Chapter 6
An Eco-political economy of AI: environmental harms and what to do about them

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1. Introduction

As the media continues to heighten awareness of the growing popularity of generative AI models, major 'Digital Lords' (Brevini 2020b) like Microsoft, OpenAI and Google have acknowledged that meeting the increasing demand for their AI tools comes at a substantial cost, including expensive semiconductors, massive energy use and an unprecedented impact on water consumption (George et al. 2023). In its most recent environmental report, Microsoft (2022) revealed a significant increase of 34% in its worldwide water consumption between 2021 and 2022, amounting to nearly 1.7 billion gallons. This uptake is closely linked to the company's AI research efforts and marks an increased liability compared with previous years.

As the obsession with AI uptake continues, COP 27, which took place in November 2022 in Egypt, reiterated once again that the planet is 'sending a distress signal' (UN 2022). The UN's *State of the Global Climate Report* for 2022 painted a 'chronicle of climate chaos', concluding that the previous eight years were on track to be the warmest on record (WMO 2022). The scientists writing the report estimated that global temperatures have now risen by 1.15 C since pre-industrial times, warning of the other wide-ranging impacts of climate change including the acceleration of sea level rise, unprecedented losses in glacier mass and record-breaking heatwaves. The Intergovernmental Panel on Climate Change (IPCC) has been sounding the alarm for years and it is now clear that, if we want to meet the Paris agreement target of keeping global warming below a 1.5 C threshold, we will need to cut emissions globally by 50% in the next decade (IPCC 2022).

While all this is unfolding, at the same time the world is attempting to recover from a global pandemic, the race towards green new deals has started: Europe is leading the way in developing strategies for a green recovery. Technological innovation 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 26 May 2020, approved by the European Council on 21 July 2020. Alongside the recovery package, EU leaders agreed on a 1,074.3 billion euro long-term EU budget for 2021-27. Among other things, the budget will support investment in the digital and green transitions and in resilience.

The Communication by the European Commission entitled 'Strategic Foresight Report 2022 Twinning the green and digital transition in the new geopolitical context' (European Commission 2022) stressed once again the crucial role of the 'twin transition', green and digital, both of which are at the top of the EU's political agenda. What is crucial about this Communication is that, for the first time, the European Commission is explicit that digital technologies will also bring additional environmental burdens with them. In particular, it explains that:

> 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).

It further acknowledges that 'further tensions will emerge in relation to electronic waste and environmental footprints of digital technologies' (European Commission 2022).

Despite growing attention on the environmental costs of ICT systems, artificial intelligence is principally heralded as the key technology to solve contemporary challenges, including the environmental crisis, with climate action being one of the UN's Sustainable Development Goals. Unfortunately, debates on green recovery plans and AI developments continue to avoid some crucial questions: how green is artificial intelligence? And how can we build AI applications that are truly sustainable?

This chapter address these questions by examining the set of environmental harms associated with AI technologies and offering solutions to this problem.

2. An Eco-political economy of AI: understanding AI's environmental costs

The book *Is AI Good for the Planet?* (Brevini 2021) addressed the question of the environmental harms of AI through an exploration of its extractive production and supply chain, thus unveiling the environmental costs of current data-driven communications systems and AI in particular.

In developing an Eco-political economy of AI, the book investigated artificial intelligence from resource, infrastructural and material points of view as 'a set of technologies, machines or infrastructures that demand and use huge amounts of energy to compute, analyse or categorise' (Brevini 2021: 94). Such a definition is key to changing our understanding of AI – which is more usually defined with a focus on its function and on its abilities to bring about desired radical change. Recent scholarship within communications studies, for example within human-machine communication, an emerging area of communications research, has defined AI as the study of the 'creation of meaning among humans and machines' (Guzman and Lewis 2019: 71). Furthermore, embracing the tradition of the critical political economy of communications allows us to view communications systems as assemblages of material devices and infrastructures (Brevini and Murdock 2017).

Is *AI Good for the Planet* argued that, if we want to develop an Eco-political economy of AI that helps us understand its environmental harms, it is imperative to initiate a new and comprehensive endeavour to define its parameters (Brevini 2021: 40). Here, the definition adopted by the 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' (European Commission 2020: 2).

3. From the 'sublime phase' of AI to its environmental costs

Technology has long been considered a fix-all solution to the inequalities of capitalism. As Vincent 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: 117). Embedded in this neoliberal, techno-determinist discourse is a belief that digital technology can disrupt inequalities and power asymmetries, without the need to challenge the status quo. Following similar mythologies, the 'sublime phase' of AI offers its applications as solutions to the greatest challenges of the age: addressing chronic illness, repairing the economy, managing social services, anticipating cybersecurity threats and solving the climate crisis.

However, this portrayal of AI as the magic, sublime hand that will rescue society obfuscates the materiality of the infrastructures (Brevini 2020a, 2021) that are central to the environmental questions that have been so consistently, and so artfully, side-stepped (Brevini 2020a). Instead, we need to understand AI in its infrastructural context as depleting scarce resources throughout its production, consumption and disposal, increasing the amount of energy used and thus exacerbating the climate crisis. We need, instead, to develop an Eco-political economy of AI which entails studying its entire global supply chain in order to comprehend why it generates an array of environmental problems, most notably energy consumption and emissions, material toxicity and electronic waste.

4. An Eco-political economy of AI: understanding its global production/supply chain and its life cycle

To recognise the environmental harms of AI, the starting point of every discussion should be an analysis of its global supply chains, starting with the extractivism and neglect of social and environmental justice (NRDC 2022) in terms of the environmental costs that AI currently has and which lie in the production, transportation, training and disposal of the technologies on which it operates (Brevini 2021).

In order to produce the material resources needed for AI, we need to start with the extraction of rare metals and mineral resources which follow the logics of colonialism (NRDC 2022). In her work on digital developments with humanitarian structures, Mirca Madianou has developed the notion of 'technocolonialism' in order to analyse how 'the convergence of digital developments with humanitarian structures and market forces reinvigorate and rework colonial legacies' (Madianou 2019: 2). The same colonial genealogies and inequalities characterise the global production/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: the European Communication has stressed that the demand for lithium in the EU, mainly for use in batteries, is projected to rise by 3,500% by 2050 (European Commission 2022).

Moving to the second section of the global production/supply chain, the production of AI models also shows high environmental costs. A study published 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 linguistics training model can emit more than 284 tonnes 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 New York (Brevini 2021). Moreover, more recent studies focusing on ChatGPT have highlighted the urgency of recognising the massive water footprint caused by AI models (George et al. 2023; Microsoft 2022).

Additionally, 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 (Greenpeace International 2011; Murdock and Brevini 2019). Today, data centres' energy use averages 200 terawatt hours each year (Jones 2018; IEA 2017): more than the national energy consumption of many countries, including Iran. Moreover, the information and communications technology (ICT) sector, that includes mobile phone networks, digital devices and television, accounts for 2% of global emissions (Jones 2018). Greenhouse gas emissions from 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. Additionally, data centres require large, continuous supplies of water for their cooling systems, raising serious policy issues in places like the US and Australia where years of drought have ravaged communities (Brevini 2021; Sensorex 2022).

Thirdly, AI development is based on a model of surveillance capitalism (Brevini 2021: 45; Zuboff 2019) enhanced by data extraction, analysis and monetisation. This, in turn, has contributed to the development of increased consumption habits. Facilitated by decades of unregulated capitalism, AI services and products bear major responsibility for generating the uberconsumerism which surrounds digital services and the destructive hyperconsumption that leads to unattainable energy demands (Brevini 2021). New developments in AI – especially neural networks – place high demands on energy while the gains in efficiency currently achieved in data centres have proved very slow in compensating for the escalating demands of computational power.

Lastly in the global AI supply chain, when communication and computational machines are discarded they become electronic 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, as the case of Kenya demonstrates (Napainoi 2021).

To make things worse, while holding out the promise of solving the Climate Emergency, AI companies are marketing their offers and services to coal, oil and gas companies, thus compromising efforts to reduce emissions and divest from fossil fuels. A new report on the future of AI in the oil and gas market published by Zion Market Research found that AI in oil and gas is expected to reach around 4 billion dollars globally by 2025 from 1.75 billion in 2018 (Zion Market Research 2019).

5. Conclusion

Developing an Eco-political economy of AI that entails a focus on its global production/supply chain enables us to grasp its real environmental toll.

We need to ask who should own and control the essential infrastructures that power artificial intelligence and, at the same time, be sure to place the Climate Emergency at the centre of the debate. For what purposes, and with what consequences for collective wellbeing, should we shape artificial intelligence? What values should guide its development if we want to address the Climate Emergency? At the time of writing, there are a number of international agreements, position papers and guidelines that are being discussed, initiated in global forums or at national levels, illustrating that progress is being made. For example, UNESCO's recently adopted recommendation on artificial intelligence explicitly clarifies that 'if there [is a] disproportionate negative impact of AI systems on the environment (...) they should not be used' (UNESCO 2021).

There is a clear need to demand climate accountability from those who own cloud computing operations and data centres. One crucial intervention could be to adopt government-mandated green certifications for server farms and centres to achieve zero emissions, given AI's increasing computing capabilities.

Moreover, a Tech Carbon Footprint Label, providing information about the entire global supply chain of the AI devices we use, from the raw materials used, the carbon costs involved and the recycling options that are available, could be implemented. This would result in stronger public awareness about the implications of adopting a piece of smart technology.

Making transparent the energy used in producing, transporting, assembling and delivering the technology we use daily would enable policymakers to make more informed decisions and the public to make more informed choices. Added to this could be policy intervention which requests manufacturers lengthen the lifespan of smart devices and provide spare parts to replace faulty components. Global policymaking should encourage educational programmes to enhance green tech literacy and raise awareness of the costs of hyperconsumerism as well as the importance of responsible energy consumption. Green tech literacy programmes should also entail interventions to ban the production of products that are too demanding in data terms and that deplete energy too significantly.

As artificial intelligence, like all technologies, is always in 'a full sense social' (Williams 1981: 227), the choice to develop the kind of 'green AI' that can enhance environmental sustainable goals rests with us. Unfortunately, the current development of AI does not display the kind of environmental commitment that is needed to address the Climate Emergency we are facing. An Eco-political economy of AI could, however, lead us in the right direction.

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