CHAPTER 3

Artificial Intelligence, Artificial Solutions

Placing the Climate Emergency at the Center of AI Developments

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CONTENTS

3.1 INTRODUCTION

The COVID-19 global pandemic has caused the worst economic contraction since the Great Depression. It has underscored the need to rethink what type of economy and society we want to build as we face the worsening climate emergency. Europe is leading the way in developing strategies for a Green Recovery. Technological innovations and digital services are at the core of recovery with the potential to create millions of jobs and boost economies devastated by the pandemic. The European Commission proposed a major recovery plan for Europe on May 26, 2020, approved by the European Council on July 21, 2020. Alongside the recovery package, EU leaders agreed on a €1,074.3 billion long-term EU budget for 2021–2027. Among others, the budget will support investment in the digital and green transitions and resilience.

The newly published Communication by the European Commission titled "Strategic Foresight Report 2022" on "Twinning the green and digital transition in the new geopolitical

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context", published on June 29, stresses once again the crucial role of the "twin transition", green and digital, both at the top of the EU's political agenda. What is crucial about this Communication (European Commission, 2022) is that for the first time, the European Commission is explicit about the fact that digital technologies will also bring additional environmental burdens to them.

In particular, it explains

> Unless digital technologies are made more energy-efficient, their widespread use will increase energy consumption. Information and communications technology (ICT) are responsible for 5–9% of global electricity use and around 3% of greenhouse gas emissions. . . . However, studies show that ICT power consumption will continue to grow, driven by increasing use and production of consumer devices, demand from networks, data centres, and crypto assets.
>
> (European Commission, 2022, p. 2)

It further acknowledges that "further tensions will emerge in relation to electronic waste and environmental footprints of digital technologies" (ibid., p. 3).

However, despite growing attention to the environmental costs of ICT systems, Artificial Intelligence (AI) gets principally heralded as the key technology to solve contemporary challenges, including the environmental crisis, which is one of the goals of sustainable development. As explained in the introduction to this book, *sustainability* comprehends much more than the environmental challenges we are facing, as every environmental concern is a social, economic, and political concern.

Unfortunately, debates on Green Recovery plans and AI developments continue to avoid a crucial question: How green is Artificial Intelligence? And, considering that the most important international framework to achieve sustainability is enshrined in the UN's Sustainable Development Goals (SDGs) (United Nations, 2015; Sætra, 2022), is AI enabling or hindering SDGs specifically related to sustainable environmental development?

This chapter builds on the agenda of inquiry established in the collection Carbon Capitalism and Communication (Brevini & Murdock, 2017; Murdock & Brevini, 2019) in which communication systems are approached as assemblages of material devices and infrastructures, capable of depleting scarce resources in their manufacturing, usage, and disposal. It will also build on the volume *Is AI good for the Planet?* (Brevini, 2021) where AI applications were investigated as technologies, machines, and infrastructures that demand excessive amounts of energy to compute, analyze, and categorize; they use limited resources in their production, consumption, and disposal, potentially exacerbating problems of waste and pollution. After reflecting on a definition of AI that considers its materiality (Brevini, 2021) away from mainstream hypes, this chapter explores the multifaceted ways in which AI is impacting the climate emergency, thus impacting sustainable environmental development (and specifically, for example, SDG 13 (climate action), SDG 14 (life below water), SDG 15 (life on land).

It concludes by offering a set of solutions to limit the direct challenges that AI poses to SDGs.

3.2 PANDEMIC, CLIMATE CRISIS, AND ENERGY CONSUMPTION

The pandemic has hastened our reliance on technology and the massive acceleration of the adoption of AI, Big Data, cloud computing, and video technologies. We eat, socialize, work, study, exercise online, and plug in the cloud. New research from Milkround (2021) in the United Kingdom reveals that video conferencing has surpassed e-mail as the most widely used form of business communication during the lockdown.

So, we are reliant on communication systems as never before, while the planet is facing the biggest crisis ever faced. We now know that unless emissions fall by 7.6% each year between 2020 and 2030, the world will miss the opportunity to get on track toward the 1.5°C goal. We also know that we are currently on a trajectory for a temperature rise of over 3°C (United Nations Environment Programme, 2019). Yet, for almost 2 years we have been constantly bombarded by media reports that the pandemic has been incredibly good for the climate crisis, reducing climate emissions, taming transport, flights, and movements (Gössling & Humpe, 2020, p. 2).

On the contrary, even despite the lockdowns of 2020, greenhouse gas emissions have remained stubbornly high. Daily global carbon dioxide emissions fell by as much as 17% in early April 2020. But, as the world's economy started to recover, emissions rebounded; and the UN showed that 2020 only saw a 4–7% decline in carbon dioxide relative to 2019 (UN News, 2020). While transportation and industrial activity declined from January 2020, electricity consumption remained constant, which partly explains the minimal drop in emissions (IEA, 2020). How, you may ask? According to the World Energy Outlook 2019, globally 64% of the global electricity energy mix comes from fossil fuels (coal 38%, gas 23%, oil 3% (IEA, 2019)). Since fossil fuels are the largest source of greenhouse gas emissions, without fundamental shifts to renewable resources in the global energy production we shall not be able to prevent incalculable loss of life.

The book *Carbon Capitalism and Communication* has focused specifically on developing a type of communication scholarship that focuses on the materiality of communication systems: Communication systems run on machines and infrastructures that deplete scarce resources in their production, consumption, and disposal, thus increasing the amounts of energy in their use, and exacerbating problems the climate crisis (Brevini & Murdock, 2017). Researchers Lotfi Belkhir and Ahmed Elmeligi estimate that the tech industry's carbon footprint could increase to 14% by 2040, "accounting for more than half of the current relative contribution of the whole transportation sector" (Belkhir & Elmeligi, 2018, p. 448). Data centers will make up 45% of this footprint (up from 33% in 2010) and network infrastructure 24% (ibid., p. 457).

3.3 UNDERSTANDING ARTIFICIAL INTELLIGENCE AND ITS ENVIRONMENTAL TOLL

While more information is being collected on the environmental toll of data centers, little is being discussed about the impact of communication technologies, specifically Artificial Intelligence (AI). If we are to understand AI as an emerging communication technology, one deeply reliant on data to power its machine learning capabilities, more research needs to be done to understand what resources will be needed, as well as the ensuing environmental costs and damages, to operate it.

In mainstream debates, AI has been defined as the ability of machines to mimic and perform human cognitive functions. These include reasoning, learning, problem-solving, decision-making, and even the attempt to match elements of human behavior such as creativity.

In recent scholarship within communication studies, for example, within Human–Machine Communication (HMC), an emerging area of communication research defined AI as the study of the "creation of meaning among humans and machines" (Guzman & Lewis, 2019, p. 71). Others instead focused on refinement and theory related to people's interactions with technologies such as agents and robots (Spence, 2019).

In *Is AI Good for the Planet* (Brevini, 2021, p. 40), I argued that definition adopted by the latest *White Paper on Artificial Intelligence* issued by the European Commission serves as a good starting point to regain an understanding of the *materiality* of AI highlighting the connection between AI, data, and algorithms: "AI is a collection of technologies that combine data, algorithms and computing power. Advances in computing and the increasing availability of data are therefore key drivers of the current upsurge of AI" (ibid.).

Embracing the tradition of critical political economy of communication, in which communication systems are approached as assemblages of material devices and infrastructures (Brevini & Murdock, 2017), AI then can be better understood as technologies, machines, and infrastructures that demand amounts of energy to compute, analyze, and categorize. As a consequence, these communication technologies use scarce resources in their production, consumption, and disposal, exacerbating problems of waste and pollution.

3.4 THE POTENTIALS OF ARTIFICIAL INTELLIGENCE: AI FOR THE CLIMATE

Artificial Intelligence – so we are told – is helping to solve some of the world's biggest challenges, from treating chronic diseases and reducing fatality rates in traffic accidents to fighting Climate Change and anticipating cybersecurity threats (Brevini, 2020, p. 2).

Hence, it's not surprising that it also promises to tackle the most urgent emergency: The Climate Crisis that the earth is facing. A famous report titled *Harnessing Artificial Intelligence for the Earth*, published in January 2018 by the World Economic Forum, reiterated that the solution to the world's most pressing environmental challenges is to employ technological innovations and more specifically AI (World Economic Forum, 2018).

"We have a unique opportunity to harness this Fourth Industrial Revolution, and the societal shifts it triggers, to help address environmental issues and redesign how we manage our shared global environment" (World Economic Forum, 2018, p. 3). "The intelligence and productivity gains that AI will deliver can unlock new solutions to society's most pressing environmental challenges: climate change, biodiversity, ocean health, water management, air pollution, and resilience, among others" (ibid., 19).

Beyond these glorified claims, AI applications that enhance environmental management are growing at a rapid rate and there are increasing numbers of scientists committed to employ AI tools to forecast adverse effects of future climate change (Rolnick et al., 2022; Donti, 2020). For example, Treeswift, a spin-off from Penn Engineering, provides an

AI-powered forest-monitoring system that uses autonomous drones and machine learning to capture data, images, and inventory in order to map forest biomass. Treeswift can provide carbon capture data, deforestation monitoring, growth forecasting, and support forest management with targeted applications across preservation, the timber industry, and wildfire control (Lopez, 2020) all in principle aligned with SDGs 13 and 15. AI is also predicted to assist in the integration and spread of renewable energy through ductile price mechanisms and efficient energy storage and load operation (SDG 13). By enhancing the productivity of the agriculture industry, AI is said to play a key role in resource management, to minimize the environmental impact of farming, and to increase global resilience to extreme climate through various applications focused on data, on informed decision-making, and on augmented responses to changes in supply and demand (Mann, 2021). This will be supported in part by the budding field of climate informatics, in which AI and deep learning networks are leveraged to revolutionize our understanding of weather and climate change. AI is also progressively applied in water management (SDG 15). For example, in analyzing the conditions of a mountainous watershed in Northern China, AI methods identified climatological–hydrological relationships and projected future temperature, precipitation, and streamflow along with annual hydrological responses to these variables (Zhu et al., 2019). Other relevant applications are explored by Umbrello and Capasso in Chapter 4 of this book.

3.5 TECHNO-SOLUTIONISM, TECH OPTIMISM, AND ECOMODERNISM

Technology has long been considered a fix-all solution to the inequalities of capitalism. As the introduction to this chapter has succinctly explained, *Techno-solutionism* can be easily connected to the concept of *Techno-optimism* (Danaher, 2022, p. 1), with its clear view "that technology, when combined with human passion and ingenuity, is the key to unlocking a better world". As Mosco eloquently argued, "one generation after another has renewed the belief that, whatever was said about earlier technologies, the latest one will fulfil a radical and revolutionary promise" (Mosco, 2004, p. 8). Embedded in this neoliberal, techno-determinist discourse is a belief digital technology can disrupt inequalities and power asymmetries, without the need to challenge the status quo.

Linked to this concept, but specifically addressing the environmental problem is the credo of Ecomodernism (Asafu-Adjaye et al., 2015). Against those who place the unequal capitalist power relations at the center of the climate emergency (Brevini & Murdock, 2017; Foster, 2002), the Ecomodernist Manifesto (Asafu-Adjaye et al., 2015) cites technology as our answer to the ecological crisis, evading the need to confront the inherent environmental destructiveness of capitalism.

Authored by a group of sustainability figures from the Breakthrough Institute, *An Ecomodernist Manifesto* argues that "meaningful climate mitigation is fundamentally a technological challenge" (Asafu-Adjaye et al., 2015). For Ecomodernists, limitless economic growth is not disputed but encouraged.

Ecomodernism is also being adopted in leftist circles (Isenhour, 2016), among scholars who claim "the idea that the answer to Climate Change is consuming less energy – that a shift to renewables will necessarily mean a downsizing in life – feels wrong" (Bastani, 2017).

For Bastani, a proponent of Fully automated green communism (ibid.), "rather than consuming less energy, developments in wind and solar (and within just a few decades) should mean distributed energy of such abundance that we won't know what to do with it" (ibid.).

Despite its discussions around limiting greenhouse gas emissions, the International Kyoto Protocol also did little to dissuade an Ecomodernist agenda, instead encouraging environmental advocates in the United States (see Al Gore's presidential campaign) to push for technological improvement in energy efficiency as a way of averting environmental disaster (Foster, 2001, 2002).

This view, which we similarly find in cybertarian Silicon Valley circles, turns into a powerful apology for the status quo and is embraced by the same corporate giants that traditionally opposed action on Climate Change. Unfortunately, "a fundamental faith in growth" and a "foundational techno-optimism" (Sætra, 2022, p. 103, see also Chapter 18) are also very engrained in the framework of SDGs.

3.6 INEQUALITY AND EXPLOITATION: UNDERSTANDING THE ENVIRONMENTAL COSTS OF AI AS COMMUNICATION TECHNOLOGIES

After re-establishing the focus on the material basis of Artificial Intelligence, completely overlooked in green recovery debates and SD frameworks, I want to focus specifically on the multiple environmental costs of AI.

The starting point of every discussion should be an analysis of global supply chains of Artificial Intelligence, starting with the extractivism and neglect of social and environmental justice that AI currently require to produce, transport, train, and dispose (Brevini, 2021), certainly at odds with SDG 12 (responsible consumption), SDG 13 (climate action), SDG 15 (life on land), SDG 7 (clean energy) but also with more generic sustainability goals like with SDG 12 (responsible consumption).

In order to produce the material devices needed for AI to run, we need to start exploring its planetary costs by considering the extraction of rare metals and mineral sources that are needed happens following logics of colonialism.

In her work on digital developments with humanitarian structures, Mirca Madianou (2019) has developed the notion of "technocolonialism" in order to analyze how "the convergence of digital developments with humanitarian structures and market forces reinvigorate and rework colonial legacies" (2019, p. 2). The same "tenacity of colonial genealogies and inequalities" (Madianou, 2020, p. 1) characterize the global supply chains of Artificial Intelligence, as the extractive nature of technocolonialism resides in the minerals that need to be mined to make the hardware for AI applications. So, for example, the demand for mineral resources is growing exponentially, because of the AI uptake, thus compromising several SDGs (13, 15, 12 to list a few). The European Communication has stressed, for example, that of lithium in the EU, mainly in batteries, which is projected to raise by 3500% by 2050 (European Commission, 2022). This of course stresses the contradictions highlighted by authors such as Sætra (2022) and in Chapter 18 of this book between the drive to "growth" and preservations of land and see SDGs 14–15.

Moving to the second phase of the global supply chain, the production of AI model also shows high environmental costs, thus challenging SDGs.

A study published in 2019 by the College of Information and Computer Sciences at University of Massachusetts Amherst (Strubell et al., 2019) quantifies the energy consumed by running artificial intelligence programs. In the case examined by the study, a common AI training model in Linguistics can emit more than 284 tons of carbon dioxide equivalent. This is comparable to five times the lifetime emissions of the average American car. It is also comparable to roughly 100 return flights from London to NYC (Brevini, 2021, p. 68). Meanwhile, the converged communication systems upon which AI relies generate a plethora of environmental problems of their own, most notably energy consumption and emissions, material toxicity, and electronic waste (Brevini & Murdock, 2017). According to the International Energy Agency, if the energy demand continues to accelerate at the current pace, the residential electricity needed to power electronics will rise to 30% of global consumption by 2022 and 45% by 2030 (Maxwell, 2015).

Artificial Intelligence relies on data to work. At present, cloud computing eats up energy at a rate somewhere between the national consumption of Japan and that of India (Brevini, 2021; Murdock & Brevini, 2019). Today, data centers' energy usage averages 200 terawatt hours (TWh) each year (Jones, 2018; IEA, 2017) more than the national energy consumption of some countries, including Iran. Moreover, the information and communications technology (ICT) sector that includes mobile phone networks, digital devices, and television amounts to 2% of global emissions (Jones, 2018). Greenhouse gas emissions from the Information and Communication Industry (ICT) could grow from roughly 1–1.6% in 2007 to exceed 14% worldwide by 2040, accounting for more than half of the current relative contribution of the whole transportation sector, thus raising serious challenges to SDG 7 and SDG 13, for example.

Moreover, data centers require large, continuous supplies of water for their cooling systems, raising serious policy issues in places like the United States and Australia where years of drought have ravaged communities (Mosco, 2017), again compromising SDG 15. As the website of Google's Deepmind website explains (Evans & Gao, 2016),

> One of the primary sources of energy use in the data centre environment is cooling . . . . Our data centres – which contain servers powering Google Search, Gmail, YouTube, etc. – also generate a lot of heat that must be removed to keep the servers running. This cooling is typically accomplished via large industrial equipment such as pumps, chillers and cooling towers.

According to Deepmind, the solution to this problem is of course Machine Learning, which is also extremely energy consuming and generative of carbon emissions.

At the end of the global supply chain, we should also consider the problem of disposal of the devices employed in AI.

When communication machines are discarded, they become electronic waste or e-waste, saddling local municipalities with the challenge of safe disposal. This task is so burdensome that it is frequently offshored, and many countries with developing economies have become digital dumping grounds for more privileged nations (Brevini & Murdock, 2017).

Finally, while promising to solve the climate emergency, AI companies are marketing their offers and services to coal, oil, and gas companies, thus compromising efforts to reduce the emissions and divest from fossil fuels. A new report on the future of AI in oil and gas market published by Zion Market Research (Zion Market Research, 2019) found that the sector of AI in oil and gas is expected to reach around USD 4.01 billion globally by 2025 from 1.75 billion in 2018. AI companies around the world are pushing their capabilities to the oil and gas sectors to increase their efficiencies, optimize their operations, and increase productivity: In other words, they are selling their services to increase the pace and productivity of excavation and drilling. Exxon Mobil, for example, signed a partnership in February this year with Microsoft to deploy AI programs, while oil and gas exploration in the fragile ecosystem of Brazil has seen recent employment of AI technology by state oil giant Petrobras; similarly, European oil major Royal Dutch Shell has signed a partnership with AI company C3 (Joppa & Herweijer, 2018).

3.7 PLACING THE CLIMATE EMERGENCY AT THE CENTER OF SCHOLARSHIP

New developments of Artificial Intelligence place escalating demands on energy, water, and resources in their production, transportation, and use, reinforce a culture of hyper-consumerism, and add to the accumulating amounts of waste and pollution already generated by accelerating rates of digital obsolescence and disposal (see Brevini, 2021; Gabrys, 2013). Instead of embracing new developments in Communication technologies and AI as a new utopia that will fix the world and capitalism problems, we should start quantifying and considering the environmental costs and damages of the current acceleration of algorithm-powered data communication that can too easily compromise SDGs (Sætra, 2021; Sætra, 2022).

We need to ask who should own and control the essential infrastructures that power data communication and Artificial Intelligence and make sure to place the climate emergency at the center of the debate on sustainable development. How can we shape the future of Artificial intelligence to be one of collective well-being and minimized climate impact?

Progress is being made at global fora and national levels as international agreements, legislative frameworks, position papers and guidelines are being drawn up by the European Union and Council of Europe, and UNESCO is in the midst of developing a Recommendation on the Ethics of Artificial Intelligence.

Despite this, however, it seems that global discussions the climate emergency – for example, in the context of UN COP – are yet to connect environmental with AI policy discussions, and more research is needed to ascertain the environmental damage caused by Artificial Intelligence.

As this chapter showed, if we consider the material basis of AI and look at its techno-colonialist character, we should consider all its environmental costs. They start with mineral extractions, water, energy, and natural resources necessary for hardware and machine production (generating huge challenges to SDGs 6, 7, 13, 14, and 15); it then generates additional resource depletion for distribution, transportation, and post-consumption of material technology (challenging SDGs 7, 13, 14, and 15) to end with major e-waste disposal needs (SDGs 6, 7, 13, 14 and 15). Added to this is the major environmental cost of data extraction, computing, and analysis (SDGs 7 and 13).

We know many corporations now audit the production conditions of sub-contractors' factories, but there is still an urgent need to demand accountability for those who own clouds and data centers. One crucial intervention could be government-mandated *Green Certification* for server farms and centers to achieve zero emissions. Given AI's increasing computing capabilities, the disclosure of its carbon footprint could be a first step in the right direction. This could take the form of a *Tech Carbon Footprint* Label, which would provide information about the raw materials used, the carbon costs involved, and what recycling options are available, resulting in stronger public awareness about the implications of adopting a piece of smart technology.

Making transparent the energy used to produce, transport, assemble, and deliver the technology we use daily would enable policymakers to make more informed decisions and to the public to make more informed choices. Added to this could be policy intervention which requests manufacturers to lengthen the lifespan of smart devices and provide spare parts to replace faulty components.

Global policymaking should encourage educational programs to enhance *green tech literacy* and raise awareness of the costs of hyperconsumerism, as well as the importance of responsible energy consumption as crucially linked to SDGs 3 and 4.

In line with SDG 4, *green tech literacy* programs should also entail interventions to ban production of products that are too data demanding and deplete too much energy.

As Artificial Intelligence, like all technologies, is always, in "a full sense social" (Williams, 1981, p. 227), the choice to develop the kind of "green AI" that can enhance environmental sustainable goals rests on us. Unfortunately, the current development of AI does not display the kind of environmental ethos that is needed to address the climate emergency we are facing.

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