Digitally sustainable: a new economic approach to face the twin challenge?

Presentation for the EEAC Annual Conference
"Digital Transformation for a Sustainable Anthropocene: Ethical, Green and Inclusive"

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18 November 2021

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- Intermezzo: Digitalisation & discourse

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Part 1

Overview of first principles:

- Digitalisation

- Sustainability

- Economics

reflections on the nature of things

First principles: digitalisation

"It is possible to invent a single machine which can be used to compute any computable sequence."

Alan Turing, 1936, In his paper "On Computable Numbers, with an Application to the Entscheidungsproblem"

Alan Turing in 1936
Passport photograph, 24 years old

machine uniquely. The machine whose D.N is n may be described as $\mathcal{M}(n)$.

To each computable sequence there corresponds at least one description number, while to no description number does there correspond more than one computable sequence. The computable sequences and numbers are therefore enumerable.

Let us find a description number for the machine I of §3. When we rename the m-configurations its table becomes:

q_1	S_0	PS_1, R	q_2
q_2	S_0	PS_0, R	q_3
q_3	S_0	PS_2, R	q_4
q_4	S_0	PS_0, R	q_1

Other tables could be obtained by adding irrelevant lines such as

| q_1 | S_1 | PS_1, R | q_2 |

Our first standard form would be

$q_1 S_0 S_1 R q_2$; $q_2 S_0 S_0 R q_3$; $q_3 S_0 S_2 R q_4$; $q_4 S_0 S_0 R q_1$;.

The standard description is

$DADDCRDAA$; $DAADDRDAAA$;

$DAAADDCCRDAAAA$; $DAAAADDRDA$;

A description number is

3133253117311335311173111332253111731111335317

and so is

3133253117311335311173111332253111173111133531731323253117

A number which is a description number of a circle-free machine will be called a *satisfactory* number. In §8 it is shown that there can be no general process for determining whether a given number is satisfactory or not.

6. *The universal computing machine.*

It is possible to invent a single machine which can be used to compute any computable sequence. If this machine $\mathcal{U}$ is supplied with a tape on the beginning of which is written the S.D of some computing machine $\mathcal{M}$,

SER. 2. VOL. 42. NO. 2144. R

# First principles: sustainability

Gro Harlem Brundtland in 1992
Rio Earth Summit (United Nations Conference on Environment and Development)

Photo: UN Photo/Michos Tzovaras; source:
https://www.norway.no/en/missions/UN/norway-and-the-un/norways-rich-history-at-the-un/important-norwegians-in-un-history/gro/

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Brundtland Commission, 1987, in the report „Our Common Future" by the World Commission on Environment and Development (Brundtland Commission)
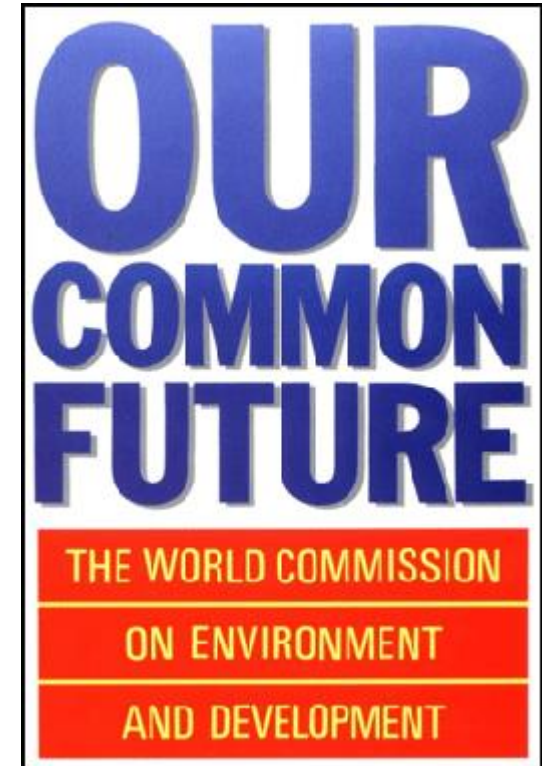
First principles: market economics
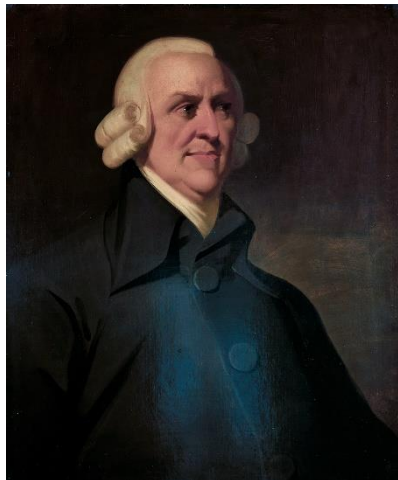
Adam Smith (1723-1790)
The Muir Portrait (unknown artist)

Image: Public domain); source:
https://en.wikipedia.org/wiki/Adam_Smith#/media/File:Adam_Smith_The_Muir_portrait.jpg

"They are led by an **invisible hand** to make nearly the same distribution of the necessaries of life, which would have been made, had the earth been divided into equal portions among all its inhabitants, and thus without intending it, without knowing it, advance the interest of the society, and afford means to the multiplication of the species. When Providence divided the earth among a few lordly masters, it neither forgot nor abandoned those who seemed to have been left out in the partition."
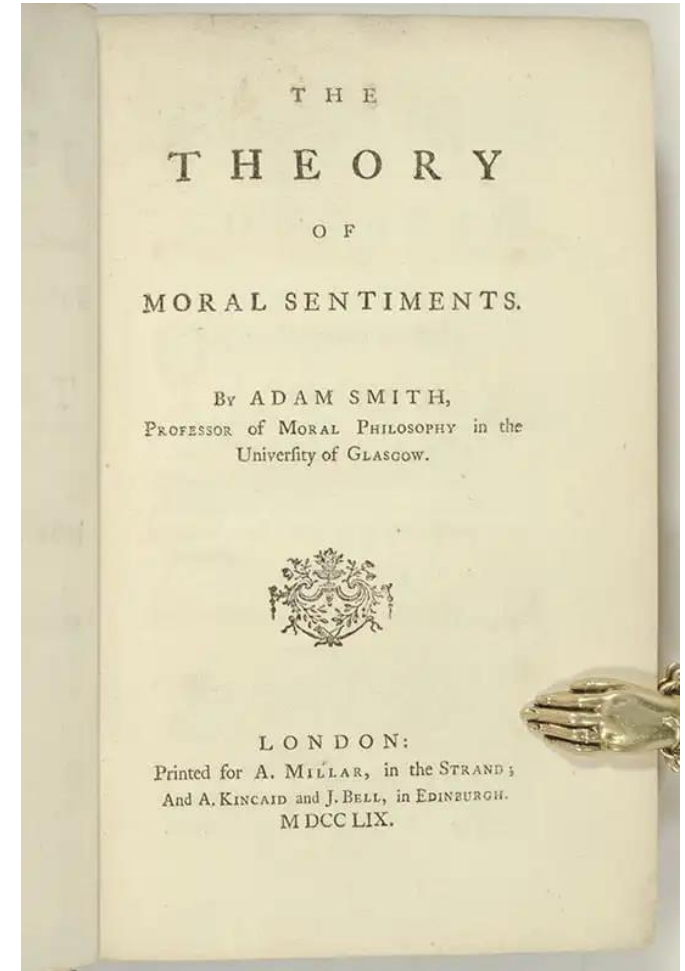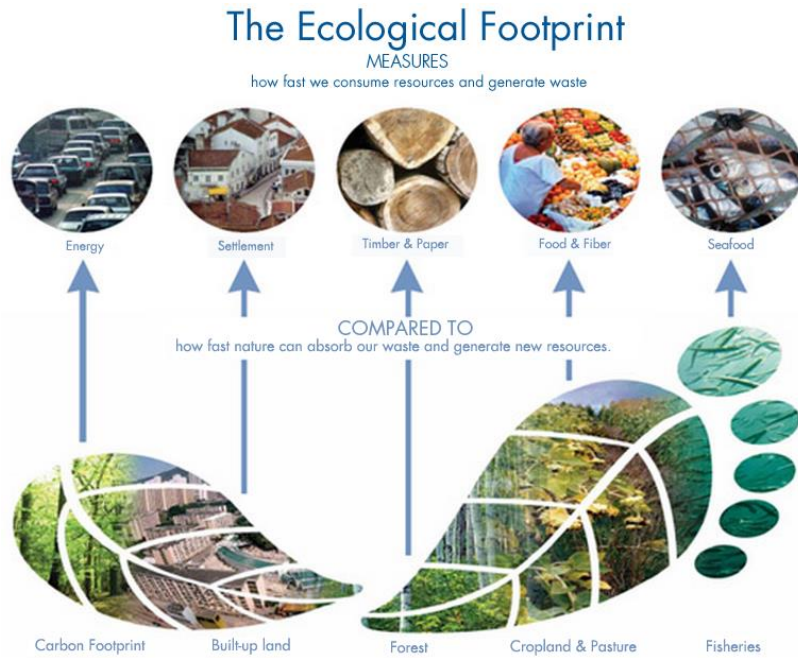Adam Smith, 1759, *The Theory of Moral Sentiments*

Image source:
https://www.raptisrarebooks.com/product/the-theory-of-moral-sentiments-adam-smith-first-edition-rare-book/

First principles: ecological economics

The Ecological Footprint
MEASURES
how fast we consume resources and generate waste

Energy Settlement Timber & Paper Food & Fiber Seafood

COMPARED TO
how fast nature can absorb our waste and generate new resources.

Carbon Footprint Built-up land Forest Cropland & Pasture Fisheries

Ecological Footprint was launched in 1990.

Image: Ecological Footprint Network, source: https://www.footprintnetwork.org/our-work/ecological-footprint/

How many Earths do we need
if the world's population lived like...

U.S.A.	5.0	
Australia	4.1	
South Korea	3.5	
Russia	3.3	
Germany	3.0	
Switzerland	2.9	
U.K.	2.9	
France	2.8	
Japan	2.8	
Italy	2.6	
Spain	2.3	
China	2.2	
Brazil	1.8	
India	0.7	
World	1.7	

Source: Global Footprint Network National Footprint Accounts 2018
Image: CC BY-SA 4.0; Source: https://en.wikipedia.org/wiki/Ecological_footprint#/media/File:How_many_earths_2018_English.jpg
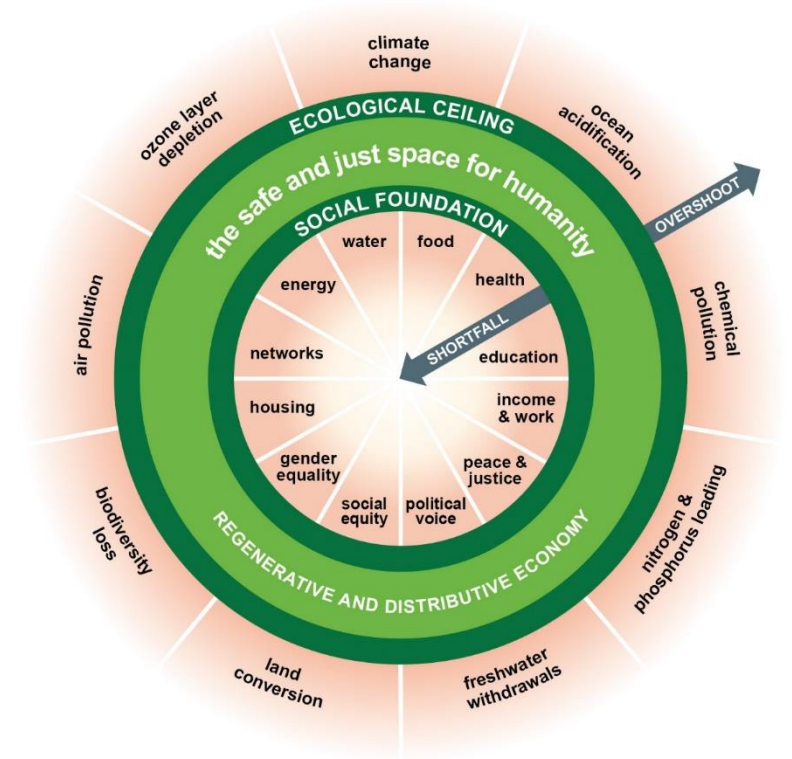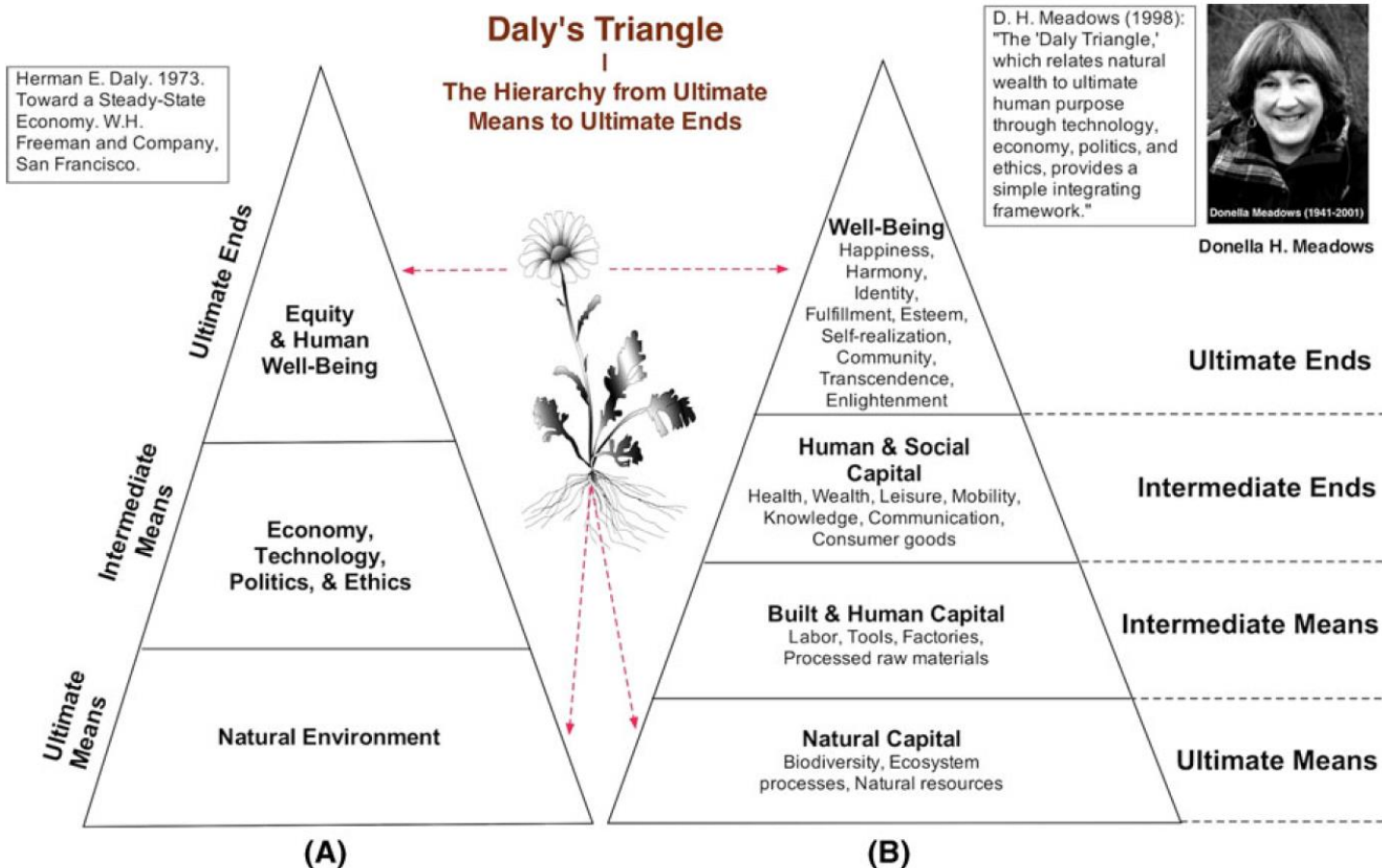

Doughnut economics
Kate Raworth, 2012

Image: CC BY-SA 4.0; source:
https://en.wikipedia.org/wiki/Doughnut_(economic_model)#/media/File:Doughnut_(economic_model).jpg

First principles: the full ends-means continuum

Fig. 3 The Daly Triangle, a strong sustainability framework that explicitly links the concepts of the triple bottom line, the hierarchy of human needs, and the different forms of capital. **a** The original version (redrawn from Daly 1973) and **b** the refined version (modified from Meadows 1998)

Image: Reproduced from Jianguo Wu (2013); source: https://www.researchgate.net/publication/257617123_Landscape_sustainability_science_Ecosystem_services_and_human_well-being_in_changing_landscapes

- Digitalisation <u>for</u> what?

- Digitalisation <u>from</u> what?

First principles combined

- **Digitalisation** > advanced machines will compute any computable sequence (sequences we can't currently foresee)

- **Sustainability** > meet intragenerational needs and foster intergenerational fairness

- **Multidextrous economics** –coordinated "hands" that create well-being while respecting healthy limits (market economics, environmental / ecological economics, information economics, political economics, behavioral economics, ethics)

Core elements of a new economic approach

To be digitally sustainable, core elements of a new economic approach must address:

- Planetary boundaries / environmental limits
- Market failure (externalities)
- Rebound effects (system responses that offset efficiency gains)
- Price elasticity (responsiveness to prices)
- Network effects (market concentration and winner-takes-all dynamics)
- Behavioural economics (nudging)
- Truth, virtue, civility, civics, care and agency
- Pursuit of "the good lives" by individuals with their communities

Intermezzo:

The Great User Inversion
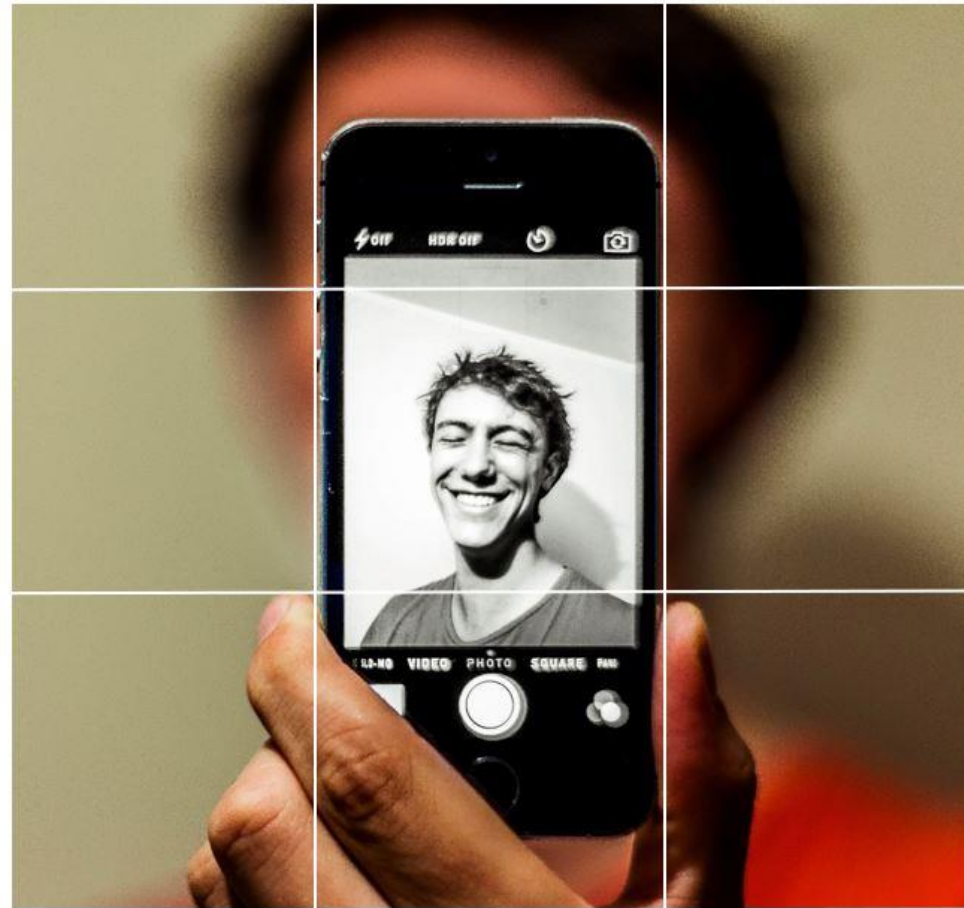
Photo by Antoine Beauvillain on Unsplash. Image modified by Aaron Best.

Intermezzo:

Discourse and democracy under threat

NEW!

- US Senate hearing 2019: *Optimizing for Engagement: Understanding the Use of Persuasive Technology on Internet Platforms*

- US House hearing 2020: *Americans at Risk: Manipulation and Deception in the Digital Age*

- US Senate hearing 2021: *Algorithms and Amplification: How Social Media Platforms' Design Choices Shape Our Discourse and our Minds*: "A business model that preys on human attention means that we are worth more as human beings and as citizens of this country when we are addicted, outraged, polarized, narcissistic and disinformed because that means that the business model was successful at steering our attention using automation. . . . [The business] model of everyone getting a chance to speak and have it go viral to millions of people, so long as that is the promise, with personalization, we are each going to be steered into a different rabbit hole of reality." Testimony of Tristan Harris, Center for Humane Technology

Part 2

How digitalisation can help or hamper in the climate crisis

THINK 2030

Policy paper

How digitalisation can help or hamper in the climate crisis
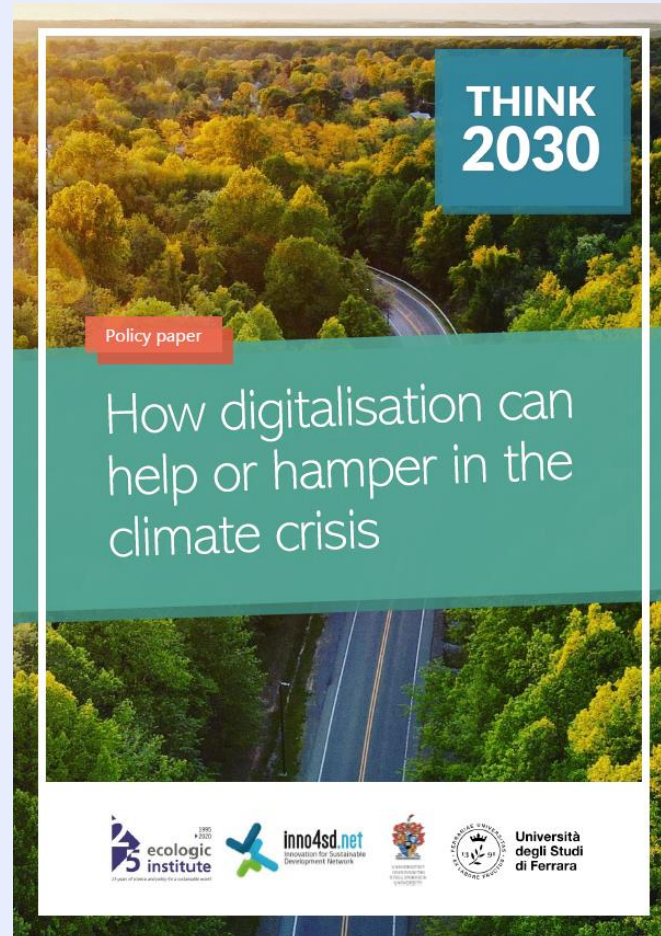
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Topics covered in the paper

General topics
- Digitalisation in context
- Recent EU developments
- Sustainability impacts of digitalisation, positive and negative
- Digitalisation - transformational across all dimensions of sustainability
- Policy principles: digital innovation for a green recovery
- References and recommended reading

Specific topics
- European Green Deal – connecting the sustainability and digitalisation agendas
- The negative environmental footprint of key digital technologies
- Country snapshot: German developments in digitalisation and sustainability
- Country snapshot: Italian manufacturers
- Digitalisation and COVID-19
- Digitalisation and democracy

The future impact of digitalisation on Earth's climate is unknown.

1. Two global megatrends—climate change and digitalisation—will continue to shape EU policy for decades.

2. Digitalisation encompasses a wide range of technologies and socio-economic processes with countervailing climate effects. It is characterised by unpredictable breakthroughs and hard-to-imagine emergent phenomena.

3. The net effects of digitalisation on the Earth's climate will depend on the frameworks of rules and incentives adopted and adapted by governments.

Climate and digitalisation in the EU – an emerging framework.

19 February 2020	European Commission releases its communication **"Shaping Europe's digital future"**
11 December 2020	European Commission releases its communication **"The European Green Deal"**
9 February 2021	European Parliament passes the EU's €672.5 billion **Recovery and Resilience Facility** (37% of MS expenditure must go to climate investment & reforms and 20% to foster the digital transition)
9 March 2021	European Commission launches **"Europe's Digital Decade: digital targets for 2030"**
21 April 2021	European Commission releases the **"EU Taxonomy Climate Delegated Act"** presenting implementing rules defining criteria for "green" investment
12 May 2021	European Commission launches a public consultation and discussion on **EU digital principles** as a follow-up to "Europe's Digital Decade"
14 July 2021	European Commission releases **"Fit-for-55" package**, (Delivering the European Green Deal)

Climate-friendly principles for digital innovation

Embedded Digitalisation
"computers for climate!"

Right Incentives
"prices tell the truth and guide flexible action"

Complementarity Effects
"coordinating environmental and digital policy regimes"

Green I/O
"green input, green processing, green output"

Addressing Algorithms
"be careful what you wish for"

Responsible Governance
"protect democracy, safeguard liberty"

Embedded Digitalisation

Digital strategies should be explicitly embedded in both the concept of sustainable development (anchored to the SDGs) as well as the fight against climate change (anchored to climate targets and international climate commitments).

Right Incentives

Specific technological solutions should not be dictated if a more flexible approach can be implemented to achieve environmental objectives, especially when technology can change rapidly. Because digitalisation is so pervasive and flexible, public policy should help ensure that price signals tell the environmental truth and that regulatory frameworks are ones that foster innovation and spur creative solutions.

Complementarity Effects

For systemic issues like digitalisation and climate change, the effectiveness of any individual policy regime can be further increased by understanding synergies and complementarities with other policy aims. The European Green Deal provides an excellent framework for institutionalising such an approach at scale within the EU.

Green I/O

Processing inputs and outputs extends beyond information to include physical aspects: the supply chains of materials into electronic devices, the amount and types of energy they use, the purposes to which digital capabilities are put, and how obsolete technologies are returned full circle to become materials for new devices. Along every part of this path, opportunities exist to reduce negative environmental impacts and increase positive ones.

Addressing Algorithms

The Internet of Things, Big Data and Artificial In-telligence (and the algorithms that drive them) are frequently tied to ethical choices with complex systemic effects that can scale rapidly. Better interdisciplinary work is needed across the digitalisation and environmental policy communities to develop effective policy measures for these novel developments.

Responsible Governance

Central elements of democratic governance and civil society are under threat via developments in social media, disruptions to the business models of media outlets, and growing levels of disinformation and propaganda. Effective climate and environmental policies are dependent on functioning governance frameworks. Erosive dynamics should not be ignored by those concerned about effective environmental policy in a democratic context.

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Thank you

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Annex: Climate-friendly principles for digital innovation

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