Environmental Science and Policy 150 (2023) 103590

Contents lists available at ScienceDirect

Environmental Science and Policy

journal homepage: www.elsevier.com/locate/envsci

AI and the governance of sustainable development. An idea analysis of the European Union, the United Nations, and the World Economic Forum

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ARTICLE INFO

Keywords:
Idea analysis
Artificial intelligence
Sustainable development
Global environmental governance
Discourse

ABSTRACT

This paper presents an idea analysis of AI in the policy documents and reports of the United Nations, the European Union, and the World Economic Forum. The three organisations expect AI to contribute to sustainability and a prosperous future with better data analysis, greater amounts of quantitative knowledge, and by making economic and social activities less wasteful and more energy efficient. Several challenges are also named: ethics, human rights, cybersecurity, access to reliable data, transparency, and the digital gap. The solutions presented are multi-stakeholder collaboration, cohesive but flexible governance frameworks, but also taking the lead to push for ethical and value-based AI and making sure AI is sustainable. Ideas about AI appear to stem from discourses of ecological modernisation and green governmentality. This framing turns political and structural challenges into technical issues to be solved with more data, greater collaboration, and technical progress. The similarities in ideas between the EU, the UN, and the World Economic Forum also suggest that ideas about AI and sustainable development have reached discourse institutionalisation. Ideas about AI are therefore likely to reinforce already existing institutional and discursive settings.

1. Introduction

Interest in how artificial intelligence (AI) impacts sustainability pathways and international relations has grown over the years (Briscoe and Fairbanks, 2020; Shaw, 2017; Vinuesa et al., 2020). AI is an umbrella term whose definitions are manifold (Crawford, 2021) and often includes technologies such as machine learning, neural networks, and all types of autonomous systems. AI is sometimes referred to as a general-purpose technology (Chief Executive Board for Coordination, 2020; European Commission, 2021a; Smart Africa, 2021), as its use is increasingly pervasive in a vast array of fields. This breadth contributes to a vagueness that is often reflected in policies and governance settings (Ulnicane et al., 2022). In this paper, AI "refers to a class of computer programs [and related technologies, *our addition*] designed to solve problems requiring inferential reasoning, decision-making based on incomplete or uncertain information, classification, optimization, and perception" (Bathaee, 2018, p. 898).

The political impact of AI on sustainability varies depending on its implementation and context thereof. AI can be an asset in safeguarding biodiversity and fostering sustainable development (Goralski and Tan, 2020). Alternatively, it can reinforce behaviours behind current environmental crises (Dauvergne, 2020a). Countries like the United States, China and Russia want to leverage AI to shift the balance of power in their favour (Shaw, 2017; Dauvergne, 2021; Lee, 2018; Thornton and Miron, 2020), whereas other international actors could make sense of AI in different ways, depending on their interests, goals, and contexts.

The understanding of policy problems is always, at least in part, socially constructed by employing discursive tools such as storylines (Hajer, 1997) and ideas (Blyth, 2002; Gofas and Hay, 2010). This begs the question of what is meant when decision-makers speak of AI for sustainability.

Examining ideas about AI for sustainability can deepen our understanding of political and other discursive underpinnings of AI strategies and policies. This paper offers a qualitative idea analysis of policy documents and reports that directly or indirectly link AI and sustainability. It analyses ideas about AI in global environmental governance, using the European Union (EU), the United Nations (UN), and the World Economic Forum as case studies. We ask: how is "AI" framed in the selected material, and how is it articulated in relation to broader environmental and sustainability discourses?

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https://doi.org/10.1016/j.envsci.2023.103590
Received 12 April 2023; Received in revised form 12 August 2023; Accepted 17 September 2023
Available online 22 September 2023

We began our study with the hypothesis that idea frames about AI and sustainability either spur change within discourses and institutions or, conversely, reinforce already existing discourses. We understand sustainability as a "people-centred and conservation-based concept that implies the development of the standard of human life by respecting nature's capacity to afford life-support facilities and resources" (Rout et al., 2020, p. 4). Sustainable development is a strand of sustainability concerned more specifically with promoting economic growth within the boundaries of Earth's natural systems (Portney, 2015). Our focus is on how ideas shed light on the role of AI in social and environmental wellbeing.

2. Theoretical and methodological background

2.1. Why should we approach AI from an idea perspective?

Science and technology scholars have long studied the political impacts of technologies (Eubanks, 2011; Feenberg, 2002; Winner, 1980). Despite some notable exceptions (Ulnicane et al., 2022; Thornton and Miron, 2020; Cath et al., 2017; Ulnicane, 2022), the literature on international relations and sustainable development has not engaged with AI in terms of discourses or political ideas, even when political effects on democracy, equity and ethics are recognised (see for example Shaw, 2017; Lee, 2018; Nour, 2019).

Ideas spur or uphold institutional and political changes (Blyth, 2002; Fairclough, 2010; Parsons, 2003; Pierson, 1992), reflect power and ideological struggles (Fairclough, 2010; Laclau and Mouffe, 2001), and affect both social and material reality (Schmidt, 2017). Following a long tradition in political science, ideas are recognised as the bases of ideologies and policy outcomes (regulations, policies, implementation, etc.). Ideas have real impacts on the conduct of social relations, political arrangements, and economic structures (Blyth, 2002; Gofas and Hay, 2010; Lindberg, 2018; Brink and Metze, 2006). Ideas can lock in specific policy pathways (Lee, 2018) and create the backbone of institutions that will provide stability (Blyth, 2002). Ideas can also, conversely, spur policy and institutional change. Blyth explains that ideas help interpret goals, causes, courses of action and actors involved in times of uncertainty, and enable collective action and coalition building. Finally, ideas can be 'weaponised' to change policy outcomes and institutions (Blyth, 2002). Schmidt (Schmidt, 2008) argues that institutions can be changed or maintained through idea mediation (Schmidt, 2017, 2008).

Considering the many ideas on the risks and promises of AI and its impact on sustainability action and governance (Crawford, 2021; Dauvergne, 2021), scrutinising AI as a discursive referent in international sustainability policies is timely.

2.2. Method

2.2.1. Case selection

International organisations hold critical potential as knowledge brokers, coordinators, agenda setters and programme implementers (Karns et al., 2015; Barnett and Duvall, 2004). They can redefine interests and worldviews for other international actors such as states (Barnett and Finnemore, 2004) and are "international social institutions characterized by behavioural patterns based on international norms and rules, which prescribe behavioural roles in recurring situations that lead to a convergence of reciprocal expectations" (Rittberger et al., 2019). They often serve as platforms or advocates in spreading and shaping new discourses and norms (Karns et al., 2015; Fukuda-Parr and Hulme, 2011), and as such are an important link in policymaking, ideational and institutional change.

This paper focuses on is the European Union (EU), the United Nations (UN) and the World Economic Forums in their role as 'idea entrepreneurs', i.e. as organisations or sets of organisations defending and promoting certain ideas in order to translate them into policies and norms (Levinson, 2021). Other international organisations, most notably the Organisation for Economic Co-operation and Development (OECD), place a considerable focus on how AI principles are being formed (Schmitt, 2022). To delimit the study, we selected the three organisations because they represent distinct mandates and diverse types of international organisations. The UN is global intergovernmental with global reach mandated to spur sustainable development which gathers diverse types of economies and geopolitical interests. The EU is supranational, regional, and political with clear stakes in the development of AI. The World Economic Forum is non-governmental with significant convening power of business and government representatives and has a substantial analysis function. We chose organisations with distinct mandates to potentially capture different governance aspects and interests (Ulnicane et al., 2022; Schmitt, 2022).

2.2.2. Document selection and analysis

Our corpus of documents is composed of policy documents, white papers and reports linking AI applications to sustainability. The corpus was found through searches on the official websites of the EU, the UN and the World Economic Forum up to February 2022. We used different combinations of the terms "AI", "sustainab* ", "environment* ", "green" and "SDG". We also included documents from Smart Africa, Microsoft, the International Research Center on Artificial Intelligence, and Future Earth for triangulation. We retained 28 documents altogether, published from 2018 to 2021.

After data selection, the analysis proceeded iteratively. Preliminary categories included metaphors, categorisations, problem descriptions, areas of implementation, and storylines. Additional subcategories were added through a continuous process of adjustment and reorganisation.

2.3. Analytical framework

2.3.1. VDP triad

This paper focuses on political ideas. They are claims and assumptions about the desirable, possible, effective and legitimate goals and courses of action in society (Blyth, 2002; Lindberg, 2018; Schmidt, 2008; Vernon, 2010). Political ideas delimitate the 'proper' course of action, as well as its scope, place and time. Additionally, ideas may identify the agents and objects to be included, and present underlying assumptions about the world within which agents and institutions operate (Blyth, 2002; Schmidt, 2008; Lynch, 2007).

Political ideas are the substantive content of discourses (Schmidt, 2017, 2008). In this paper, we refer to discourse as "a specific ensemble of ideas, concepts and categorisations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities" (Hajer, 1997).

We use idea analysis and the VDP-triad to operationalise our analysis (Lindberg, 2018). The triad corresponds to (V) values or value-judgements; (D) descriptions or judgements of reality, i.e. problem formulation; and (P) prescriptions or practical proposals for actions.

We use the VDP-triad to identify how the governance aspects of AI are framed. Framing an issue involves defining problems, diagnosing causes, making moral judgments, and suggesting remedies in an internally logical manner (Entman, 1993; Wibeck and Linnér, 2021). We see frames as assemblages of ideas underpinning discourses. Framing analysis goes beyond the VDP-triad to also call attention to what is excluded.

2.3.2. Sustainability discourses

Our study presupposes that AI as a discursive referent will either instigate discursive change or reinforce already existing institutional and discursive designs. To explore these options, we provide a summary of three dominating sustainability discourses. The discourses used as reference are ecological modernisation (Hajer, 1997; Bäckstrand and Lövbrand, 2006), green governmentality (Bäckstrand and Lövbrand, 2006, 2019; Rutherford, 2017; Luke, 1995), and civic environmentalism (Bäckstrand and Lövbrand, 2006, 2019). These three discourses stem from the Enlightenment perspective. Other discourses such as

environmental justice or survivalism also exist (Zannakis, 2009), but they did not appear in any significant manner in our corpus.

Ecological modernisation is understood as "the discourse that recognizes the structural character of the environmental problematique but nonetheless assumes that existing political, economic, and social institutions can internalize the care for the environment" (Hajer, 1997). Hajer explains that ecological modernisation (1) makes sense of environmental change in a way that is calculable, from a monetary perspective in particular; (2) frames environmental changes as a positive-sum game enabled by the cooperation between different actors; and (3) assumes that economic growth and environmental protection are coupled. This discourse favours small tweaks in politics and the economy in the form of green, decentralised, cost-effective and collaborative regulations, technological innovation, investment and trade (Bäckstrand and Lövbrand, 2006).

Green governmentality focuses on how governmental mechanisms and technologies are used to govern environmental problems (Rutherford, 2017; Fletcher, 2017). It also addresses how knowledge of environmental processes is construed, negotiated, and represents sites of power production (Rutherford, 2017). Production of knowledge about the environment steers the "management" of the natural world and individuals' behaviour. Put simply, the environment is (re)presented by means of statistics, maps and models through which states, international and non-governmental organisations can devise solutions (Rutherford, 2017). This is conducive to techno-solutionism that construes the planet and its ecosystems as "infrastructure[*s*] subject to state protection, management and domination" (Bäckstrand and Lövbrand, 2006, p. 55). The way the environment is made knowable and governable often leads to the creation of specific types of self-governing subjects, for example the green citizen (Rutherford, 2017).

Civic environmentalism stipulates that an effective way to deal with environmental problems is through increased participation in the decision-making process (Bäckstrand and Lövbrand, 2006). All those affected (minorities and women in particular) by environmental change should have the opportunity to have their voices heard. Bottom-up approaches are to be favoured. However, the extent to which political structures should be reformed and civic engagement secured varies between more reform-oriented and radical approaches to civic environmentalism (Bäckstrand and Lövbrand, 2006).

3. Key idea frames

We identified two frames. They mediate the understanding of AI as a mode of sustainability governance -i.e. as ways to develop and implement regulations and incentives in order to change behaviours (O'Neill, 2017)- and as an object of governance in its own right. One frame represents AI as a tool for sustainability governance and the other advocates for a governance framework to promote sustainable AI. We abridged the first frame as *AI for sustainability* and the second as *Governance of sustainable AI*. Fig. 1 provides a summary of the results. In the case of AI policies, the term governance is rarely defined (Ulnicane et al., 2022). We define governance as an ensemble of rules and networks of actors and practices aiming to manage political problems.

Although "AI" is an umbrella term that encompasses a variety of technologies with different applications, opportunities and challenges, the framing of AI is not always specific in the documents selected. We therefore kept AI as a general referent for the analysis.

3.1. AI for sustainability

3.1.1. Values

The UN, the EU and the World Economic Forum explicitly state that the use of AI should be steered in a way that contributes to the Sustainable Development Goals (SDGs) (World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019, 2018, 2020; International Telecommunication Union, 2020; Chief Executive Board for

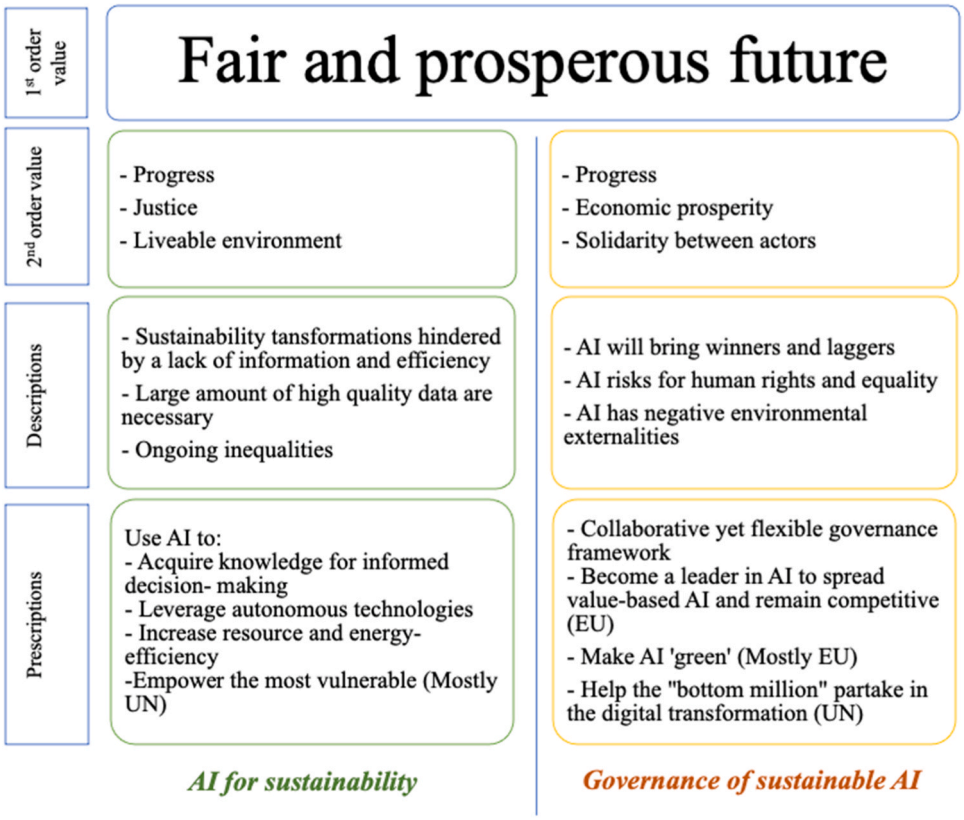

Fig. 1. Summary of the frames found.

Coordination, 2019a; United Nations, 2020). AI is part, or the source, of transformations towards a more prosperous, fair and sustainable future, which represents the first-order value. This prosperous future involves healthy, educated citizens allowed to evolve in a world where the effects of climate and environmental change are mitigated, where social inequality and poverty are eradicated, and where the pursuit of knowledge is beneficial.

The second-order values engaged in this frame are rooted in the ideals of the Enlightenment and correlate with ecomodernist imaginaries (Symons, 2019). There is an underlying trust in technological progress for the betterment of society, and a recognition of the need for human flourishing and social justice: technologically assisted sustainable transformations will secure the wellbeing of all humans.

The documents emphasise the transformational potential of technologies. The term transformation and its derivatives appear in 25 of the 28 documents. Rather than society-wide transformations, they range from precise individual areas, such as public procurement, distributed energy grids and smart homes, to sectors such as employment, education, and health. Nevertheless, these examples are framed as contributing to fundamental societal transformations. The World Economic Forum refers to the "digital revolution" or the "fourth industrial revolution", while the European Commission states that "[l]ike the steam engine or electricity in the past, AI is transforming our world, our society and our industry" (European Commission, 2018a, p.1). The World Economic Forum also makes the comparison (World Economic Forum, 2018). Technologies become "powered by AI" (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; IRCAI, 2021; European Commission, 2018b; Gailhofer et al., 2021; International Telecommunication Union, 2021), which strengthens the association with electricity or fuel. Other similar phrases such as "information age" and "digital age" are sporadically used and imply a similar argument: high technologies define our era, in the way the industrial development is said to have defined the 18th century. These phrases frame the current period as one of exponential development and innovation, where high technologies play a leading role.

3.1.2. Descriptions

The core challenge described is how to bring about transformations towards a prosperous and sustainable future in the face of climate change and unsustainable practices. The documents also acknowledge the rampant inequalities between diverse groups, especially between men and women and between the Global North and the Global South.

Mostly, AI is heralded for its potential for data collection and analysis. Concerns centre around ensuring sufficient energy-efficient computational power to analyse the volume, velocity, and variety of big data. As such, documents frame data as a resource to harness, as "[i]t has become commonplace to refer to data as the 'new oil' of the global economy" (World Economic Forum, 2019, p.4). According to the European Commission, "Europe's current and future sustainable economic growth and societal wellbeing increasingly draws on value created by data" (European Commission, 2020b, p.1).

Another problem presented in the dataset is the widening gap between states and companies able to develop and adopt AI, and the 'have-nots'. This is a general assessment made when it comes to AI. However, the documents also make this argument in light of sustainable development, since laggers might miss an opportunity to develop their economy and decrease poverty in their territory. It also implies that AI laggers will not be able to leverage algorithms and monitoring technologies in the case of biodiversity conservation or climate mitigation. The UN also considers the dangers of lagging behind and focuses on the inclusion of the Global South and minorities. UN documents discuss how the digital divide can negatively affect people in developing countries, women, girls, migrants, and other minorities (United Nations, 2020, p.18).

Implicit in the assumptions that AI answers a need for more informed decision-making and better information flows (see 3.1.3) is an understanding that knowledge is lacking to develop the best courses of action. Additionally, automation suggests that less energy use will contribute to making economic and social activities more sustainable. The sustainability crisis is thus understood as an optimisation problem.

3.1.3. Prescriptions

The documents recognise potential benefits of AI in areas as diverse as the economy (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2018; Chief Executive Board for Coordination, 2019a; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; IRCAI, 2021; World Economic Forum, 2020b; European Commission, 2021b; Microsoft) -circular economy in the case of the EU (European Commission, a, 2021, 2020b, 2018b; Gailhofer et al., 2021)-, health (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; UN Global Pulse, 2020; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; IRCAI, 2021; European Commission, 2018b; World Economic Forum, 2020b; European Commission, 2021b, 2018c), the environment -biodiversity, ocean and forest protection, etc.- (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; Chief Executive Board for Coordination, 2019a; European Commission, 2018a, 2020a; Future Earth; IRCAI, 2021; European Commission, 2018b; Gailhofer et al., 2021; World Economic Forum, 2020b; Microsoft), decarbonisation (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; Future Earth; Gailhofer et al., 2021; World Economic Forum, 2020b; Microsoft), security (Smart Africa, 2021; European Commission, 2021a; UN Global Pulse, 2019, 2018; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; European Commission, 2018b; World Economic Forum, 2020b; European Commission, 2021b; Microsoft; European Commission, 2018c), agriculture (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; International Telecommunication Union, 2020; European Commission, 2018a; Future Earth; IRCAI, 2021; European Commission, 2018b; Gailhofer et al., 2021; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019), energy (World Economic Forum, 2018; European Commission, 2021a; International Telecommunication Union, 2020; European Commission, 2018a; Future Earth; European Commission, 2018b; Gailhofer et al., 2021; World Economic Forum, 2020b; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019; World Economic Forum, Bloomberg, and Deutsche Energie-Agentur, 2021), public sectors (Smart Africa, 2021; a, 2018, 2021; UN Global Pulse, 2019; a, 2020a; World Economic Forum, 2020a; IRCAI, 2021; b; Gailhofer et al., 2021; b, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019), democracy and civil society movements (Smart Africa, 2021; European Commission, 2021a; UN Global Pulse, 2019, 2018; Chief Executive Board for Coordination, 2019a; European Commission, 2020a; Future Earth; Gailhofer et al., 2021; European Commission, 2021b; World Economic Forum and Center for the Fourth Industrial Revolution, 2019), and transport (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; European Commission, 2018b; Gailhofer et al., 2021; European Commission, 2021b; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019). Reportedly, "SDGs 3 (Good Health and Wellbeing), 9 (Industry, Innovation and Infrastructure), 10 (Reduced Inequalities), 13 (Responsible Consumption and Production), and 17 (Partnership for the Goals) are currently the top five most common SDGs addressed by the

UN AI initiatives" (International Telecommunication Union, 2021). EU documents highlight the role of AI in smart agriculture, health, mobility, and in the public sector. The World Economic Forum issued a number of documents illustrating the role of AI in different sectors, for example in energy transition, environmental protection, at home, or in public procurements (World Economic Forum, 2018, 2020a, 2020b; World Economic Forum, Bloomberg, and Deutsche Energie-Agentur, 2021).

We identified four main applications of AI: (1) better data collection and analysis leading to greater knowledge, scientific and industrial discovery, and better-informed decision-making; (2) increased use of automation (in transports, industry, etc.); (3) enhanced efficiency (individual consumption, energy, resources, etc.); and (4) greater equality and poverty alleviation.

3.1.3.1. Better data collection and analysis. The documents highlight that AI analyses and finds correlations in vast amounts of data, which facilitates scientific discovery, innovation, and understanding of the world in general. The conclusion set out in the documents is that AI leads to more informed and faster decision-making. Such applications of AI involve machine learning, smart sensors, satellite imagery, the Internet of Things, computer vision, drones, and digital twins. These technologies are showcased for real-time monitoring of weather and climate events, as well as forests, species migration, water sanitation systems, public transports, and electricity consumption.

Some documents additionally mention forecasting capabilities, for example, better assessment of future energy consumption, CO_2 emissions, and climate change. The UN's *Roadmap for Digital Cooperation* states that the "utilization of big data and artificial intelligence to create digital public goods in the form of actionable real-time and predictive insights is critical […] as they can serve to identify new disease outbreaks, counter xenophobia and disinformation and measure impacts on vulnerable populations, among other relevant challenges" (United Nations, 2020, p.8). The World Economic Forum believes that AI technologies can be harnessed to face the challenges brought about by climate and environmental change, especially with the processing of big data to find patterns, which make decision-making and forecasting more efficient (World Economic Forum, 2018) (Fig. 2). Similar arguments are made by the UN (UN Global Pulse, 2019, 2020) and the EU (European Commission, 2021a, 2018a, 2020a). The World Economic Forum gives the examples of quantum computing, "general artificial intelligence" and autonomous decision-making. These technologies would foster a sustainable world by mitigating environmental change, helping individuals control their consumption, and predicting episodes of crises (crop diseases, drought, etc.) (World Economic Forum, 2018, 2020b; World Economic Forum, Bloomberg, and Deutsche Energie-Agentur, 2021).

AI is further expected to promote better democratic systems and more responsible economic models by facilitating information access, faster and more accessible communication lines, and better tracking of waste and inefficiency. In the field of security, AI can enhance cybersecurity capability, track complex and vast criminal networks, obtain and analyse real-time data in case of conflicts, and streamline migration and asylum processes.

3.1.3.2. Automation. The documents also promote automation and its potential to free humans from repetitive tasks through, for example, robotics and automated vehicles. These include non-creative tasks at work, management of electric appliances at home, and driving. Automation would therefore contribute to human wellbeing by allowing more time for creative tasks.

3.1.3.3. Greater efficiency. When combined with data analytics, automation helps avoid redundancy, energy waste and unnecessary emissions. In the documents, AI is expected to contribute to more efficient sustainable manufacturing and agricultural production. In the field of agriculture and precision farming, AI technologies can help reduce the use of pesticides, fertilisers and water, help with weeding, promote animal welfare, and identify crop diseases. AI is also helpful at home to use electricity more wisely or to assess the most sustainable choices when buying products. Other examples given are resource and energy efficient transport flows, waste management, and energy systems, such as smart homes helping citizens to run their appliances at the best time, and smart grids managing diverse sources of electricity (for example, renewable energy). The EU illustrates that "smart thermostats can reduce energy bills by up to 25% by analysing the habits of the people who live in the house and adjusting the temperature accordingly" (European Commission, 2018c, p.1).

3.1.3.4. Reduced inequalities. The AI sector is expected to help promote equality between genders and between the Global North and the Global South. The documents mention new employment opportunities, for women and girls in particular. Mindful of big economies like China, the USA and the EU having a competitive technological advantage in AI development, the UN developed an "internal plan to support capacity

Fig. 2. Timeline for AI development envisioned by the World Economic Forum (World Economic Forum, 2018).

development efforts related to artificial intelligence technologies, especially for developing countries, with a particular emphasis on the bottom billion" (Chief Executive Board for Coordination, 2019a, p.1). The Global Pulse initiative reports exhibit how AI technologies help people in developing countries, particularly women, by tracking gender-based violence more efficiently, mapping which districts are considered unsafe, etc (UN Global Pulse, 2019, 2020). According to the report *AI for Good: Global Impact*, "[f]or Africa, AI represents access, efficiency and a potential antidote to unemployment and underdevelopment" (International Telecommunication Union, 2020, p.31), as the continent can create AI-related jobs for its largely young population, enhance food security, help local farmers, and export the vast and diverse data Africa can provide. Hence, the UN rearticulated this idea to prominently display the role of AI in poverty alleviation and in promoting equality.

The EU and the World Economic Forum also highlight the potential for reduced inequality, although less explicitly and systematically (European Commission, 2018a, 2020b; World Economic Forum, 2020b). The EU, addressing inequalities within its borders, believes that AI can contribute to its Green Deal (European Commission, 2020b, 2021a, 2021c; Gailhofer et al., 2021), and aims to focus on "human-centred AI" (European Commission, 2018b, 2020b; Gailhofer et al., 2021). AI is thus made sense of as an opportunity to foster more social justice and equality, through which even the most vulnerable can be empowered.

3.2. Governance of sustainable AI

The second frame is reflected in the common understanding among the EU, the UN and the World Economic Forum that despite its potential, AI needs safeguards to be beneficial. These safeguards involve protecting the safety and privacy of citizens and avoiding misuse. Regarding environmental sustainability, the main argument is that stakeholders and policymakers need to actively promote AI technologies that have a low CO_2 and energy footprint. As such, AI needs to be regulated and governed. It is worth noting that the frame *Governance of sustainable AI* has many overlaps with general calls for the governance of AI (Andonova et al., 2022; Butcher and Beridze, 2019).

3.2.1. Values

The problem descriptions are related to the challenges of a sustainable and prosperous future for all as a first-order value, similar to the previous frame. Ethical standards, safeguards for privacy, human rights, transparency, cybersecurity, and attribution of responsibilities in case of malfunction, are linked to social justice and democratic values.

There is an underlying assumption that states and other actors are interdependent, especially when solving complex, transboundary issues like environmental problems, or the governance of AI in this case. There are therefore strong incentives for cooperation and international community-building (O'Neill, 2017). The focus on winners and laggers, and the need for 'value-based AI', suggest values about social justice, where humans should be able to thrive, where human rights and peace are secured, etc.

However, the focus, especially from the EU, on becoming first-movers of AI innovation to gain competitive advantage conflicts with the cooperation narrative. This concern for staying competitive is also potentially a consequence of a realist understanding of international relations, where states are in permanent competition to balance power and secure their interests, and where the best chances at stability are if one actor gathers enough power to become a hegemon. It suggests that the values of collaboration and competition coexist in this frame.

3.2.2. Descriptions

AI is associated with a number of risks. Examples are breaches in cybersecurity and data protection (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; UN Global Pulse, 2018; Chief Executive Board for Coordination, 2019a; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; European Commission, 2018b; Gailhofer et al., 2021; World Economic Forum, 2020b; European Commission, 2021b, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019). The documents tackle user privacy and data management, algorithmic transparency, the lack of explainability of AI outputs, and the necessity to foster ethical use and development of AI (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; UN Global Pulse, 2019; International Telecommunication Union, 2020; UN Global Pulse, 2018; Chief Executive Board for Coordination, 2019a; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; IRCAI, 2021; European Commission, 2018b; Gailhofer et al., 2021; European Commission, 2020b; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019). There is additional emphasis on liability and responsibility attribution, and on inequality and discrimination -either in terms of access to AI or algorithmic bias (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; International Telecommunication Union, 2020; Chief Executive Board for Coordination, 2019a; United Nations, 2020; European Commission, 2018a, 2020a; Future Earth; World Economic Forum, 2020a; IRCAI, 2021; Gailhofer et al., 2021; European Commission, 2021b; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019). The documents also highlight challenges to law enforcement and trust (European Commission, 2021a; World Economic Forum, 2018; European Commission, 2021a, 2018a, 2020a; Future Earth; European Commission, 2020b; World Economic Forum, 2020b), and safety and fundamental right protection in general. Finally, challenges also concern how to grant citizens and policymakers the digital skills necessary to stay attractive on the job market and partake in the digital society, and thus curb unemployment (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; Chief Executive Board for Coordination, 2019a; European Commission, 2018a, 2020a; Future Earth; IRCAI, 2021; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019).

The World Economic Forum acknowledges that AI has so far been mostly developed for economic gains and competitive advantages, which subsequently undermines focus on sustainability and social justice (World Economic Forum, 2019; World Economic Forum and Center for the Fourth Industrial Revolution, 2019). The EU frames AI as key to achieving global leadership and asserting their position in the international landscape. Lagging behind would constitute brain-drain and reliance on possibly unethical solutions developed elsewhere.

The social components of sustainability are the primary focus of our selected documents. However, it can be noted that all three organisations recognise that AI is not intrinsically environmentally friendly. Concerns typically involve the use of electricity to train the algorithms and the energy consumption of AI and data centres (European Commission, 2021a; International Telecommunication Union, 2020; Future Earth; European Commission, 2018b; Gailhofer et al., 2021; European Commission, 2020b; Microsoft). A few reports are concerned with the rebound effects and the use of AI for CO_2 emitting activities (Smart Africa, 2021; European Commission, 2020a; Future Earth; IRCAI, 2021; World Economic Forum, Bloomberg, and Deutsche Energie-Agentur, 2021).

Finally, although the report *The Role of Artificial Intelligence in the European Green Deal* recognises that the energy efficiency of data centres is steadily increasing, it concludes that "[d]irect negative environmental effects of AI result from the use of digital hardware and infrastructures such as data centres and networks. This leads directly to the increased consumption of material resources and energy" (Gailhofer et al., 2021, p.9). It is the only document selected that deals with material extraction (Gailhofer et al., 2021).

3.2.3. Prescriptions

3.2.3.1. Limit AI's negative environmental externalities. As mentioned previously, the social and economic implications of AI are the main concern of the documents we selected. Among the three organisations, the EU brought the most attention to making AI more environmentally sustainable. One specific prescription is to continue enhancing the energy efficiency of data centres and computers (International Telecommunication Union, 2020). The annexe to the *Coordinated Plan on Artificial Intelligence* states that "[n]ew paradigms beyond scaling are already emerging and new energy-efficient computing architectures (such as neuromorphic and quantum) will be needed to ensure sustainable use of energy" (European Commission, 2018b, 2021b, p.3). The European Commission suggests that the European Fund for Strategic Investments, Horizon 2020 and the European Investment Fund could prioritise energy-efficient blockchain, AI's contribution to sustainable production, and low-power technology (European Commission, 2021a, 2018b). The EU also mentions the need for strong, yet energy-efficient computational power to train AI models. Low-power processors are examples of potential solutions (European Commission, 2021a).

The World Economic Forum proposes 'responsible AI' to include sustainability principles in addition to safety, ethics and values throughout investment, design, and implementation of AI technologies, both for the private and the public sector. The Forum also encourages states to include social and environmental considerations in their national AI strategies (World Economic Forum, 2018).

3.2.3.2. An appropriate governance framework. One of the solutions presented is an suitable governance framework to ensure the full benefits of AI from a social, economic, and environmental perspective. Among the aspects mentioned are soft and hard law, common global standards, national strategies, and the need to find a balance between law and protection and the ability to innovate and use data (European Commission, a, 2021, 2021b, 2020a; World Economic Forum, 2019; European Commission, b, 2021, 2021b). Of the three organisations, the World Economic Forum advocates technical and private certifications the most, contending that AI technologies should be ethical in their very design (World Economic Forum, 2019, 2020b; World Economic Forum, Bloomberg, and Deutsche Energie-Agentur, 2021). The EU similarly supports an 'ethics by design' and 'security by design' approach to technological research and development (European Commission, 2018b). The EU also created the classification of "high-risk AI", which is subject to special regulatory and monitoring procedures (European Commission, 2021a, 2020b).

The UN, the EU and the World Economic Forum agree that governance frameworks ought to be flexible to adapt to the fast pace of innovation, and that regulations should be standardised between actors of different kinds. The EU and the UN refer to regulatory sandboxes (a, 2020, 2021; Smart Africa, 2021; a, 2020, 2021; Chief Executive Board for Coordination, 2019a; a, 2018b, 2021b), a comprehensive governance framework to mitigate the risks posed by AI technologies and ensure safe and ethical usages that protect privacy, fundamental rights, and benefit even the most vulnerable. The governance of AI is also expected to help societies prepare for changes in the labour market, which is especially pronounced in EU documents (Smart Africa, 2021; World Economic Forum, 2018; European Commission, 2021a; Chief Executive Board for Coordination, 2019a; European Commission, 2018a, 2020a; Future Earth; IRCAI, 2021; Microsoft; European Commission, 2018c; World Economic Forum and Center for the Fourth Industrial Revolution, 2019).

Algorithm training requires substantial amounts of data. Some documents showcase the use of publicly owned data, collaboration, and pooling of data between private and public actors, common cloud data spaces, as well as the need to foster trust and shape a strong data protection framework so citizens feel more at ease when sharing their data. The UN relies on the concept of data philanthropy, i.e. the sharing of data by the private sector to supplement that of the public sector to the benefit of the more marginalised people (UN Global Pulse, 2019, 2020; Chief Executive Board for Coordination, 2019a). The UN additionally promotes gender-disaggregated data and data availability within developing states to be more beneficial for more vulnerable actors (Chief Executive Board for Coordination, 2019a). Computational capacities should also be increased to make it possible to train AI (Smart Africa, 2021; World Economic Forum, 2018; a, 2018, 2021; International Telecommunication Union, 2020; UN Global Pulse, 2018; a, 2018b, 2021b; World Economic Forum and Center for the Fourth Industrial Revolution, 2019).

3.2.3.3. Sustainable and ethical AI: best addressed through collaboration. Collaboration among a vast array of stakeholders – academia, civil society, citizens, and the private sector – is presented as necessary for the uptake of AI and to ensure its sustainability. This may be to achieve better knowledge of AI, and to limit discrimination and biases (European Commission, 2021a). Fig. 3 illustrates this emphasis on collaboration between different actors.

This idea also highlights the need to ensure that the impact of AI will be beneficial for most people and to make access to data easier. To this end, private companies and academia provide expertise, while the public sector can offer appropriate regulations, funds, and support. Citizens and users should be included through digital and technical skill acquisition. Transparency and explainability should be secured for informed consent and trust. The UN, the EU and the World Economic Forum further consider that interdisciplinary research can propel AI applications towards more sustainable and socially just grounds (Chief Executive Board for Coordination, 2020; World Economic Forum, 2018, 2020a; European Commission, 2021a, 2020a, 2018c; UN Global Pulse, 2020).

3.2.3.4. Governance of AI by the UN. The UN steers efforts towards ethical and sustainable uses of AI and big data by driving research, fostering multi-stakeholder collaboration, and providing expertise, capacity-building, and technical and policy support to its partners. To this end, the Chief Executive Board of Coordination elaborated a three-step approach: "developing shared guiding principles on artificial intelligence technologies that would help to define the internal strategic direction of the United Nations system; articulating a system-wide framework[2] on artificial intelligence technologies in order to encourage and guide integrated action within the United Nations system; and elaborating recommendations and concrete actions towards a capacity-building programme for developing countries" (Chief Executive Board for Coordination, 2020, 2019a, p.3).

The UN also notes the uneven distribution of AI benefits, and the need to carefully assess the impact of AI technologies to be sure they are the appropriate tools and contribute to the SDGs (Chief Executive Board for Coordination, 2020, 2019a, 2019b). The UN stresses the need to support developing and least developing countries with capacity-building and to focus on discrimination, data protection, human rights, diversity, and the data philanthropy undertaking to reduce inequalities.

3.2.3.5. Governance of AI by the EU. The European Commission asserts that the EU is in an excellent position to foster "human-centric, sustainable, secure, inclusive and trustworthy artificial intelligence" (European Commission, 2021a). As such, the EU can foster positive and ethical uses of AI thanks to solid legislation, a strong research environment and a careful understanding of AI uptake. *The Role of Artificial*

[2] What is meant here is a system that is common to all UN agencies and bodies.

Fig. 3. Illustration from the 2019 Global Pulse report (UN Global Pulse, 2019).

Intelligence in the European Green Deal summarises: "[m]ost of the international initiatives around AI do not sufficiently consider the environmental dimension of sustainable development and the EU could fill this gap" (Gailhofer et al., 2021, p.11). The European Commission states that "a human-centric approach to their [AI] development and use, the protection of EU values and fundamental rights such as non-discrimination, privacy and data protection, and the sustainable and efficient use of resources are among the key principles that guide the European approach" (European Commission, 2021a, p.31). The focus on ethics and sustainability is expected to bring a competitive advantage to Europe (European Commission, 2018a, 2018b, 2020b).

4. Discussion

In this section, we critically discuss our results in light of the research question: how is AI framed, and how is it articulated in relation to broader environmental and sustainability discourses?

4.1. Frames: data as a point of salience

The EU, the UN and the World Economic Forum put a strong emphasis on gathering and analysing data. More data is presented as a tool towards better decision-making and knowledge production. This focus takes precedence over concerns about the geopolitical aspects of environmental change and AI's role in this context.

It is worth noting that algorithms need a vast array of high-quality data to avoid biases and provide realistic and accurate results. It is therefore logical that the need for data is highlighted. Likewise, AI contributes to better decision-making and more accurate quantitative data analysis when pitfalls are avoided (Vinuesa et al., 2020; Goralski and Tan, 2020; D'Amore et al., 2022; Garske et al., 2021; Mondejar et al., 2021). To foster cooperation and strengthen the legitimacy of their claims, global governance actors must additionally demonstrate that the information they use is sound and unbiased (Keohane and Nye, 1998). Algorithms can help in this regard. However, although the need for data has material causes, the way international organisations construe this need draws upon discursive and ideational factors.

First, stressing the need for large amounts of real-time data in the frame *AI for sustainability* is compatible with green governmentality. In both cases, environmental and sustainability problems are constructed through technological devices and expert knowledge (be it human- or machine-generated), with an emphasis on measuring, predicting and mitigating environmental risks (Bäckstrand and Lövbrand, 2006). For example, all three organisations highlight that AI can use diverse types of data and find patterns better than humans. There are also multiple examples of how satellite imagery, digital twins and forecasting models can help visualise different environmental and social processes in a real-time manner. Automation further holds the promise that AI can help streamline human activities by making them more energy- and resource-efficient. Finally, smart appliances hold the promise to nudge individuals towards more sustainable choices. As such, the way AI is framed correlates with the green governmentality assumption that environmental challenges and human behaviours can be ordered by means of technical devices and knowledge production.

The green governmentality underpinnings imply that sustainable transformations are a problem of being better informed and running activities more efficiently. Such assumptions posit that the problem is of a technical nature, not a political one. They present the problem as one of knowledge and data and focus on the sciences and effects of climate change, rather than mitigating and adapting actions. The UN, the EU, and the World Economic Forum formally recognise the diversity of knowledge systems and their values in other contexts. However, such recognition does not appear in the documents we selected, which could suggest that ideas about AI are not significantly linked to concerns about knowledge diversity. In this context, ideas about AI could encourage knowledge production that is mainly positivist and quantitative with all sorts of big data analytics, visualisation tools and sensors. This process potentially produces hegemonizing effects, hides human perspectives and arbitrary decisions within the algorithms and sets aside other forms of knowledge (Kloppenburg et al., 2022; Machen and Nost, 2021; Couldry and Mejias, 2019).

Secondly, the focus on gathering data – as opposed to where to build and how to run data centres, or how and where to source raw materials for the hardware – contributes to presenting high technologies as clean and almost immaterial (Crawford, 2021; Pellow and Park, 2002). The literature highlights that running algorithms, producing hardware, and gathering the necessary energy for an optimal implementation of AI implies that consumers and polities will need to buy new equipment (Dauvergne, 2020a, 2020b). Resources such as rare earths, lithium, gold and cobalt need to be extracted, often in terrible conditions in developing countries (Crawford, 2021; Dauvergne, 2021; Alvarez Leon, 2021; Crawford and Vladan, 2018). AI-related technologies require substantial energy to run and emit significant carbon emissions if left unchecked (Dhar, 2020; Schwartz et al., 2020; Strubell et al., 2019) and generate waste that will need to be disposed of at the end of their life cycles (D'Amore et al., 2022; Ahirwar and Tripathi, 2021). The documents often pay little attention to these challenges, favouring instead discussions on how to gather and analyse data, or on more social considerations such as ethics and human rights protection. These questions are of course of great importance, but we argue that they should not overshadow environmental concerns. There are even fewer mentions of the geopolitical consequences of where the raw material comes from, the hardware is built, the servers are maintained, and the e-waste is sent. The digital divide is mostly presented in terms of haves and have-nots,

even when the documents acknowledge that the lack of necessary infrastructures and computational power will hinder some countries.

Consequently, focusing on data access limits broader discussions about environmental degradation, extraction, and redistribution. Over-reliance on technological fixes may for example undermine behavioural, social, and political changes that are desired by citizens and often necessary for comprehensive societal and sustainable transformations (Dauvergne, 2021, 2020b; Linnér and Wibeck, 2019, 2021), particularly when it comes to consumption patterns (Crawford, 2021; Kloppenburg et al., 2022; Dauvergne, 2020b).

4.2. Discourse institutionalisation

The EU, the UN, and the World Economic Forum converge in the ensemble of ideas about the opportunities AI brings, the challenges that need to be mitigated, and the general solutions. Schmitt has also identified the convergence of global AI initiatives and their propensity to happen in existing governance architecture (Schmitt, 2022), which would suggest a convergence both in terms of ideas and policy outputs.

The confidence in economic, social and environmental progress towards a more equal and prosperous future, and the strong focus on collaboration can be attributed to the institutional and ideational background of the UN, the EU and the World Economic Forum. All are international organisations that assume that international stakeholders can collaborate for the greater good, while at least the EU pairs this logic with one of competitive advantage. Additionally, multistakeholder and public-private partnerships are common modes of sustainability governance (Andonova et al., 2022). This corresponds to policy frames that can be identified in general AI governance discourses stressing the potential for societal transformations coupled with the duality between the logics of competition and collaboration (Ulnicane et al., 2022). It suggests ideational and institutional mediation in how AI is understood in the documents we analysed.

The similarities lead us to conjecture that *AI for sustainability* and *Governance of sustainable AI* are in the process of discourse institutionalisation, in the sense that the frames identified appear to have become hegemonic and have found standardised political and institutional translations (Hajer, 1997; Fairclough, 2010).

Nevertheless, the different mandates, scopes and members of the organisations are also reflected in their documents. For example, while the EU's framing of leadership implies a more active role as an international actor with a direct impact on its territory and a focus on building an economically strong and cohesive union, the UN and the World Economic Forum assume more traditional roles as platforms for collaboration, policy supporters, and knowledge brokers. Similarly, the pushing of the World Economic Forum for private certification in some of its documents can be easily explained by the fact that its primary members are businesses (Friesen, 2020). Finally, the UN's ideas are situated in its five-decade-long pursuit of bridging environmental protection with economic and social development, culminating in the 2030 Agenda (Linnér and Selin, 2013).

4.3. Are ideas about AI transformative?

The documents analysed suggest a process of discourse institutionalisation around AI, sustainability, and governance. AI can be used as a "technology of government" that makes climate change and sustainable development measurable and knowable (in a quantitative sense), reflecting green governmentality. It can also be used to make sustainable transformations easy and automated for the different actors, thus monitoring the "conduct of conducts" (Dean, 2009; Foucault, 1979) in a way that can accommodate a broad range of actors.

The two frames presented additionally align with the premises of ecological modernisation. They display strong compatibility between innovation, economic growth, and environmental protection, while encouraging flexible and collaborative decision-making. AI is in this respect presented as an influential tool to decouple carbon emissions from economic activities thanks to real-time analysis and greater energy- and waste-efficiency.

Yet, AI is framed not only as an economic opportunity that will produce winners and laggers, but also as a tool for social justice, environmental protection, and sustainable development. It may underscore a tension between the value that the world is a level-playing field, where whoever harnesses technologies can be better off irrespective of their background (Eubanks, 2011), and the increasing recognition that there are structural obstacles for developing states, minorities and environmental protection. AI is situated in the logics of power balances and competition between state interests. The dataset sporadically emphasises the need to make AI beneficial for vulnerable groups, especially in the case of the UN. However, since there are few examples and suggestions on how to include citizens in the processes of policymaking and AI implementation (the focus being on ensuring trust and explainability), the discourse of civic environmentalism is hardly reflected in the data. It is rather a case of "strong" ecological modernism, i.e. the branch of ecological modernism that recognises the need to democratise sustainability governance and to pay greater attention to the fairness of the process (Bäckstrand and Lövbrand, 2006).

Our results suggest that ideas about AI as leveraged by the UN, the EU and World Economic Forum correlate with already existing discourses. They are likely to strengthen institutional and political stability, instead of inducing institutional change. This is in line with previous research: AI governance tends to be polycentric and fragmented (Schmitt, 2022; Cihon et al., 2020) and is mostly addressed through existing policy frameworks (Schmitt, 2022).

This is particularly interesting as AI is associated with large-scale "quantum leap" societal transformation (Linnér and Wibeck, 2020) at the value level. That is to say that with *AI for sustainability* and *Governance of sustainable AI*, the expectations are that the technologies will transform all aspects of society and the economy very rapidly (Linnér and Wibeck, 2020). However, when looking in detail at prescriptions and descriptions, what emerges are more specific and incremental types of transformations: sectors will be more energy-efficient, waste will be reduced, and decisions will rely on larger datasets and better models. In contrast, many scholars and science policy researchers emphasise the multi-layered nature of societal transformations towards sustainability. They typically do not only involve interacting technical, economic, political, social, cultural and environmental change, but also the interplay between three spheres: practical (social or technical innovations, lifestyle changes), political (rules, institutions, economic exchange), and personal (worldviews, perspectives) (O'Brien, 2018). The dominant frame of *AI for sustainability* concerns exclusively the technical innovations in the practical sphere. Little, if any, attention is given to its role in the political and personal spheres. In short, what is offered is a more "convergent" approach to transformation - i.e. fast changes of particular societal segments (Linnér and Wibeck, 2020).

5. Conclusion

This paper seeks to (1) unpack how ideas about sustainability and governance include AI within their framing, and (2) examines how such ideas are embedded within broader sustainability discourses and to what effects.

We identify two dominating frames: *AI for sustainability*, and *Governance of sustainable AI*. In the first frame, AI contributes to a sustainable and prosperous future with better data analysis, greater amounts of quantitative knowledge, and by making human activities more energy- and cost-efficient. AI, therefore, responds to an understanding of sustainability challenges as technical and knowledge-based. While AI may contribute to the practical changes needed in sustainability transformations, international organisations pursuing the transformational imperative of the 2030 Agenda need to consider AI's implications for the political and personal spheres.

The *governance of sustainable AI* is meant to address the challenges brought by AI. These include ethics, human rights, cybersecurity, access to reliable data, transparency, and the digital gap. The documents we analysed also deal with concerns about the CO_2 emissions and energy consumption of AI and the need to make sure AI is environmentally sustainable. Most challenges identified are related to social and human wellbeing. The solutions named are multi-stakeholder collaboration, cohesive but flexible governance frameworks at various levels, taking the lead to push for ethical and value-based uses of AI, and focusing on the "bottom million" in the case of the UN.

Regarding our second objective, ideas about AI and sustainability correlate with ecological modernisation and green governmentality. The frames identified underwent a process of discourse institutionalisation and now form a coherent ensemble within the ecological modernisation and green governmentality umbrellas. The UN, the EU and the World Economic Forum emphasise the need for data access. This is to a large extent due to how AI algorithms function, but it is also at least in part a constructed stance: other potential focus points are side-lined, among others the environmental impact of AI, and the potential tensions between algorithmic and other forms of knowledge.

The similarities between the frames identified and ecological modernisation and green governmentality, the process of discourse institutionalisation, as well as the focus on data, suggest that ideas about AI at present are reinforcing already existing institutional settings, rather than contributing to a deep transformative change.

CRediT authorship contribution statement

Marie Francisco: Term, Conceptualisation, Methodology, Investigation, Data Curation, Writing - Original Draft, Visualisation. **Björn-Ola Linnér**: Term, Conceptualisation, Methodology, Validation, Writing - Review & Editing, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

This manuscript and related research are part of the Mistra Geopolitics programme (https://www.mistra-geopolitics.se/). Thank you to the research team, particularly Vincent Boulanin (Stockholm International Peace Research Institute) and Fredrik Heintz (Linköping University) for providing insight and advice.

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