goal (Hochreiter, 2022). Narrow AI is a specific form of AI in which a learning algorithm is tailored to perform a single, specific task, and any knowledge acquired during that task is not inherently transferable to other tasks. Unlike general AI (broad AI), which aims to replicate complex cognitive processes, narrow AI is designed to excel at a single task without human intervention. Most AI applications in use today fall into the narrow AI category. It is sometimes referred to as 'weak AI' (Rouse, 2023).

3. Sustainable development

The concept of sustainable development emerged in the 1970s to highlight how prevailing economic development models would soon lead to the depletion of Earth's resources and, hence, the economy's collapse. The accumulated evidence of the negative environmental impacts of the Green Revolution on agriculture and industrial pollution made clear the "limit of the growth" (Ekins, 1993). Before the concept of eco-sustainability, the concept of eco-development was proposed, which emphasized the importance of making development capable of preserving the habitable conditions of the planet. However, this concept could have been more successful in international policy (Ruggerio, 2021). On the other hand, sustainable development was widely publicized by the World Conservation Strategy (Pezzey, 1992). The first definition of sustainable development refers to intergenerational equity:

“Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987, p. 43). Over time, as Sachs (2015) emphasized, intergenerational equity has evolved into a more practical definition of sustainable development, where the goal is to integrate economic development with social development and environmental protection. The time for sustainable development is not only the future but also the present. These beliefs shaped the 2030 Agenda, the United Nations’ current sustainable development strategy, launched at the 1992 Earth Summit in Rio de Janeiro. Agenda 2030 includes 17 Sustainable Development Goals (SDGs) and 169 sub targets (UN, 2015). These objectives are clustered under five core principles: people, the planet, prosperity, peace, and partnership (commonly called the five P). SDGs align with the three pillars of sustainable development, encompassing the economic system, society, and environment. A report is compiled annually to evaluate progress in the goals and sub targets. The sustainable development perspective has been criticized for its internal logical contradictions. Sustaining infinite economic growth on a planet with limited resources would be impossible. This criticism has been followed for new environmental approaches such as “degrowth” and “buen vivir” (Kothari et al., 2014). However, sustainable development has become the cornerstone of development and has been incorporated into national laws and constitutions. The concept of sustainability pervades different issues, such as business, agricultural production, and industry. It has also inspired the birth of green and circular economies (Ruggerio, 2021).

4. Artificial intelligence and sustainable development

One of the most striking features of the Agenda 2030 project is its emphasis on evidence-based policymaking, that is, a perspective in which policy decisions are based on carefully established objective evidence. This is one of the reasons why, in the past decade, the subject of sustainability has crossed paths with Big Data as a decision-support tool. The United Nations has recognized the importance of big data in achieving the 2030 Agenda (Maarof, 2015). However, as Bennato (2020) points out, it should be noted that the link between technology and sustainable development is not a recent phenomenon. Already in the Club of Rome’s ‘The Limits to Development’ report, dated 1970 and written by Meadows and colleagues computer simulations based on a vast amount of data were used to statistically predict plausible scenarios regarding the future development of natural resources in relation to world population growth. Simulations were performed using sophisticated calculation systems. In

the context of sustainable development, technologies have always played a key role in the formulation and dissemination of evidence-based policies (Bennato, 2020). Given the crucial role of technologies, it is not surprising that in recent years, there has been an effort by both public and private actors to analyze the connection between artificial intelligence and sustainable development. This effort has led to numerous case studies and research papers. Within this vast scientific field, it is possible to identify two main research strands. The first is focused on the way in which AI can enable or inhibit the attainment of the targets fixed in the Agenda (Chui et al., 2018; Gupta et al., 2021; Sætra, 2021; Vinuesa et al., 2020; Yeh et al., 2021) while the second aimed at implementing sustainable targets in the AI code.

4.1 Role of AI in SDG achievement

There is evidence that AI can positively impact achieving SDGs. Specifically, by analyzing 160 AI social impact use cases, researchers at the McKinsey Global Institute have identified ten areas where AI can deliver a positive large-scale social impact (Chui et al., 2018). They found that various AI capabilities, primarily focused on computer vision and natural language processing, hold great promise for addressing a wide range of societal challenges. These AI capabilities are particularly relevant in four key areas: healthcare and hunger relief, education, enhancing security and justice, and promoting equality and inclusion. These areas offer significant potential for using AI to benefit broad population segments. In healthcare, for example, AI-enabled wearable devices are already demonstrating high accuracy (i.e. 85 per cent) in detecting early signs of diabetes using heart rate sensor data. The report argues that if these technologies can be made affordable, they could help over 400 million people affected by the disease worldwide. In education, adaptive learning technology has the potential to benefit more than 1.5 billion students by tailoring educational content to their specific abilities. However, the relationship between artificial intelligence and sustainable development remains to be determined. It has been shown that artificial intelligence can play a negative role in the achievement of SDGs. In their study, Vinuesa and colleagues (2020) employed an expert-elicitation method to gauge the impact of AI on the attainment of SDGs. Their extensive literature review results are ambivalent, as AI can play an enabling or inhibiting role, depending on the specific SDGs. In particular, they found that AI has the potential to help achieve 134 targets. However, it can also inhibit progress on 59 targets, such as poverty reduction, hunger eradication, quality education and gender equality. About the gender equality objective, for example, the authors found that the

use of AI could be problematic due to a lack of research assessing the potential impact of technologies such as intelligent algorithms, image recognition or reinforcement learning on the perpetuation of discrimination against women and minority groups. Word embedding, a widely used technique in natural language processing, has been shown to reinforce existing gender stereotypes. Beyond the lack of diversity in training data, another primary concern is the lack of gender, racial and ethnic diversity in the AI workforce. Diversity is one of the fundamental pillars that underpin innovation and social resilience. This factor will become increasingly important in a society undergoing the changes associated with the advancement of AI.

4.2 Implementing sustainable targets in the AI code

From the perspective of Actor-Network Theory (ANT) (Callon, 1984; Latour & Woolgar, 1979; Law, 1992), the negative consequences that AI can have on SDGs are not unexpected. According to the ANT perspective, AI is a socio-technical instrument endowed with authority and capable of influencing individual and collective actions (Cheney-Lippold, 2011; Rogers, 2013). The operational logic behind its decisions is opaque (Burrell, 2016; Pasquale, 2015) and capable of automatically establishing relationships (Chen et al., 2021; Roopa et al., 2019). Because AI is embedded in a set of social, economic and cultural practices, it tends to reproduce them if correctives are not integrated, and it is from this perspective that the second strand of research identified here on AI and sustainable development can be placed. Studies have focused on implementing rules within AI to optimize the criteria associated with sustainable development (Van Wynsberghe, 2021; Wilson & Van Der Velden, 2022). Van Wynsberghe (2021) focuses on the sustainability of the development and use of AI systems. He conceptualizes “sustainable AI” as a movement that aims to instigate change throughout the AI product lifecycle, encompassing idea generation, training, re-tuning, implementation and governance. In this view, sustainable AI is not limited to AI applications. Instead, it encompasses the entire socio-technical ecosystem of AI, striving for greater ecological integrity and social justice. AI can be designed to make decisions based on sustainability criteria. The AI Readiness Assessment developed by Unesco (2023) also follows this direction. The AI Readiness Assessment is a comprehensive toolkit designed to help governments gain a holistic view of the AI landscape and assess their readiness to integrate AI across different sectors. This framework has a dual focus on governments as both enablers of technological progress and consumers of AI in the public sector. Accordingly, this assessment places a high priority on addressing ethical considerations in the use of AI. The assessment

highlights the key components necessary to promote the development and responsible use of AI, including formulating policies, establishing essential infrastructure, and cultivating relevant skills. These aspects are of great importance to countries as they manage to integrate AI-driven technologies at the national level, in line with their strategic objectives and efforts to achieve the SDGs (Hadmar et al., 2023).

5. How artificial intelligence redefine sustainable development

Therefore, the relationship between AI and sustainable development is currently under research and debate. A key feature of this debate is that it is based on the normative dimensions of sustainable development identified by 2030. As we have seen, the 2030 Agenda's goals are used to define the limits and potential of AI. However, the boundaries of the debate need to be broadened to address some relevant issues. AI is a socio-technical object (Callon, 1984; Latour & Woolgar, 1979; Law, 1992). It can transform the environment in which it operates. As a result of its use in a wide range of domains, AI has an active impact on the dynamics of contemporary society, creating new demands for sustainable development. The European Union's Artificial Intelligence Act (2021) is an example of the realization of these dynamics. The AI Act of the European Union aims to develop an ecosystem of trust by proposing a reliable legal framework for AI. The AI Act is both an expression of the European institutions' awareness of the risks of the misuse of AI systems and an attempt to neutralize them by creating a regulatory system in line with the values of the European Union. The AI Act, therefore, aims to redefine the boundaries of the applicability of AI systems. Since the SDGs were adapted to the social, economic and political problems generated by socio-economic systems, it would be appropriate to update them according to the sustainability needs generated by AI, which were not adequately considered in the 2030 Agenda since it was defined before the proliferation of AI. To strengthen this thesis, we will now discuss some issues that have become salient with the advent of AI and should be included in the framework of the Sustainable Agenda, given the emphasis placed on social development. These issues are transparency, autonomy, democracy and privacy.

A) Transparency: Transparency is an extremely important issue concerning the AI systems used by public administration and companies. Often, these AI systems are proprietary, meaning that their functioning code is inaccessible to the public and cannot be analyzed or understood (Burrell, 2016; Pasquale, 2015). As a result, we can only sometimes be able to understand the reasons behind a decision made by AI, which can lead to negative consequences. In the

workplace context, the opacity of AI systems can create precarious situations; for example, it is often unclear how work shifts are assigned, which tasks are considered more lucrative, or even why content creation work on a platform can be demonetized (Ma & Kou, 2021). Regarding gender, AI can determine allocation and representation harm (Crawford, 2017). The former has economic implications, whereas the latter operates on a cultural level. Harm allocation occurs when a system unfairly distributes opportunities and resources. The lack of transparency not only hides the logic behind the decision-making process but can also conceal potential IA malfunctions, as in the famous case of teacher assignments in Italy (Aragona, 2020). In this case, the algorithm used to determine the schools to which teachers should be assigned had significant code error. This conclusion was reached after the teachers pointed out the illogical choices made by IA. Therefore, it is essential to make the underlying logic of automated decisions transparent in an understandable format to ensure greater transparency and enable everyone to understand the underlying motivations.

B) Autonomy: Autonomy is another important issue related to AI. AI systems possess a certain degree of authority, such as when they decide whether individuals can access certain services or obtain bank loans. In such situations, AI has the power to influence an individual's life path, and consequently, social stratification (Gerdon et al., 2022). However, AI's power is not always evident. For example, when a search engine returns a result or suggests which song to listen to, which operation to perform, or which product to purchase, AI exercises what is known as "soft power" (Cheney-Lippold, 2011). Soft power creates a "tailored packaging of existential possibilities." In these cases, there is a risk that the AI system may interfere with the decision-making process of the end users, potentially affecting their autonomy. Therefore, even in other contexts, avoiding excessive trust in the AI system or over-reliance on it in work processes is important. Thus, in sustainable social development, preserving autonomy from AI may become increasingly important over time. For example, the AI Act proposes to disclose when content is generated by AI.

C) Democracy: It has been demonstrated that the epistemic authority of AI, when coupled with engagement maximization logic, can create digital environments in which divisive political content circulates, inciting hatred and promoting false information. Building a virtual environment using AI can trigger harmful dynamics that undermine social fabric (O'Neil, 2016; Van Dijck et al., 2018). In this regard, it is essential to use AI in a way that does not disrupt social balances or generate negative effects on democratic systems. It is essential to adopt measures to ensure transparency and accountability in AI's decision-making processes to prevent the manipulation of public opinion and the spread of harmful content. Additionally, participation and inclusion must be promoted in the decision-making process concerning the implementation and use of AI

to ensure a pluralistic and democratic vision. Safeguarding democracy requires a responsible approach to using AI such that this technology becomes an ally for social progress without compromising the fundamental principles of democracy itself.

D) Privacy: The issue of privacy has become increasingly relevant due to the process of datafication in society, which has led to the transformation of everyday actions into data. Actions such as banking transactions, social media interactions and Google searches are transformed into data about us that can be analyzed by third parties (Mayer-Schönberger & Cukier, 2013). Once tracked, these data can be used without consent to make decisions. For example, profiling algorithms used by human resources in large companies can predict candidates' suitability for creating company value by analyzing all their online traces. During the hiring phase, some companies assess the profiles of potential candidates to determine whether they align with the company's values. Profiling algorithms are used for this purpose. For instance, Entelo software predicts the likelihood of potential job candidates fitting into a company's culture (Bogen & Rieke, 2018), where as Arya software identifies the best candidates based on their online behaviors (Raub, 2018). In addition to privacy concerns, these algorithms infringe on the freedom of expression of individuals when they select them based on their values and beliefs. Individuals could become victims of discriminatory policies resulting from fully automated processes enabled by data breaches.

In the report "Progress towards the Sustainable Development Goals: Towards a Rescue Plan for People and Planet" which monitors nations' progress towards sustainable development, concepts such as transparency, autonomy, democracy, and privacy¹ are never mentioned, despite being fundamental to the sustainable implementation of AI that respects balanced social development.

6. Conclusive reflections

The transformative impact of artificial intelligence on contemporary society is redefining its priorities and needs. The 2030 Agenda, with its framework for sustainable development, is a complex document that seeks to address many of the needs expressed by global society. However, as it was conceived before the advent of AI, it should be reviewed and adapted to take

¹ Privacy has received greater recognition in international forums. A resolution by the United Nations General Assembly in 2020 has established guidelines for integrating Big Data to achieve the 2030 Agenda.

account of emerging needs due to AI impacts. Some of these needs have already been considered and used as guiding principles for regulatory proposals (e.g. European Union IA Act) or for the creation of tools to assess AI implementation (Readiness Assessment Methodology). Based on these documents and the literature on the negative impacts of AI on individuals and society, four areas of attention have been identified: transparency, autonomy, democracy and privacy. A first step could be to include these areas in the 2030 Agenda, using them as defining principles. Although these issues have been debated in the past, incorporating them into the 2030 Agenda would mean focusing efforts on developing sustainable AI systems that can, for example, filter fake news and improve the quality of democratic systems. Although these issues have been debated in the past, including them in the 2030 Agenda would mean focusing efforts on developing sustainable AI systems capable of, for example, filtering fake news and improving the quality of democratic systems. The four areas of focus identified in this paper are not meant to be exhaustive, but rather represent an initial mapping facilitated by available literature on AI impacts. Their existence proves the importance of expanding the 2030 Agenda framework and the need for continued research on AI impacts.

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