Sustainability and AI

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A little bit of advice for Phase 2: Avoid the Nikola effect…

"Alignment" is AI-speak for "Design for Values"

From IEEE Ethically aligned design, 2023, https://standards.ieee.org/wp-content/
uploads/import/documents/other/ead_v2.pdf.

The conceptual complexities surrounding what "values" are (e.g., Hitlin and Piliavin, 2004; Malle and Dickert, 2007; Rohan, 2000; Sommer, 2016) make it currently difficult to envision A/IS that have computational structures directly corresponding to social or cultural values (such as "security," "autonomy," or "fairness"). However, it is a more realistic goal to embed explicit norms into such systems because norms can be considered instructions to act in defined ways in defined contexts, for a specific community (from family to town to country and beyond). A community's network of norms is likely to reflect the community's values, and A/IS equipped with such a network would, therefore, also reflect the community's values, even if there are no directly identifiable computational structures that correspond to values per se. (For discussion of specific values that are critical for ethical considerations of A/IS, see the sections "Personal Data and Individual Access Control" and "Well-being".)

Norms are typically expressed in terms of obligations and prohibitions, and these can be expressed computationally (e.g., Malle, Scheutz, and Austerweil, 2017; Vázquez-Salceda, Aldewereld, Dignum, 2004). At this level, norms are typically qualitative in nature (e.g., do not stand too close to people). However, the implementation of norms also has a quantitative component (the measurement of the physical distance we mean by "too close"), and the possible instantiations of the quantitative component technically enable the qualitative norm.

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What is the value of sustainability?

- "We have to protect nature for future generations"
- Instrumental value of nature

- "We have to protect nature for its own sake"
- Intrinsic value of nature

Anthropocentrism

Biocentrism

Background: AI as a sociotechnical system/ infrastructure

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Narrow conception of technology

The functional "stuff" under the control of engineers and designers, that goes on to have a life in a real-life environment.

Broad conception of technology

That stuff, plus all the users, institutions, and social elements needed in order to make it do something in the real-world environment.

Hasselbalch & Van Wynsberghe (CHLEP Ch. 6): AISTIs broaden this to include the network of infrastructure presupposed by a given technology

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Sociotechnical systems

"Sociotechnical systems … are hybrid systems, consisting of, or involving, "components" or "elements" that, by the description we have available for their behavior, belong to other domains than just the domain of the material objects --- described by natural science. Among these components or elements we may distinguish individual people, but also corporate actors such as business companies and governmental bodies, and more abstract social entities such as institutions, and laws, regulations and other rules."

Franssen & Kroes 2009

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Geography of AI (taken in the broadest sense)

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Atlas of AI/ Anatomy of AI (Crawford): [Anatomy of an AI System](#)

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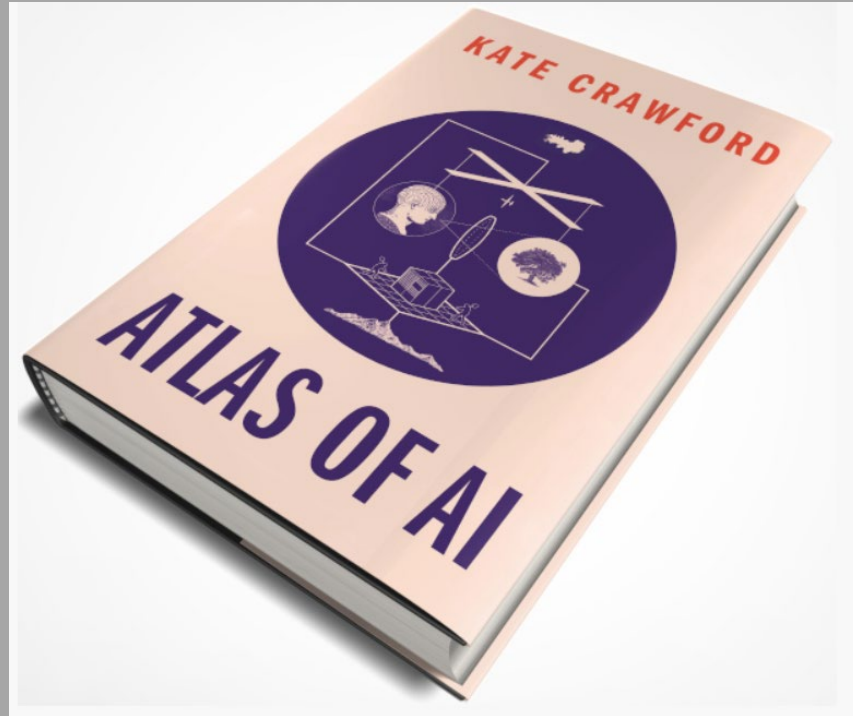
Far-flung elements of the sociotechnical system

Data servers
Mines for rare elements
Micro-workers

"the production of AI is a labor-intensive process, which particularly needs the little-qualified, inconspicuous and low-paid contribution of "micro-workers" who annotate, tag, label, correct and sort the data that help to train and test smart solutions"

Tubaro & Casilli 2019

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"Negative Externalities" (CHLEP p. 125)

Externalities are those costs, risks, or harms created by an enterprise that do not appear on its balance sheet (hence they are imposed on others).

Examples are when hosting an AI model used by millions of people causes…
- Major disruptions to educational institutions
- Uncompensated pollution such as discard of old devices
- Strain on the energy grid

Without insuring or compensating for them.

We can use this idea to formulate a normative premise: Enterprises should insure or compensate for their negative externalities.

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Meaning of sustainability

Primary meaning regards the acceptability of long-term environmental risks and harms;
There is more recently an emphasis on social sustainability, e.g., regarding employment and political stability. This is related.

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PRACTICE WHAT YOU TEACH!

TU/e Sustainability

Directly to
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→ **OUR SUSTAINABILITY VISION**
→ **BEST PRACTICES**

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Meet the team >

Sustainability news

Best Practices

Research

Sustainability@TU/e

At TU/e we practice Sustainability: it is one of the key **strategic priorities** of our university. This means, for example, that we **separate our waste**, aim to provide **catering** with socio-environmental Sustainability in mind, and try to make use of **renewable energy** as much as possible in our **Campus Operations**. Moreover, scientists working at TU/e contribute to the **SDGs** in their **Research**. On top of that, we integrate Sustainability into our **Education**. We aim to assist our students to become active change agents for Sustainable Transitions, capable of facing and solving the challenges of tomorrow. This is done with the aid of our **Sustainability Core Team** and in collaboration with key stakeholders, such as the **GO Green Office**, and other groups from all four dimensions of the university.

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Sustainability

EU energy policy emphasizes

- the need for technological breakthroughs
- The need for social breakthroughs in e.g.
    - government decision making,
    - market uptake
    - user activation.

Companies search for sustainable business models & becoming more sustainable themselves

Civil society organizations & consumers experiment with local renewable energy communities, sharing systems, and other forms of user engagement towards sustainable consumption patterns.

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Image from [AI and Sustainability: Opportunities, Challenges, and Impact | EY - Netherlands](#)

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Self-interest and collective interest

My choice:
M1) Reduce environmental damage
M2) Business as usual

Others' choice:
O1) Reduce environmental damage
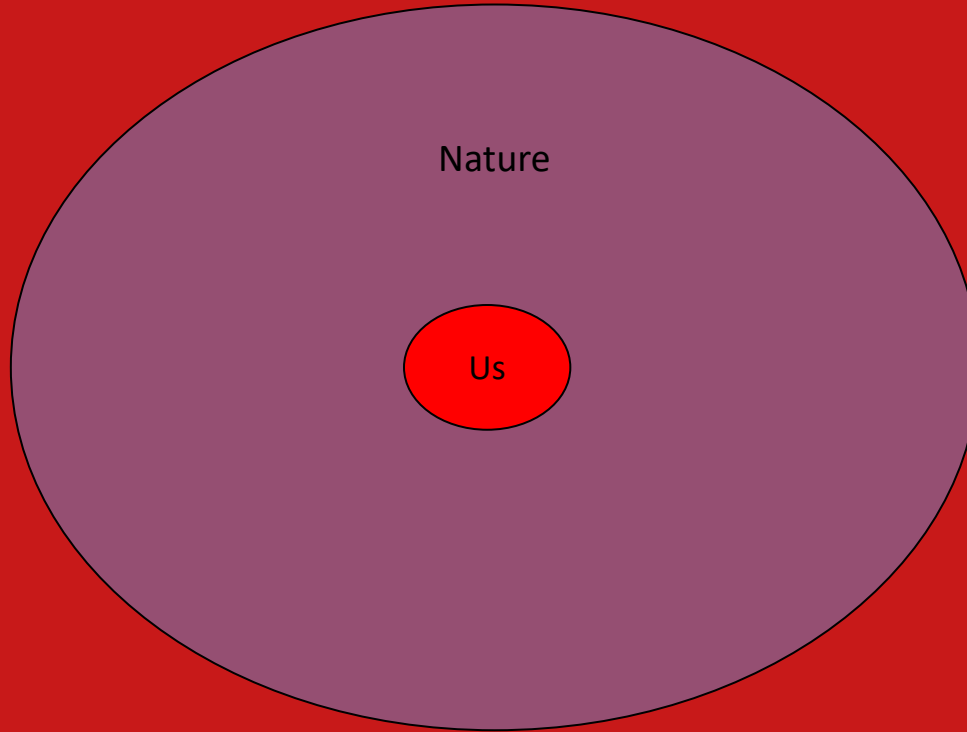O2) Business as usual

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The scale of technology in relation to the environment

Stockholm 1972 (referenced in CHLEP Ch. 6, p. 119)

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Change through technology

Environmental Values and the definition of sustainability

Brundtland: ''development that meets the needs of the present without compromising the ability of future generations to meet their own needs''

[SDG Actions Platform | Department of Economic and Social Affairs](#)

Intra- and Intergenerational justice: Fairness across the world and across generations
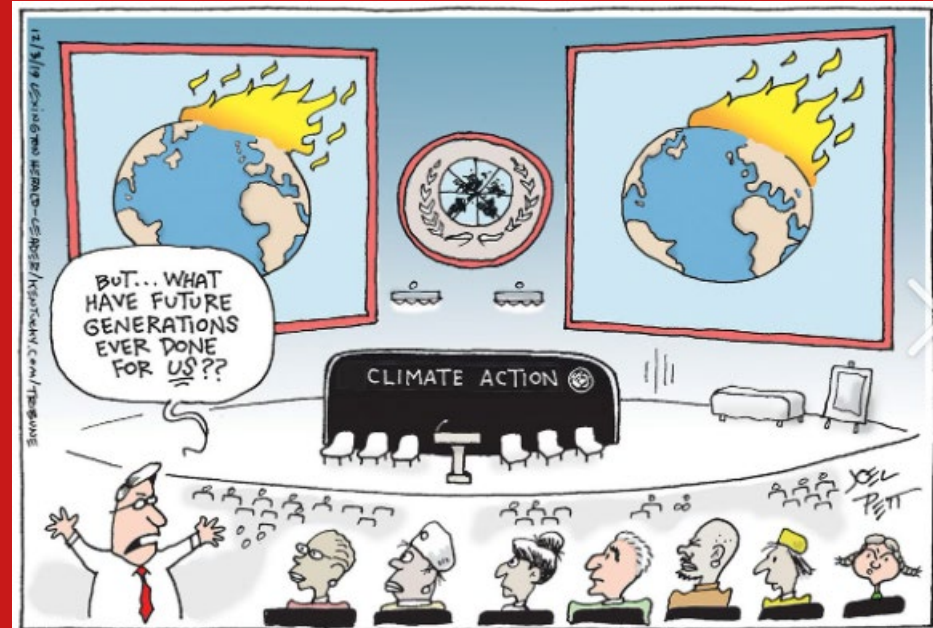
Sustainability & risk: The Precautionary Principle

The Precautionary Principle is meant to deal with uncertainty, rather than quantifiable risks.

"Where there are threats to the environment or human health, precautionary measures should be taken, even if some cause-and-effect relationships are not fully established scientifically" (Rio Declaration)

The Precautionary Principle's four dimensions (p. 238-9 of ETE):
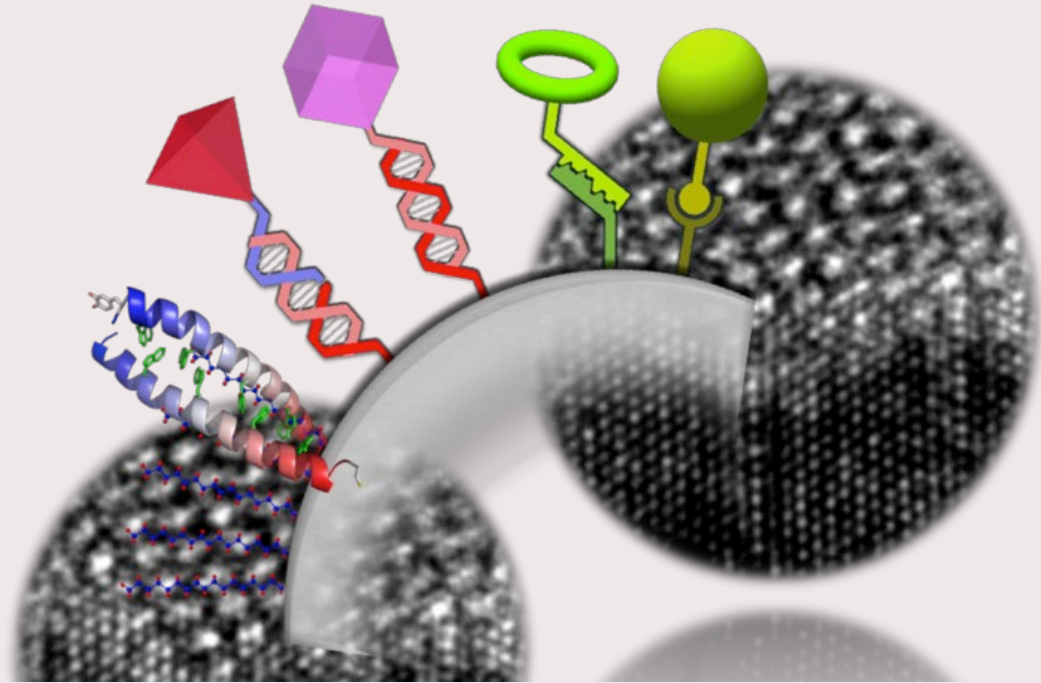
- threat
- uncertainty
- action
- prescription

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Precautionary Principle not only relevant to environmental issues

The Sustainability Dilemma of AI

Two directions

AI for sustainability: e.g., in relation to SDGs

- "Environmentally Sound Technologies"
- "Sustainable AI"

Sustainability of AI:

- Hasselbalch & Van Wynsberghe: AISTI-focused
- "data pollution" encompasses tangible and intangible impacts: not just environmental damage, but also data "spills," privacy violations, discrimination.
- "Privacy … [is] the needle on the gauge of society's power balance" (Hasselbalch & Tranberg 2016)

'An essential guide to one of the most pressing modern issues.'
HANNAH FRY
author of *Hello World*

PRIVACY IS POWER

WHY AND HOW YOU SHOULD
TAKE BACK CONTROL
OF YOUR DATA

CARISSA VÉLIZ

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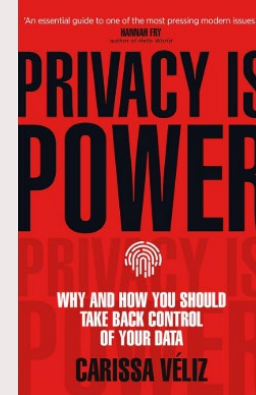
"Power dynamics" and sustainability ethics at three levels in AI

Micro: An engineer makes choices about development of an AI tool, e.g., whether to make it depend on a big tech provider, how much computation to use.

Meso: Companies and institutions establish standards and policy.

Macro: The global system reacts to and influences the historical and political trajectory of "system technologies" like AI.

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Some Concrete Meso-Level Proposals

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Lin's normative premise

"Limiting global warming to 1.5°C and bringing greenhouse gas emissions to zero by the middle of the twenty-first century are necessary steps for mitigating the harmful effects of climate change on ecosystems and humanity's wellbeing."

Lin, Patrick K. 2022. "The Cost of Teaching a Machine: Lighting the Way for a Climate-Aware Policy Framework That Addresses Artificial Intelligence's Carbon Footprint Problem." *Fordham Env't L. Rev.* 34.

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Three policy proposals in Lin 2022

1. Monitoring emissions impact (control → measurement)
2. Climate-aware guidelines for AI training
3. Clean energy for data centers

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Possible counterarguments to Lin?

→ European data sovereignty, security, and industrial competitiveness via AI are so important that cuts in the carbon footprint should come elsewhere.

→ Lin's policy measures are too weak to reduce emissions substantially.

→ Lin's policy measures do not ensure elimination of relevant externalities.

Rob Engelaar

NOS Nieuws • Vrijdag 10 juni 2022, 19:59

Hyperscale-datacenters in Nederland? Nog maar op twee plekken welkom

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The footprint of machine learning

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Three points of impact (Lin 2022)

1. The impact of training machine learning
2. The impact of building and maintaining data centers
3. Impact of real-life application of machine learning

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Measurement of the footprint

Some open-source resources can be used to estimate the impacts of LLMs on the environment, considering four factors:

- Training duration (amount of computation)

- Energy efficiency of GPUs

- Location of data center

- Offsets (if any)

AI and Sustainability: Opportunities, Challenges, and Impact | EY - Netherlands

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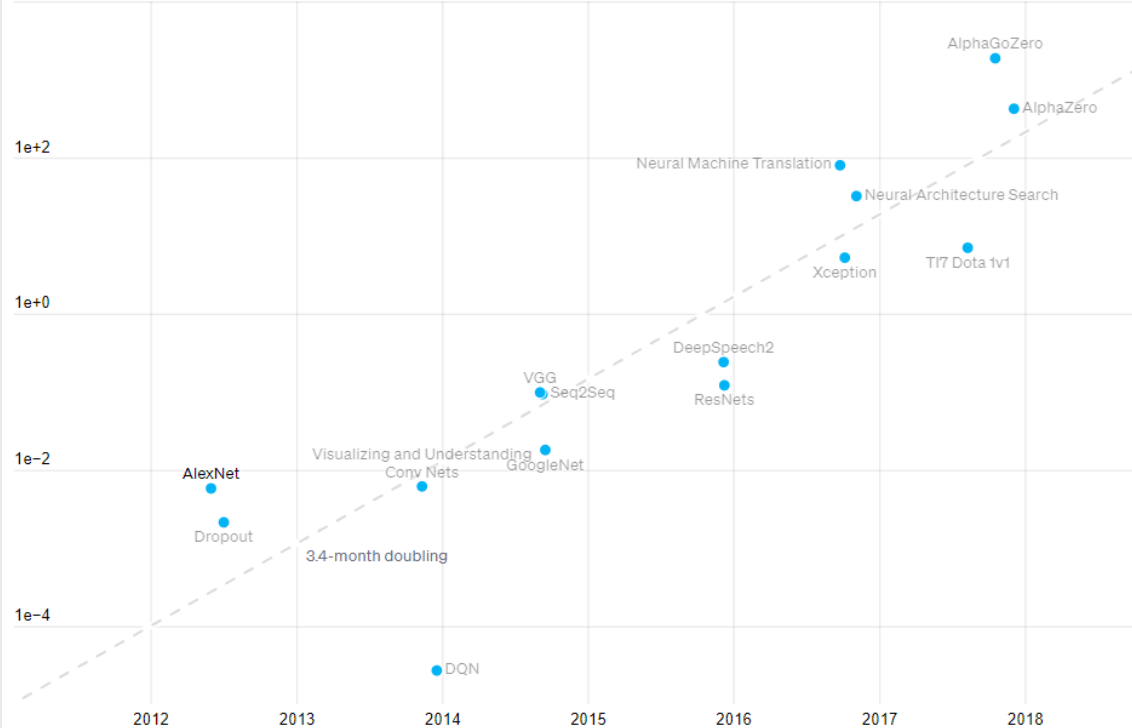Estimating the future computing needed for training AI

[AI and compute (openai.com)](openai.com)

AlexNet to AlphaGo Zero: 300,000x increase in compute

Log scale   Linear Scale

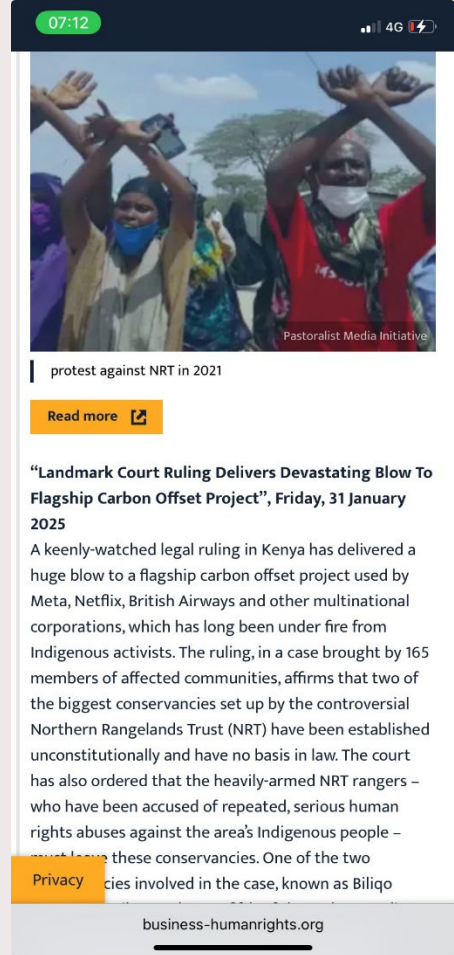The total amount of compute, in petaflop/s-days,[D] used to train selected results that are relatively well known, used a lot of compute for their time, and gave enough information to estimate the compute used.

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International ethical and legal dimension of offsets

Alvarez, C. (1 Feb 2025) Kenya: Court halts flagship carbon offset project used by Meta, Netflix, and British Airways over unlawfully acquiring community land without consent, accessed at business-humanrights.org on 18 September 2025

protest against NRT in 2021

Read more

"Landmark Court Ruling Delivers Devastating Blow To Flagship Carbon Offset Project", Friday, 31 January 2025

A keenly-watched legal ruling in Kenya has delivered a huge blow to a flagship carbon offset project used by Meta, Netflix, British Airways and other multinational corporations, which has long been under fire from Indigenous activists. The ruling, in a case brought by 165 members of affected communities, affirms that two of the biggest conservancies set up by the controversial Northern Rangelands Trust (NRT) have been established unconstitutionally and have no basis in law. The court has also ordered that the heavily-armed NRT rangers – who have been accused of repeated, serious human rights abuses against the area's Indigenous people – must leave these conservancies. One of the two conservancies involved in the case, known as Biliqo

Privacy

business-humanrights.org

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IEEE: Alignment at the meso-level

UNIVERSAL DECLARATION OF HUMAN RIGHTS -it's our Declaration

A/IS regulation, development, and deployment should, therefore, be based on international human rights standards and standards of international humanitarian laws (in the case of armed conflicts). This can be achieved if both states and private actors consider their responsibility to respectively protect and respect internationally recognized political, social, economic, and cultural rights. For business actors, this means considering their obligation to respect international human rights, as laid out in the UN Guiding Principles for Business and Human Rights (OHCHR, 2011), also known as the Ruggie principles.

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