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Artificial Intelligence, Power and Sustainability[*]

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6.1 INTRODUCTION

Artificial intelligence (AI) has the potential to address several issues related to sustainable development. It can be used to predict the environmental impact of certain actions, to optimize resource use and streamline production processes. However, AI is also unsustainable in numerous ways, both environmentally and socially. From an environmental perspective, both the training of AI algorithms and the processing and storing of the data used to train AI systems result in heavy carbon emissions, not to mention the mineral extraction, water and land usage that is associated with the technology's development. From a social perspective, AI to date has worked to maintain discriminatory impacts on minorities and vulnerable demographics resulting from nonrepresentative and biased training data sets. It has also been used to carry out invisible surveillance practices or to influence democratic elections through microtargeting. These issues highlight the need to address the long-term sustainability of AI, and to avoid getting caught up in the hype, power dynamics, and competition surrounding this technology.

In this chapter we outline the *ethical dilemma of sustainable AI*, centering on AI as a technology that can help tackle some of the biggest challenges of an evolving global sustainable development agenda, while at the same time in and by itself may adversely impact our social, personal, and natural environments now and for future generations.

In the first part of the chapter, AI is discussed against the background of the global sustainable development agenda. We then continue to discuss AI for sustainability

and the sustainability of AI,[1] which includes a view on the physical infrastructure of AI and what this means in terms of the exploitation of people and the planet. Here, we also use the example of "data pollution" to examine the sustainability of AI from multiple angles.[2] In the last part of the chapter, we explore the ethical implications of AI on sustainability. Here, we apply a "data ethics of power"[3] as an analytical tool that can help further explore the power dynamics that shape the ethical implications of AI for the sustainable development agenda and its goals.

6.2 AI AND THE GLOBAL SUSTAINABLE DEVELOPMENT AGENDA

Public and policy discourse around AI is often characterized by hype and technological determinism. Companies are increasingly marketing their big data initiatives as "AI" projects[4] and AI has gained significant strategic importance in geopolitics as a symbol of regions' and countries' competitive advantages in the world. However, in all of this, it is important to remember that AI is a human technology with far-reaching consequences for our environment and future societies. Consequently, the ethical implications of AI must be considered integral to the ongoing global public and policy agenda on sustainable development. Here, the socio-technical constitution of AI necessitates reflection on its sustainability in our present and a new narrative about the role it plays in our common futures.[5] The "sustainable" approach is one that is inclusive in both time and space; where the past, present, and future of human societies, the planet, and environment are considered equally important to protect and secure, as is the integration of all countries in economic and social change.[6] Furthermore, our use of the concept "sustainable" demands we ask what practices in the current development and use of AI we want to maintain and alternatively what practices we want to repair and/or change.

AI technologies are today widely recognized as having the potential to help achieve sustainability goals such as those outlined in the EU's Green Deal[7] and

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[1] Aimee van Wynsberghe, "Sustainable AI: AI for sustainability and the sustainability of AI" (2021) *AI and Ethics*, 1: 213, 218.

[2] Gry Hasselbalch, "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

[3] Gry Hasselbalch, *Data Ethics of Power. A Human Approach in the Big Data and AI Era* (Edward Elgar, 2021).

[4] Madeleine C Elish and Danah Boyd, "Situating methods in the magic of big data and artificial intelligence" (2018) *Communication Monographs*, 85: 57.

[5] Francesco Lapenta, *Our Common AI Future* (JCU Future and Innovation, 2021).

[6] As outlined throughout the "Brundtland report"/World Commission on Environment and Development, "Our Common Future," https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf, accessed June 6, 2023.

[7] Council of the European Union, *European Green Deal*, accessed July 19, 2024: www.consilium.europa.eu/en/policies/green-deal/

the UN's Sustainable Development goals.[8] Indeed, AI can be deployed for climate action by turning raw data into actionable information. For example, AI systems can analyze satellite images and identify deforestation or help improve predictions with forecasts of solar power generation to balance electrical grids. In cities, AI can be used for smart waste management, to measure air pollution, or to reduce energy use in city lighting.[9]

However, the ethical implications of AI are also intertwined with the sustainability of our social, personal, and natural environments. As described before, AI's impacts on those environments come in many shapes and forms, such as carbon footprints,[10] biased or "oppressive" search algorithms,[11] or the use of AI systems for microtargeting voters on social media.[12] It is hence becoming increasingly evident that – if AI is in and by itself an unsustainable technology – it cannot help us reach the sustainable development goals that have been defined and refined over decades by multiple stakeholders.

Awareness of the double edge of technological progress and the role of humans in the environment has long been a central part of the global political agenda of collaborative sustainable action. The United Nations Conference on the Human Environment, held in Stockholm in 1972, was the first global conference to recognize the impact of science and technology on the environment and emphasize the need for global collaboration and action stating. As the report from the conference states:

> In the long and tortuous evolution of the human race on this planet, a stage has been reached when, through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways and on an unprecedented scale.[13]

This report also coined the term "Environmentally Sound Technologies" (ESTs) to refer to technologies or technological systems that can help reduce

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[8] United Nations, "The future we want outcome document" (United Nations Conference on Sustainable Development, Rio de Janeiro, Brazil, 2012).

[9] Global Partnership on AI Report, "Climate change and AI. Recommendations for government action" (November 2021), GPAI, www.gpai.ai/projects/climate-change-and-ai.pdf, accessed June 6, 2023, 18–19.

[10] Alan Winfield, "Energy and exploitation: AIs dirty secrets" (June 28, 2019), https://alanwinfield.blogspot.com/2019/06/energy-and-exploitation-ais-dirty.html, accessed June 27, 2023.
Lynn H Kaack et al., "Aligning artificial intelligence with climate change mitigation" (2022) *Nature Climate Change*, 12: 518.

[11] As described in Safiya U Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (NYU Press, 2018).
Tolga Bolukbasi et al., "Man is to computer programmer as woman is to homemaker? Debiasing word embeddings" (30th Conference on Neural Information Processing Systems, Barcelona, 2016).

[12] As described in Christopher Wylie, *Mindf*ck: Cambridge Analytica and the Plot to Break America* (Random House, 2019).

[13] Report of the United Nations Conference on the Human Environment, Stockholm, June 5–16, 1972, 3. Quoted in Gry Hasselbalch, "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

environmental pollution while being sustainable in their design, implementation, and adoption.

The Brundtland report *Our Common Future*,[14] published in 1987 by the United Nations, further developed the direction for the sustainable development agenda. It drew attention to the fact that global environmental problems are primarily the result of the poverty of the Global South and the unsustainable consumption and production in the Global North. Thus, the report emphasized that while risks of cross-border technology use are shared globally, the activities that give rise to the risks as well as the benefits received from the use of these technologies are concentrated in a few countries.

At the United Nations Conference on Environment and Development (UNCED) held in Brazil in 1992, also known as the *Earth Summit*, the "Agenda 21 Action Plan" was created calling on governments and other influential stakeholders to implement a variety of strategies to achieve sustainable development in the twenty-first century. The plan reiterated the importance of developing and transferring ESTs: *"Environmentally sound technologies protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products, and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes."*[15]

In a subsequent step, the United Nations Member States adopted the 17 Sustainable Development Goals (SDGs) in 2015 as part of the UN 2030 Agenda for Sustainable Development. The goals are set to achieve a balance between economic, social, and environmental sustainability and address issues such as climate change, healthcare and education, inequality, and economic growth.[16] They also emphasized the need for ESTs to achieve these goals and stressed the importance of adopting environmentally sound development strategies and technologies.[17]

If we look at how the global policy agenda on AI and sustainability has developed in tandem with the sustainable development agenda, the intersection of AI and sustainability become clear. Hasselbalch[18] has illustrated how a focus on AI and sustainability is the result of a recognition of the ethical and social implications of AI combined with a long-standing focus on the environmental impact of science and

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[14] World Commission on Environment and Development, *Our Common Future* (1987), https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf, accessed June 27, 2023.

[15] United Nations, "Agenda 21" (United Nations Conference on Environment & Development, Rio de Janeiro, June 3–14, 1992).

[16] United Nations, "Transforming our world: The 2030 agenda for sustainable development" (March 22–24, 2023), https://sdgs.un.org/2030agenda, accessed June 6, 2023.

[17] UN Environment Programme, "Environmentally sound technologies," www.unep.org/regions/asia-and-pacific/regional-initiatives/supporting-resource-efficiency/environmentally-sound, accessed June 6, 2023. Quoted in Gry Hasselbalch, "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

[18] Ibid., Hasselbalch, 2022, 36–49.

technology in a global and increasingly inclusive sustainable development agenda. In this context, the growing awareness of AI's potential to support sustainable development goals is discussed in several AI policies, strategies, research efforts, and investments in green transitions and circular economies around the world.[19]

In this regard, the European Union (EU) has been taking a particularly prominent role in establishing policies and regulations for the responsible and sustainable development of AI. In 2018, the European Commission for instance established the High-Level Group on AI (HLEG),[20] as part of its *European AI Strategy*, tasked with the development of ethics guidelines as well as policy and investment recommendations for AI within the EU. The group was composed of 52 individual experts and representatives from various stakeholder groups. The HLEG developed seven key requirements that AI systems should meet in order to be considered trustworthy. One of these requirements specifically emphasized "societal and environmental well-being":

> AI systems should benefit all human beings, including future generations. It must hence be ensured that they are sustainable and environmentally friendly. Moreover, they should take into account the environment, including other living beings, and their social and societal impact should be carefully considered.[21]

The establishment of the HLEG on AI and the publication of its ethics guidelines and requirements illustrate a growing awareness in the EU of the environmental impact of AI on society and the natural environment. The EU's Green Deal presented in 2019 highlighted several environmental considerations related to AI and emphasized that the principles of sustainability must be a fundamental starting point for not only the development of AI technologies but also the creation of a digital society.

Furthermore, the European Commission's *Communication on Fostering a European approach to artificial intelligence*[22] and its revised Coordinated Plan on AI emphasized the European Green Deal's encouragement to use AI to achieve its objectives and establish leadership in environmental and climate change related sectors. This includes activities aimed at developing trustworthy (values-based with

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[19] See, for example, The EU's Green Deal (Ibid. Council of the European Union) and AI Strategy (https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence accessed July 19, 2024) and AI for SDGs Canada, www.ai4sdgs.org/, accessed June 6, 2023; United Nations, "The United Nation's Resource Guide on Artificial Intelligence (AI) Strategies, June 2021," https://sdgs.un.org/sites/default/files/2021-06/Resource%20Guide%20on%20AI%20Strategies_June%202021.pdf, accessed June 6, 2023.

[20] The authors of this chapter were members of the HLEG.

[21] European Commission, "Ethics guidelines for trustworthy AI" (HLEG A, 2019), https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai, accessed June 6, 2023.

[22] European Commission, "Communication on fostering a European approach to artificial intelligence" (April 21, 2021), https://digital-strategy.ec.europa.eu/en/library/communication-fostering-european-approach-artificial-intelligence, accessed June 6, 2023.

a "culture by design" approach[23]) AI systems, as well as an environmentally sound AI socio-technical infrastructure for the EU. For example, the European Commission's proposal on the world's first comprehensive AI legislation lays down a uniform legal framework for the development, marketing and use of AI according to Union values based on the categorization of risks posed by AI systems to the fundamental rights and safety of citizens. In early 2023, the European Parliament suggested adding further transparency requirements on AI's environmental impact to the proposal. Moreover, the coordinated plan on AI also focuses on creating a "green deal data space" and seeks to incorporate environmental concerns in international coordination and cooperation on AI.

6.3 AI FOR SUSTAINABILITY AND THE SUSTAINABILITY OF AI

In 2019, van Wynsberghe argued that the field of AI ethics has neglected the value of sustainability in its discourse on AI. Instead, at the time, this field was concentrated on case studies and particular applications that allowed industry and academics to ignore the larger systemic issues related to the design, development, and use of AI. Sustainable AI, as van Wynsberghe proposed, forces one to take a step back from individual applications and to see the bigger picture, including the physical infrastructure of AI and what this means in terms of the exploitation of people and the planet. Van Wynsberghe defines Sustainable AI as "*a movement to foster change in the entire lifecycle of AI products (i.e. idea generation, training, re-tuning, implementation, governance) towards greater ecological integrity and social justice.*"[24] She also outlines two branches of sustainable AI: "AI for sustainability" (for achieving the global sustainable agenda) and the "sustainability of AI" (measuring the environmental impact of making and using AI). There are numerous examples of the former, as AI is increasingly used to accelerate efforts to mitigate the climate crisis (think, for instance, of initiatives around "AI for Good," and "AI for the sustainable development goals"). However, relatively little is done for the latter, namely, to measure and decrease the environmental impact of making and using AI. To be sure, the sustainability *of* AI is not just a technical problem and cannot be reduced to measuring the carbon emissions from training AI algorithms. Rather, it is about fostering a deeper understanding of AI as exacerbating and reinforcing patterns of discrimination across borders. Those working in the mines to extract minerals and metals that are used to develop AI are voiceless in the AI discourse. Those whose backyards are filled with mountains of electronic waste from the disposal of the physical infrastructure underpinning AI are also voiceless in the AI debate.

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[23] Gry Hasselbalch, "Culture by design: A data interest analysis of the European AI policy agenda" (2020) *First Monday*, 25, https://firstmonday.org/ojs/index.php/fm/article/view/10861/10010, accessed June 27, 2023.

[24] Aimee van Wynsberghe, "Sustainable AI: AI for sustainability and the sustainability of AI" (2021) *AI and Ethics*, 1: 213.

Sustainable AI is meant to be a lens through which to uncover ethical problems and power asymmetries that one can only see when one begins from a discussion of environmental consequences. Thus, sustainable AI is meant to bring the hidden, vulnerable demographics who bear the burden of the cost of making and using AI to the fore and to show that the environmental consequences of AI also shed light on systemic social injustices that demand immediate attention.

The environmental and social injustices resulting from the making and using of AI inevitably raises the question: what is it that we, as a society, want to sustain? When sustainability carries with it a connotation of maintenance and to continue something, is sustainable AI then just about maintaining the environmental practices that give rise to such social injustices? Or, is it also possible to suggest that sustainable AI carries with it the possibility to open a dialogue on how to repair and transform such injustices?[25]

6.3.1 *Examining the Sustainability of AI: Data Pollution*

Taking an interest in sustainability and AI is simultaneously a tangible and an intangible endeavor. As Sætra[26] has emphasized, many of AI's ethical implications as well as impacts on society and nature (positive and negative) are intangible and potential, meaning that they cannot be empirically verified or observed. At the same time, many of its impacts are also visible, tangible, and even measurable. Understanding the ethical implications of AI in the context of a global sustainability agenda should hence involve both a philosophical analysis and an ethical analysis about its intangible and potential impacts and their role in our personal, social, and natural environments, as well as a sociological and technological analyses of the tangible impacts of AI's very concrete technology design, adoption, and development.

One way of examining the sustainability of AI from multiple angles is to explore the sustainability of the data of AI, often associated with concerns around "data pollution," as discussed further below.[27] Since the mid-1990s, societies have transformed through processes of "datafication,"[28] converting everything into data configurations. This process has enabled a wide range of new technological capabilities and applications, including the currently most practical application of the *idea* of AI (conceptualized as a machine that mimics human intelligence in one form or another), namely machine learning (ML). ML is a method used

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[25] Taylor Stone and Aimee van Wynsberghe, "Repairing AI" in Mark Young and Mark Coeckelbergh (eds), *Maintenance and Philosophy of Technology: Keeping Things Going* (1st ed, Routledge, 2024).

[26] Henrik S Sætra, *AI for the Sustainable Development Goals* (1st ed, CRC Press, 2022), 5.

[27] This approach has been taken by Hasselbalch and the University of Bonn's *Data Pollution and Power Group*: www.datapollution.eu. See also Gry Hasselbalch, "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

[28] Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution that Will Transform How We Live, Work and Think* (John Murray, 2013), 15.

to autonomously or semiautonomously make sense of big data generated in the areas such as health care, transportation, finance, and communication. As datafication continues to expand and evolve as the fuel of AI/ML models, its ethical implications become more apparent as well. Hasselbalch[29] has argued that AI can be seen as an extension of "Big Data Socio-Technical Infrastructures" (BDSTIs) that are institutionalized in IT practices and regulatory frameworks. "Artificial Intelligence Socio-Technical Infrastructures" (AISTIs) are then an evolution of BDSTIs, with added components that allow for real-time sensing, learning, and autonomy.

In turn, the term "data pollution" can then be considered a discursive response to the implications of BDSTI and AISTI in society. It is used as a catch-all metaphor to describe the adverse impacts that the generation, storing, handling, and processing of digital data has on our natural environment, social environment, and personal environment.[30] As an unsustainable handling, distribution, and generation of data resources,[31] data pollution due diligence in a business setting, for example, will hence imply managing the adverse effects and risks of what could be described as the data exhaust of big data.

Firstly, the data pollution of AI has been understood as a *tangible* impact, that is, as "data-driven unsustainability"[32] with environmental effects on the natural environment. For example, a famous study by Strubell et al. found that training (including tuning and experimentation) a large AI model for natural language processing, such as machine translation, uses seven times more carbon than an average human in one year.[33] The environmental impact of digital technologies such as AI is not limited to just the data they use, but also includes the disposal of information and communication technology and other effects that may be harder to identify (such as consumers' energy consumption when making use of digital services).[34]

Secondly, data pollution is also described as the more *intangible* impacts of big data on our social and personal environments. Originally, the term was used to illustrate mainly the privacy implications for citizens of the big data economy

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[29] Ibid. Hasselbalch, 2021.

[30] Gry Hasselbalch "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

[31] Dennis D Hirsch and Jonathan King, "Big data sustainability: An environmental management systems analogy" (2016) *Washington and Lee Law Review*, 72, http://dx.doi.org/10.2139/ssrn.2716785, accessed June 27, 2023; Omri Ben-Shahar, "Data pollution" (2019) *Journal of Legal Analysis*, 11: 104.

[32] Federica Lucivero et al., "Data-driven unsustainability? An interdisciplinary perspective on governing the environmental impacts of a data-driven society" (2020), Available at SSRN, http://dx.doi.org/10.2139/ssrn.3631331, accessed June 27, 2023.

[33] Alan Winfield, "Energy and exploitation: AIs dirty secrets" (June 28, 2019), https://alanwinfield.blogspot.com/2019/06/energy-and-exploitation-ais-dirty.html, accessed June 27, 2023.
Emma Strubell, Ananya Ganesh, and Andrew McCallum, "Energy and policy considerations for deep learning in NLP" (2019) Cornell University, https://arxiv.org/abs/1906.02243, accessed June 27, 2023.

[34] Federica Lucivero, "Big data, big waste? A reflection on the environmental sustainability of big data Initiatives" (2019) *Science and Engineering Ethics*, 26: 1009.

and the datafication of individual lives and societies. Schneier has emphasized the effects of the massive collection and processing of big data by companies and governments alike on people's right to privacy by stating that "*this tidal wave of data is the pollution problem of the information age. All information processes produce it.*"[35] Furthermore, Hirsch and King have deployed the term "data pollution" as analogous to the "negative externalities" of big data as used in business management.[36] They argue that when managing negative impacts of big data, such as data spills, privacy violations, and discrimination, businesses can learn from the strategies adopted to mitigate traditional forms of pollution and environmental impacts. Conversely, Ben-Shahar[37] has introduced data pollution in the legal field as a way to "*rethink the harms of the data economy*"[38] to manage the negative externalities of big data with an "*environmental law for data protection.*"[39] He, however, also recognizes that harmful data exhaust is not only disrupting the privacy and data protection rights of individuals but that it adversely affects an entire digital ecosystem of social institutions and public interests.[40] The scope of "data pollution" hence evolved over time and expanded into a more holistic approach to the adverse effects of the big data economy. In this way, the term is also a testimony to the rising awareness of what is at stake in a big data society, including a disruption of the power balances in society, across multiple environments. As argued by Hasselbalch and Tranberg in their 2016 book on data ethics: "*The effects of data practices without ethics can be manifold – unjust treatment, discrimination and unequal opportunities. But privacy is at its core. It's the needle on the gauge of society's power balance.*"[41]

6.3.2 *AI as Infrastructure*

Let us be clear that we are not speaking of isolated events when we discuss AI, ML, and the data practices necessary to train and use these algorithms. Rather, we are talking about a massive infrastructure of algorithms used for business models of large tech companies as well as for the infrastructure to power startups and the like. And this infrastructure has internalized the exploitation of people and the planet. A key issue is here that the material constitution of AI and data is often

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[35] Bruce Schneier, "The future of privacy" (2006), www.schneier.com/blog/archives/2006/03/the_future_of_p.html, accessed June 27, 2023.
[36] Dennis D Hirsch and Jonathan H King, "Big data sustainability: An environmental management systems analogy" (2016) *Washington and Lee Law Review Online*, 72(3): 406–419. https://scholarlycommons.law.wlu.edu/wlulr-online/vol72/iss3/4/, accessed June 27, 2023.
[37] Omri Ben-Shahar, "Data pollution" (2019) *Journal of Legal Analysis*, 11: 104.
[38] Ibid., 104.
[39] Ibid., 104.
[40] Ibid., 105.
[41] Gry Hasselbalch and Pernille Tranberg, *Data Ethics. The New Competitive Advantage* (1st ed, Publishare, 2016), 183.

ignored, or we are oblivious to it. The idea that data is "stored on the cloud," for example, invokes a symbolic reference to the data being stored "somewhere out there" and not in massive data centers around the world requiring large amounts of land and water.

AI not only uses existing infrastructures to function, such as power grids and water supply chains, but it is also used to enhance existing infrastructures. Google famously used the algorithm created by DeepMind to conserve electricity in their data centers. In addition, Robbins and van Wynsberghe have shown how AI itself ought to be conceptualized as an infrastructure in so far as it is embedded, transparent, visible upon breakdown, and modular.[42]

Understanding AI as infrastructure demands that we question the building blocks of said infrastructure and the practices in place that maintain the functioning of said infrastructure. Without careful consideration, we run the risk of lock-in, not only in the sense of carbon emissions, but also in the sense of the power asymmetries that are maintained, the kinds of discrimination that run through our society, the forms of data collection underpinning the development and use of algorithms, and so on. In other words, "…*the choices we make now regarding our new AI-augmented infrastructure not only relate to the carbon emissions that it will have; but also relate to the creation of constraints that will prevent us from changing course if that infrastructure is found to be unsustainable.*"[43]

As raised earlier, the domain of sustainable AI aims not only at addressing unsustainable environmental practices at the root of AI production, but it also asks the question of what we, society, wish to maintain. What practices of data collection and of data sovereignty do we want to pass on to future generations? Alternatively, what practices, both environmental and social, require a transformative kind of repair to better align with our societal values?

6.4 analyzing ai and sustainability with a data ethics of power

Exploring AI's sustainability implies understanding AI in context; that is, a conception of AI as socio-technical infrastructure created and directed by humans in social, economic, political, and historical contexts with impacts in the present as well as for future generations. Thus, AISTIs, as explored by Hasselbalch,[44] also represent power dynamics among various actors at the local, regional, and global levels. This is because they are human-made spaces evolving from the very negotiation and

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[42] Scott Robbins and Aimee van Wynsberghe, "Our new artificial intelligence infrastructure: Becoming locked into an unsustainable future" (2022) *Sustainability*, 14(8): 4829, www.mdpi.com/2071-1050/14/8/4829, accessed June 27, 2023.

[43] Ibid., 6.

[44] Gry Hasselbalch, *Data Ethics of Power. A Human Approach in the Big Data and AI Era* (Edward Elgar, 2021).

tension between different societal interests and aspirations.[45] An ethical analysis of AI and sustainability therefore necessitates an exploration of these power dynamics that are transformed, impacted, and even produced by AI in natural, social, and personal environments. We can here consider AISTIs as "socio-technical infrastructures of power,"[46] infrastructures of *empowerment* and *disempowerment*, and ask questions such as whose or what interest and values does the core infrastructure serve? For example, which "data interests"[47] are embedded in the data design? Which interests and values conflict with each other, and how are these conflicts resolved in, for example, AI policies or standards?

Hasselbalch's "data ethics of power" is an applied ethics approach concerned with making the power dynamics of the big data society and the conditions of their negotiation visible in order to point to design, business, policy, and social and cultural processes that support a human(-centric) distribution of power.[48] When taking a "data ethics of power" approach, the ethical challenges of AI and sustainability are considered from the point of view of power dynamics, with the aim of making these power dynamics visible and imagining alternative realities in design, culture, policy, and regulation. The assumption is that the ethical implications of AI are linked with architectures of powers. Thus, the identification of – and our response to – these ethical implications are simultaneously enabled and inhibited by structural power dynamics.

A comprehensive understanding of the power dynamics that shape and are shaped by AISTIs of power and their effect on sustainable development requires a multi-level examination of a "data ethics of power" that takes into account perspectives on the micro, meso, and macro levels.[49] This means, as Misa describes it, that we take into consideration different levels in the interaction between humans, technology,

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[45] Susan L Star and Geoffrey C Bowker, "How to infrastructure?" in Leah A Lievrouw and Sonia Livingstone (eds), *Handbook of New Media. Social Shaping and Social Consequences of ICTs* (SAGE Publications, 2006);
Geoffrey C Bowker, "Toward information infrastructure studies: Ways of knowing in a networked environment" in Jeremy Hunsinger et al. (eds), *International Handbook of Internet Research* (Springer Netherlands, 2010);
Penelope Harvey, Casper Jensen, and Asturo Morita (eds), *Infrastructures and Social Complexity: A Companion* (Routledge, 2017).

[46] Gry Hasselbalch, *Data Ethics of Power. A Human Approach in the Big Data and AI Era* (Edward Elgar, 2021), 11.

[47] Gry Hasselbalch, "A framework for a data interest analysis of artificial intelligence" (2021) 26 First Monday, https://doi.org/10.5210/fm.v26i7.11091, accessed August 21, 2023.

[48] Gry Hasselbalch, "Making sense of data ethics. The powers behind the data ethics debate in European policymaking" (2019) *Internet Policy Review*, 8(2) https://policyreview.info/articles/analysis/making-sense-data-ethics-powers-behind-data-ethics-debate-european-policymaking, accessed June 27, 2023.

[49] Thomas J Misa, "How machines make history, and how historians (and others) help them to do so" (1988) *Science, Technology, and Human Values*, 13: 308;
Thomas J Misa, "Theories of technological change: Parameters and purposes" (1992) *Science, Technology and Human Values*, 17: 3; Thomas J Misa, "Findings follow framings: Navigating the empirical turn" (2009) *Synthese*, 168: 357.

and the social and material world we live in.[50] In addition, as Edwards describes it, we should also consider "scales of time"[51] when grasping larger patterns of technological systems' development and adoption in society on a historical scale, while also looking at their specific life cycles.[52] This approach allows for a more holistic understanding of the complex design, political, organizational, and cultural contexts of power of these technological developments. The objective of this approach is to avoid reductive analyses of complex socio-technical developments either focusing on the ethical implications of designers and engineers' choices in micro contexts of interaction with technology or, on the other hand, reducing ethical implications to outcomes of larger macroeconomic or ideological patterns only. A narrow focus on ethical dilemmas in the micro contexts of design will steal attention from the wider social conditions and power dynamics, while an analysis constrained to macro structural power dynamics will fail to grasp individual nuances and factors by making sense of them only in terms of these larger societal dynamics. A "multi-level analysis"[53] hence has an interest in the micro, meso, and macro levels of social organization and space, which also includes looking beyond the here and now into the future, so as to ensure intergenerational justice.

The three levels of analysis of power dynamics (micro, meso, and macro) in time and space are, as argued by Hasselbalch,[54] central to the delineation of the ethical implications of AI and its sustainability. Let us concretize how these lenses can foster our understanding of what is at stake.

First, on the micro level, ethical implications are identified in the contexts and power dynamics of the very design of an AI system. Ethical dilemmas pertaining to issues of sustainability can be identified in the design of AI and a core component of a sustainable approach to AI would be to design AI systems differently. What are the barriers and enablers on a micro design level for achieving sustainable AI? Think, for example, about an AI systems developer in Argentina who depends on the cloud infrastructure from one of the big cloud providers Amazon or Microsoft, which locks in her choices.

Second, on the meso level, we have institutions, companies, governments, and intergovernmental organizations that are implementing institutionalized requirements, such as international standards and laws on, for example, data protection. While doing so, interests, values, and cultural contexts (such as specific cultures of

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[50] Thomas J Misa, "How machines make history, and how historians (and others) help them to do so" (1988) *Science, Technology, and Human Values*, 13: 308.

[51] Paul N Edwards, "Infrastructure and modernity: Scales of force, time, and social organization in the history of sociotechnical systems" in Thomas J Misa, Philip Brey, and Andrew Feenberg (eds), *Modernity and Technology* (MIT Press, 2002).

[52] Ibid.

[53] Misa, Findings follow framings.

[54] Gry Hasselbalch, "Data pollution & power: A white paper for a global sustainable development agenda on AI" (2022), www.datapollution.eu/, accessed June 27, 2023.

innovation) are negotiated, and some interests will take precedence in the implementation of these requirements. What are the barriers and enablers on an institutional, organizational, and governmental levels for tackling ethical implications and achieving sustainable AI? Think for example about a social media company in Silicon Valley with a big data business model implementing the requirements of the EU Data Protection Regulation for European users of the platform.

Lastly, socio-technical systems such as AISTIs need what Hughes has famously referred to as a "technological momentum"[55] in society to evolve and consolidate. A technological momentum will most often be preceded by sociotechnical change that take the form of negotiations of interests. A macro-level analysis could therefore consider the increasing awareness of the sustainability of AI on the geopolitical agenda and how different societal interests are being negotiated, expressed in cultures, norms, and histories on macro scales of time. This analysis would thus seek to understand the power dynamics of the geopolitical battle between different approaches to data and AI. What are the barriers and enablers on a historical and geopolitical scale for achieving sustainable AI data? Think for example about the conflicts between different legal systems, or between different political and business "narratives" that shape the development of global shared governance frameworks between UN member states.

6.5 CONCLUSION

The public and policy discourse surrounding AI is frequently marked by excessive optimism and technological determinism. Most big data business endeavors are today promoted as "AI," and AI has acquired a crucial significance in geopolitics as a representation of nations' and regions' superiority in the global arena. However, it is crucial to acknowledge that AI is a human-created technology with significant effects on our environment and on future societies. The field of sustainable AI is focused on addressing the unsustainable environmental practices in AI development, but not only that. It also asks us to consider the societal goals for AI's role in future societies. This involves examining and shaping the design and use of AI, as well as the policy practices that we want to pass down to future generations.

In this chapter we brought together the concepts of sustainable AI with a "data ethics of power." The public discourse on AI is increasingly recognizing the importance of both frameworks, and yet not enough is done to systematically mitigate the concerns they identify. Thus, we addressed the ethical quandary of using AI for sustainability, as it presents opportunities both for addressing sustainable development challenges and for causing harm to the environment and society. By discussing the

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[55] Thomas P Hughes, "The evolution of large technological systems" in Wiebe E Bijker, Thomas P Hughes, and Trevor Pinch (eds), *The Social Construction of Technological Systems* (MIT Press, 1987).

concept of AI for sustainability within the context of a global sustainable development agenda, we aimed to shed light on the power dynamics that shape AI and its impact on sustainable development goals. We argued that exploring the powers that shape the "data pollution" of AI can help to make the social and ethical implications of AI more tangible. It is our hope that, by considering AI through a more holistic lens, its adverse effects both in the present and in the future can be more effectively mitigated.