Towards a better understanding of the interface between digital tech and the physical environment (Session 332)

DESC

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

Convenors: The Digital Environment System Coalition, ICT4D.at and TaC-Together (YouthIGF)

ICT4D Collective

https://ict4d.org.uk

ICT4D Collective

together against cybercrime TaC

ICT4D.at

Youth IGF

WSIS+20 FORUM HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

Session Agenda

Digital tech and the environment WSIS 2003 - 2024 (Moderator: Paul Spiesberger)	
16.00-16.10	A little bit of history and the need for the Digital Environment System Coalition. Tim Unwin (ICT4D Collective)
Case studies (Moderator: Tim Unwin)	
16.10-16.15	ICT4D.at Regenerative Ideas Contest. Paul Spiesberger (ICT4D.at)
16.15-16.20	The importance of deep sea mining. James Crabbe (Wolfson College Oxford)
The positive value of digital tech for the environment: (Moderator: Paul Spiesberger)	
16.20-16.25	The value of a systems approach and AI. Serge Stinckwich (UNU Macau)
A youth perspective (Moderator: Paul Spiesberger)	
16.25-16.30	Intended to be *A perspective from the world's youth. Yuliya Morenets (YouthIGF and TaC-Together)* – replaced by a short overview of YouthDESC
Interactive discussion (Moderator: Tim Unwin)	
16.30-16.35 **16.35-16.43**	• Questions and comments • What needs to be done
Conclusions	
16.43-16.45	30 second final words from each of the panellists

DESC

WSIS: Geneva 2003 and Tunis 2005

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

- Climate and the physical environment largely absent in original WSIS meetings
  - The word “climate” did not feature in the Tunis Agenda for the Information Society (2005)
  - The word “nature” (in the sense of the physical world) does not feature at all in the Agenda
  - The word “environment” (in the sense of the physical world) only features twice (23.f, 90.p),
    - with “environmental” featuring once (90.g)
- Subsequent WSIS meetings
  - Action Line C7.f focuses on e-environment (with WMO as facilitator)
  - ITU currently lists six previous official events on AL C7 at WSIS held between 2016 and 2018

The dominant rhetoric since the origins of WSIS: climate change and carbon

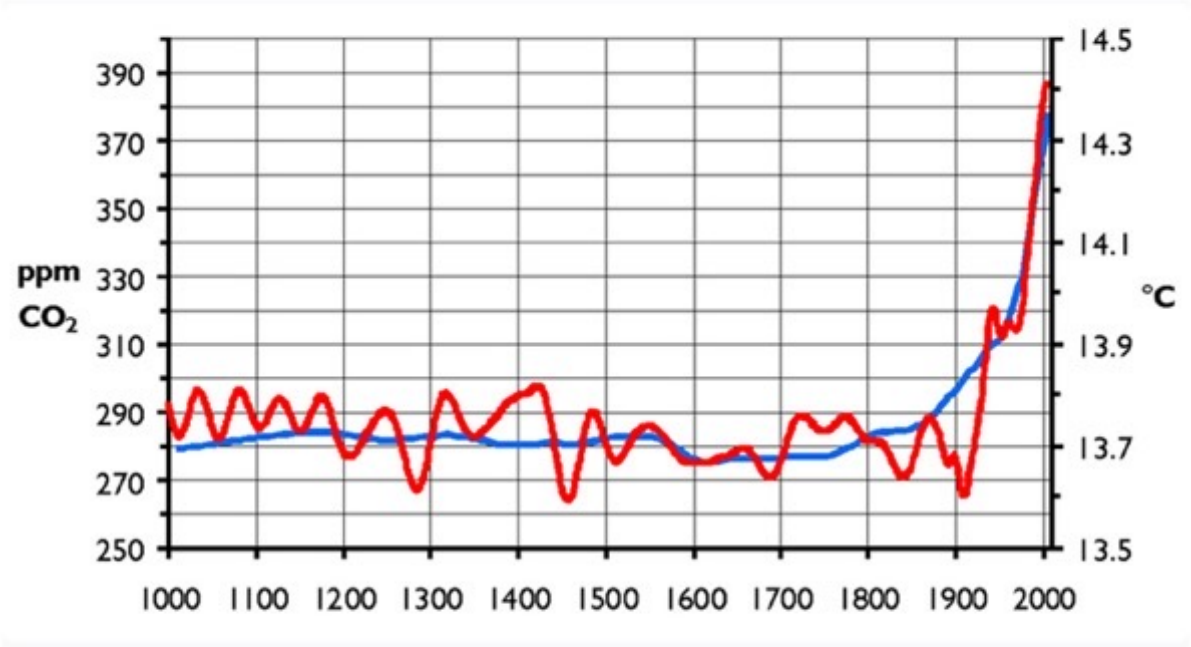
WSIS+20 FORUM HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

- Climate change has widely become seen as an external cause of harms
  - Even though it is largely driven by human behaviours
- Main focus on carbon emissions
  - And therefore on how digital tech can reduce these
- Increasing recognition on e-waste
- ITU perspectives
  - ICTs can contribute to reducing carbon emissions as part of the solution – for example, through 'dematerialization' (e.g. replacing books with digital books) or through substitution (e.g. replacing travel for meetings with participation in teleconferences).
  - Given the growing proliferation of devices in our increasingly connected lives, information and communication technologies (ICTs) are part of the problem, and responsible for a growing amount of carbon emissions and e-waste

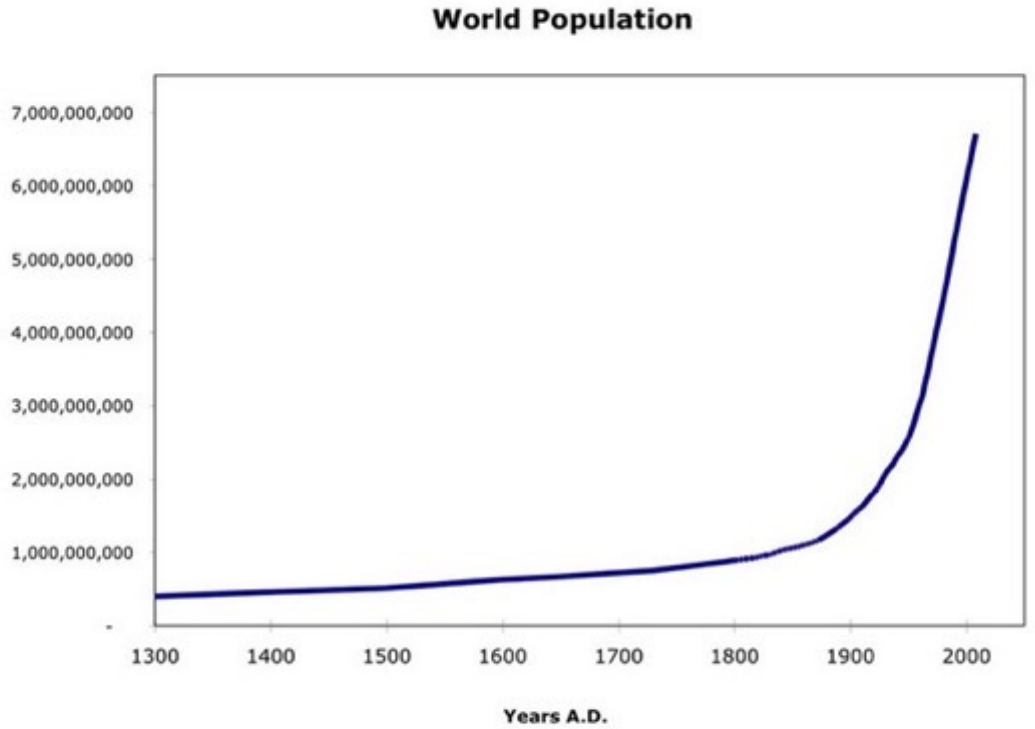
Source: NOAA

CO_2 and world population growth: population growth as the biggest driver of carbon emissions

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland



Average atmospheric CO2 and mean global temperatures since 1000



World population since 1300

https://unwin.files.wordpress.com/2022/11/graphs-2.jpg

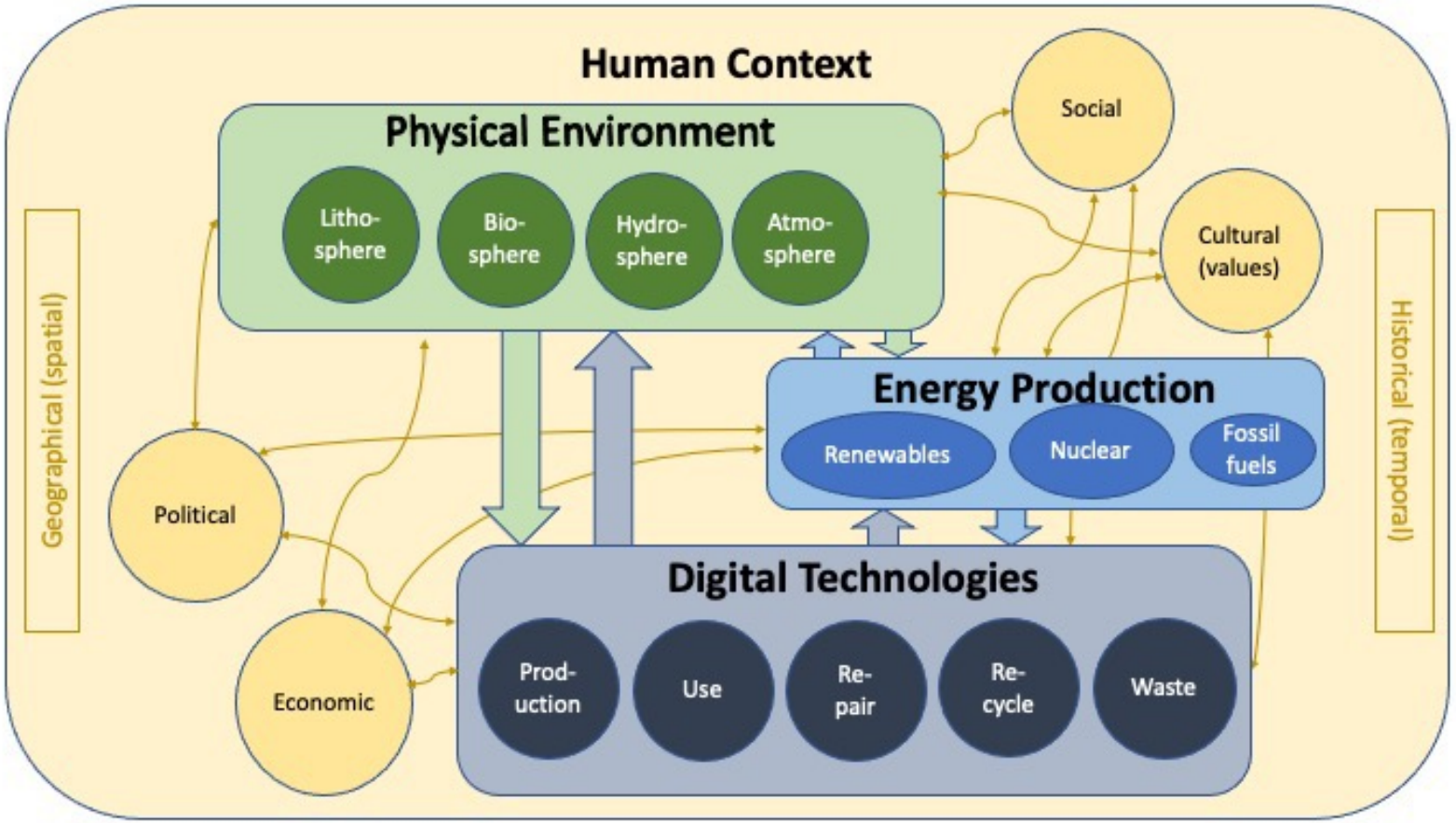
We need a fundamentally new way holistically to assess environmental impact of digital tech

That addresses both the positive and negative impacts in a holistic framing and goes far beyond the climate fetish

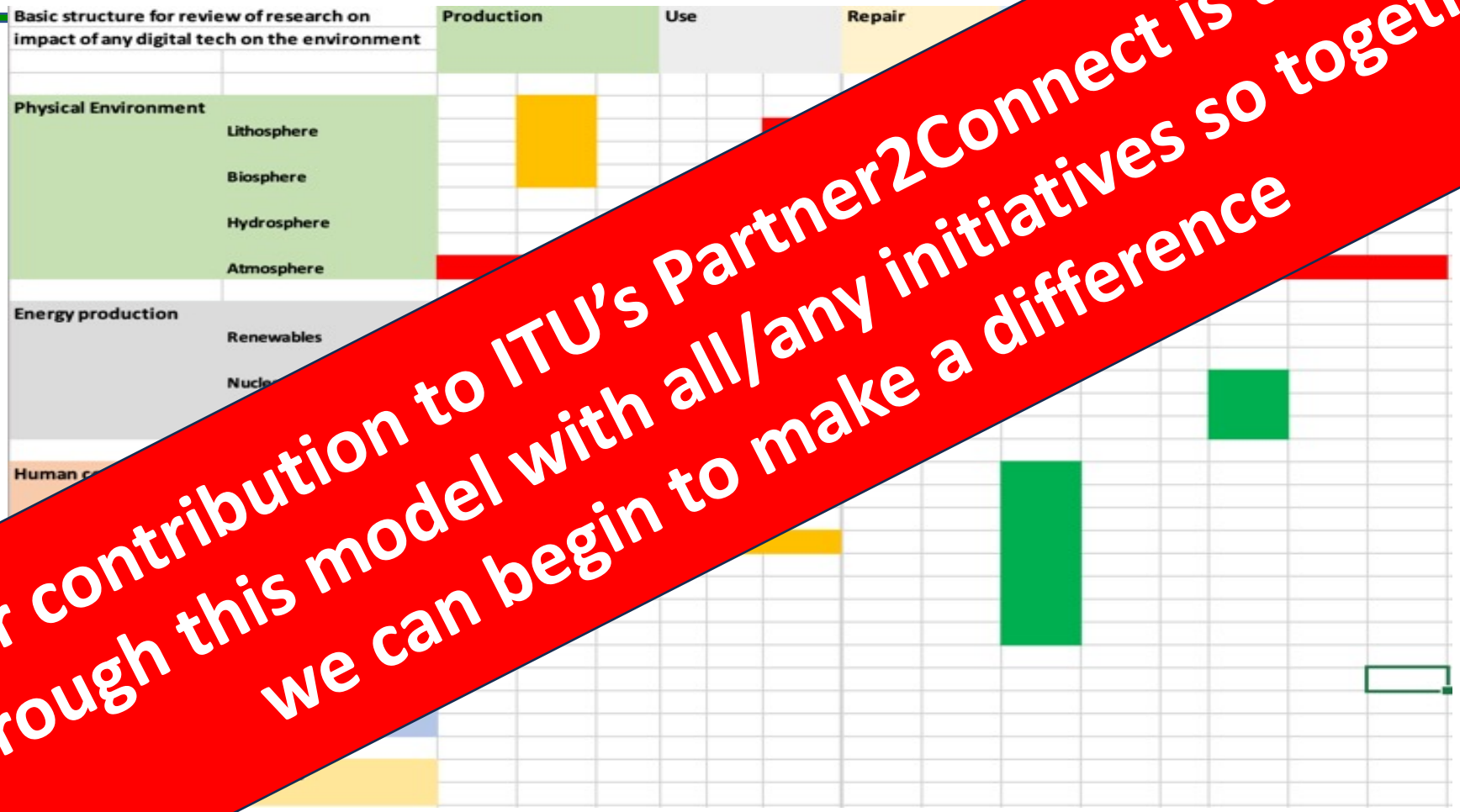
Crafting a new more holistic systemic framework

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

DESC



A framework for understanding digital intervention impact on the environme



Our contribution to ITU's Partner2Connect is to work through this model with all/any initiatives so together we can begin to make a difference

Levels of knowledge
Green = good
Orange = medium
Red = very little

Can also be used for relevant publications

https://ict4d.org.uk

Examples of issues that must be addressed

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

- Unsustainable business models
  - And the innovation fetish
- The drivers of growth
  - economic and demographic
- Outer “space” and the global commons
- Deep sea mining
- Spectrum environmental efficiency
- Indigenous environmental understandings
- … and many others

Open Innovation Idea Contest

Paul Spiesberger: ICT4D.at Regenerative Ideas Contest

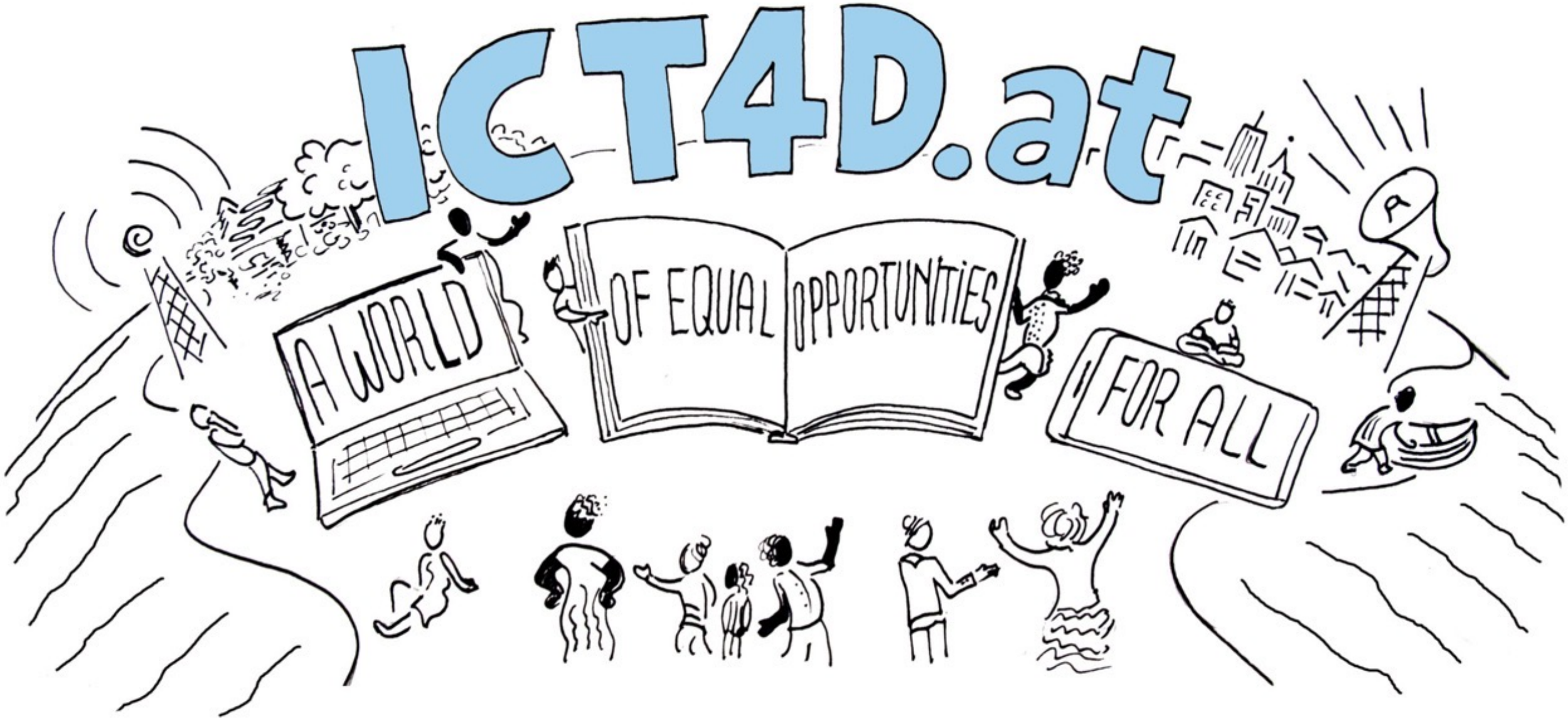
REBOOTING HOPE:

Digital Solutions for Environmental and Social Recovery

ICT4D.at

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

https://ict4d.org.uk


ICT4D.at
A WORLD
OF EQUAL OPPORTUNITIES
FOR ALL

Circle of Friends

Service Organisation

ICT4D.at

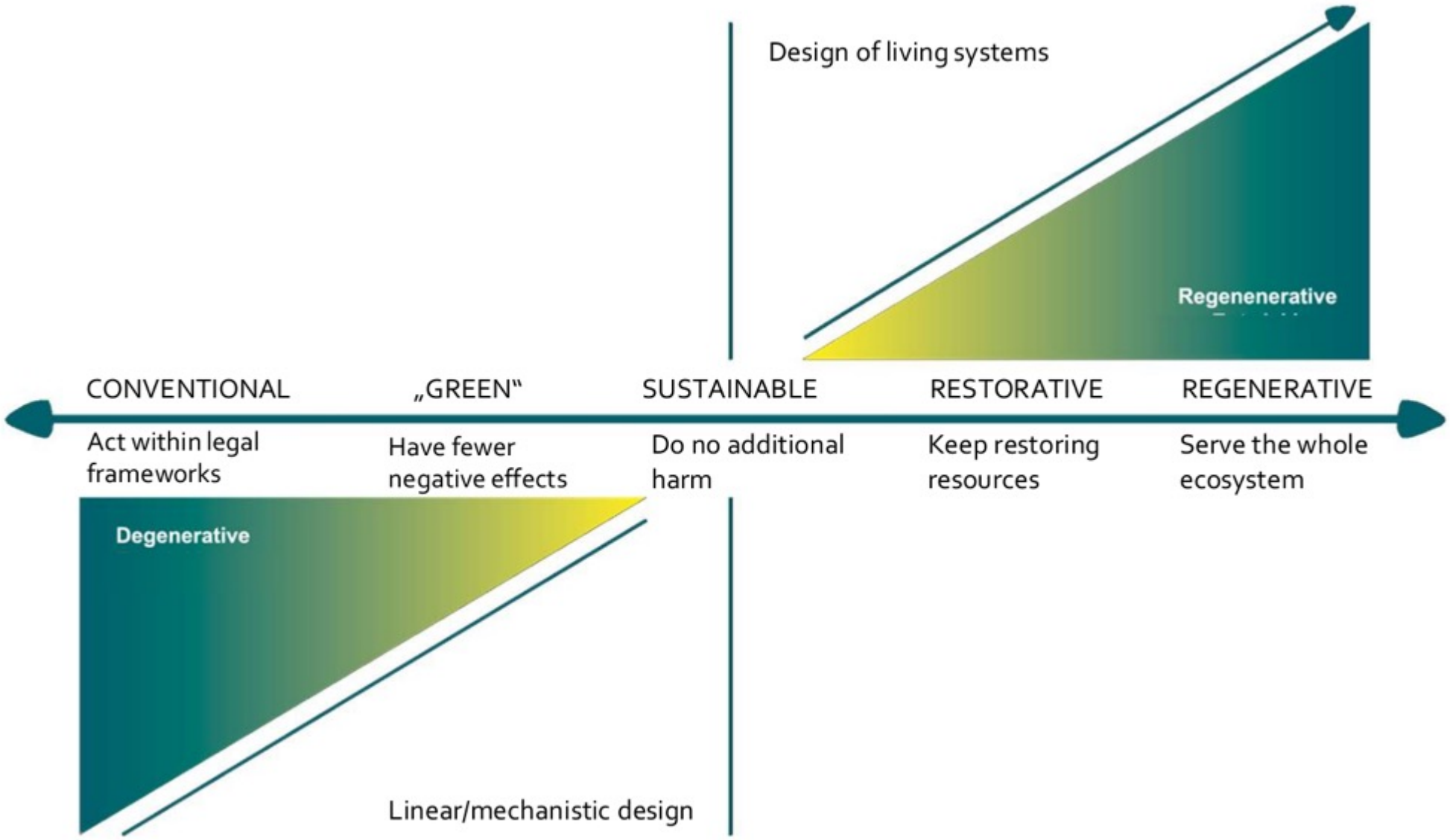
Network

Info Platform

Project Platform

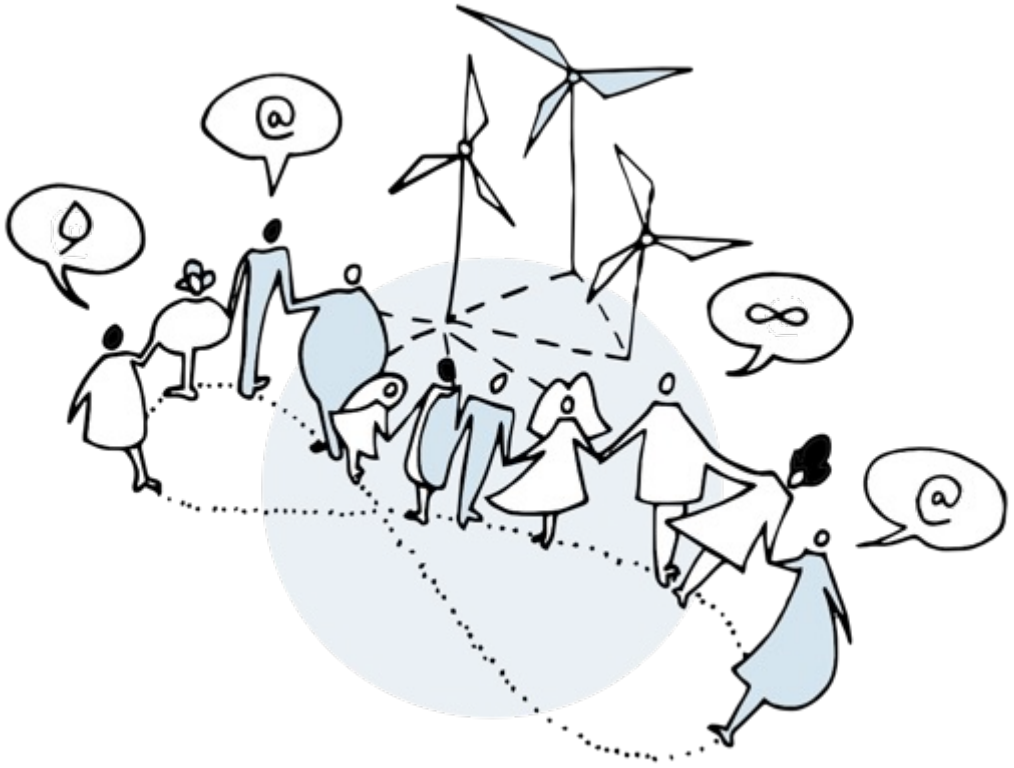
FOCUS

Regenerative Communities

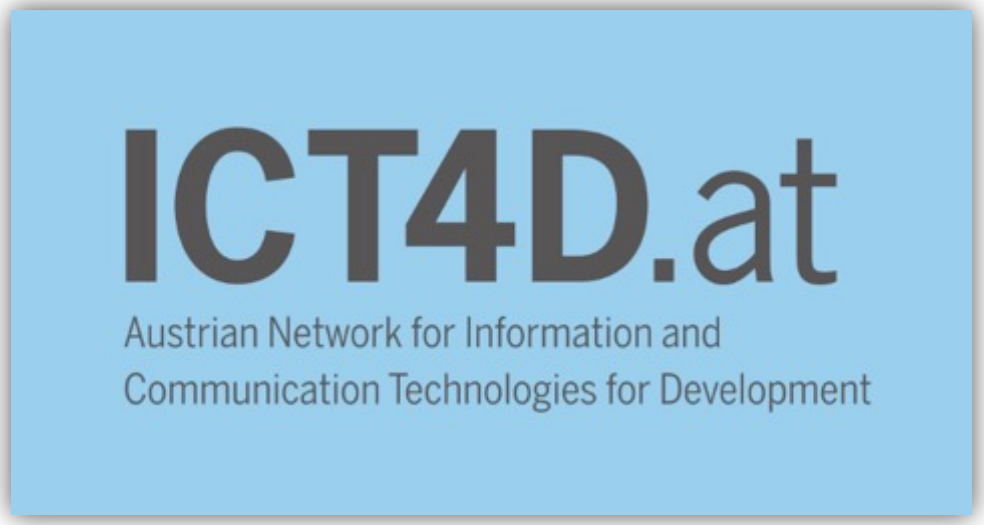


Project: IdeaContest

- „Rebooting Hope: Digital Solutions for Environmental and Social Recovery“
- Open innovation idea platform
- 65 Ideas submitted, 3 winners



https://www.ict4d.at/idea-contest-2023/



A World of Equal Opportunities for All

Through knowledge, tools and networks we empower people to develop the skills they need to achieve their full potential.

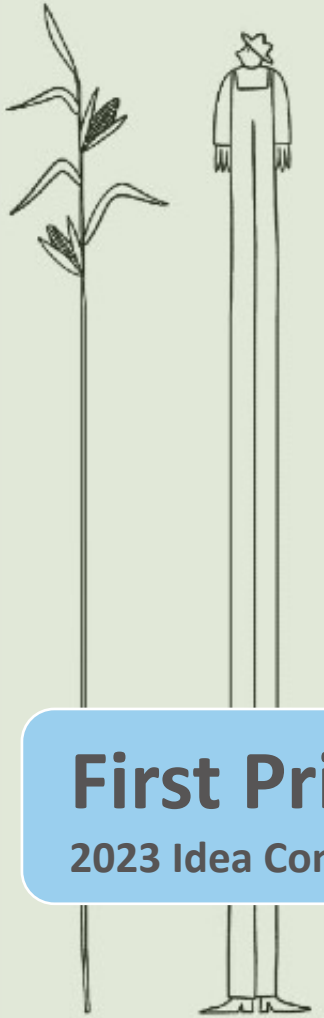
paul.spiesberger@ict4d.at

ICT4D.at

Open Innovation Idea Contest

Establishment of a regenerative organic micro-farming network directly linked to organisations

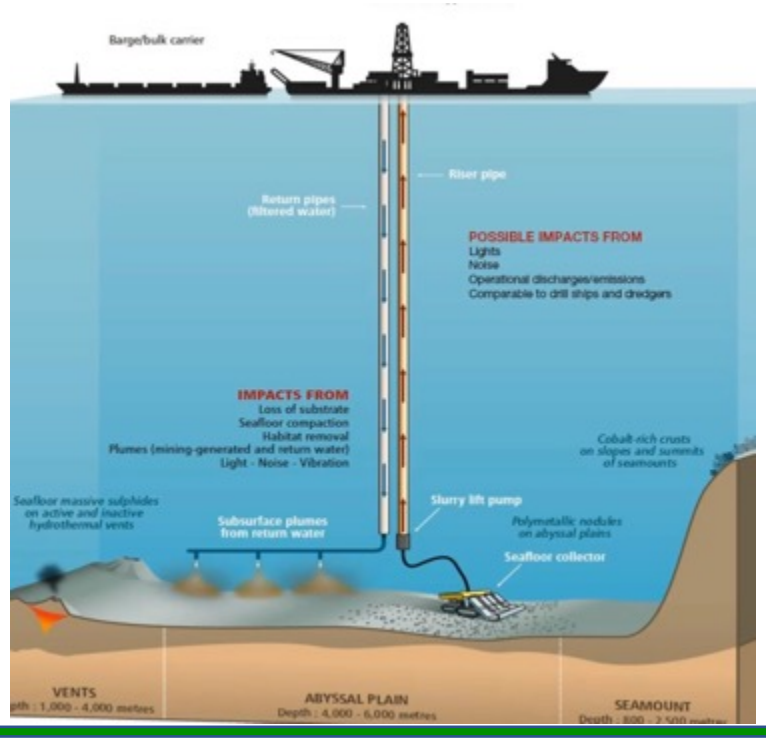
soilful



First Prize: Soilful

2023 Idea Contest

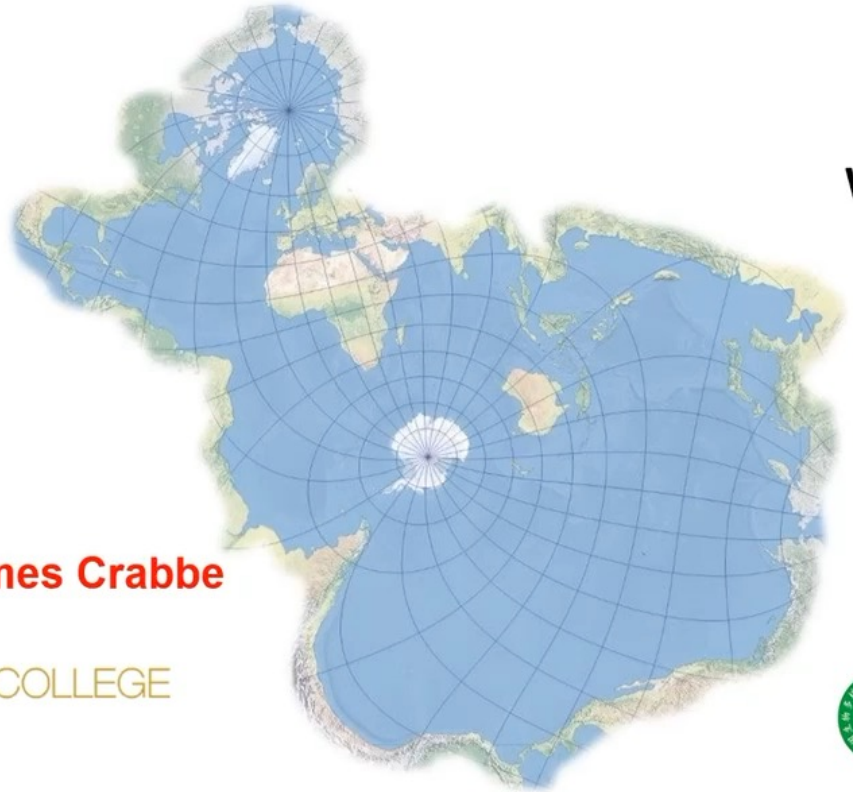
James Crabbe: Deep Sea Mining environmental impact



WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

THE FRAGILITY OF THE OCEAN FOR SMALL ISLAND DEVELOPING STATES: FROM CORAL REEFS TO DEEP SEA MINING



We live on planet ocean

DESC

Professor James Crabbe

WOLFSON COLLEGE
UNIVERSITY OF OXFORD

China Biodiversity Green Development

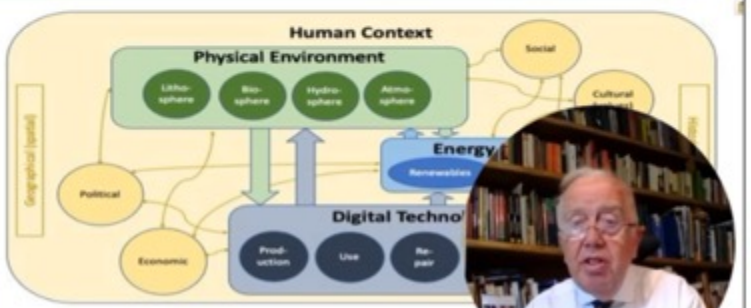
What makes DESC special?

The characteristics that make DESC different:

1. A **holistic approach** to the inter-relationships between digital technologies and the physical environment;
2. An emphasis on **both the positive benefits and the negative harms** resulting from the use of digital technologies;
3. Its focus on the **entire human-environment interface**, and not just on climate change and carbon; and
4. The combination of attention paid to both **environmental sustainability** and the **sustainability of digital technology business models**.

DESC's three main areas of activity:

1. **Research**: collating and sharing existing knowledge, and undertaking novel research where gaps are identified;
2. **Practice**: engaging with and supporting initiatives that implement positive change; and
3. **Policy**: influencing policy makers and those working in policy environments at local, national and international scales.

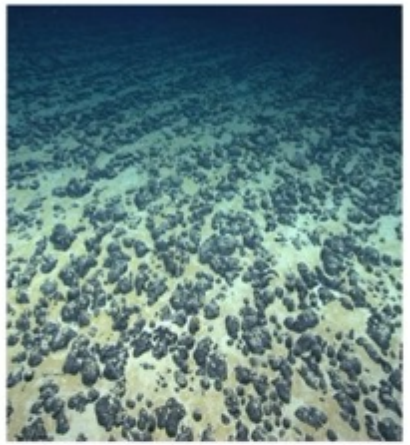


The DESC Conceptual Frame

DEEP SEA MINING: minerals for renewable technologies

- **Retrieving mineral deposits from the deep sea** – the area of the ocean below 200 m.
- **Depleting terrestrial deposits** and **rising demand for metals** are stimulating interest in the deep sea, with commercial mining **imminent**.
- The scraping of the sea floor and pollution from mining processes can **wipe out entire species** – many yet to be discovered.
- **Environmental impact assessments, regulation and mitigation strategies** are limit the impacts of deep-sea mining.
- **Comprehensive baseline omics studies** to improve our understanding of the deep s

0:51.30

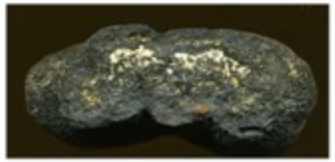


There are three types of deep sea mining that have generated great interest:

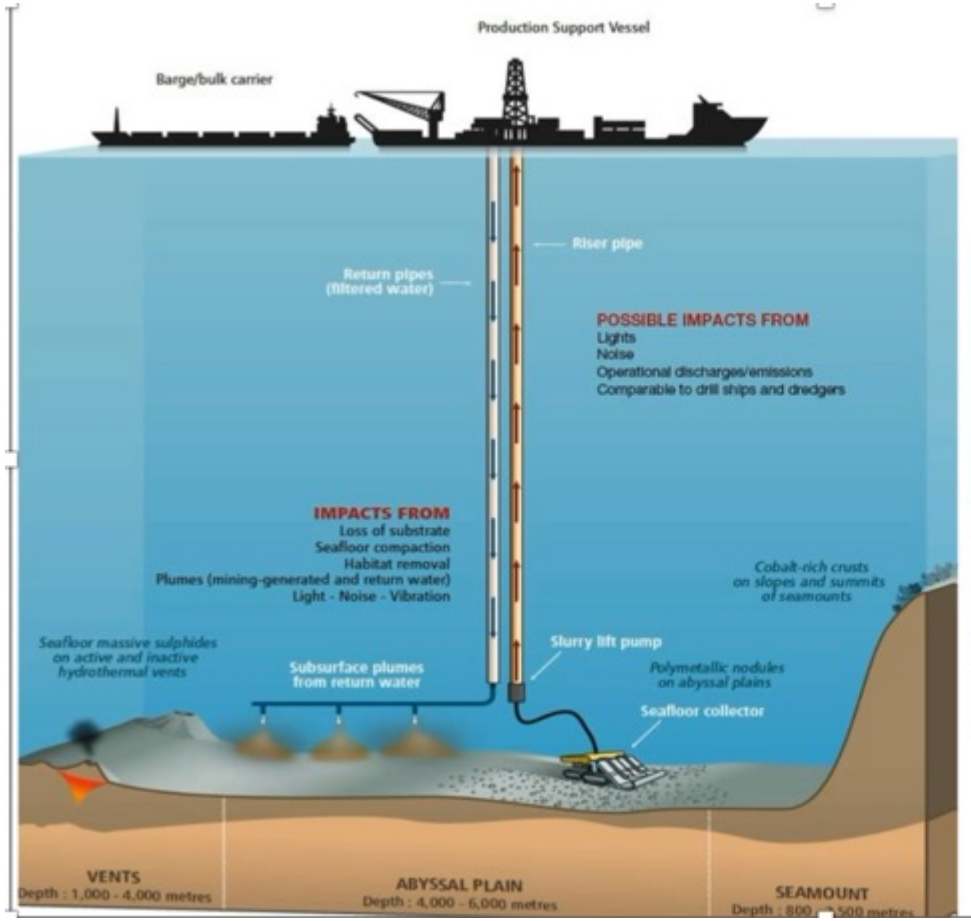
- polymetallic nodule mining,
- polymetallic sulphide mining,
- cobalt-rich ferromanganese crusts.

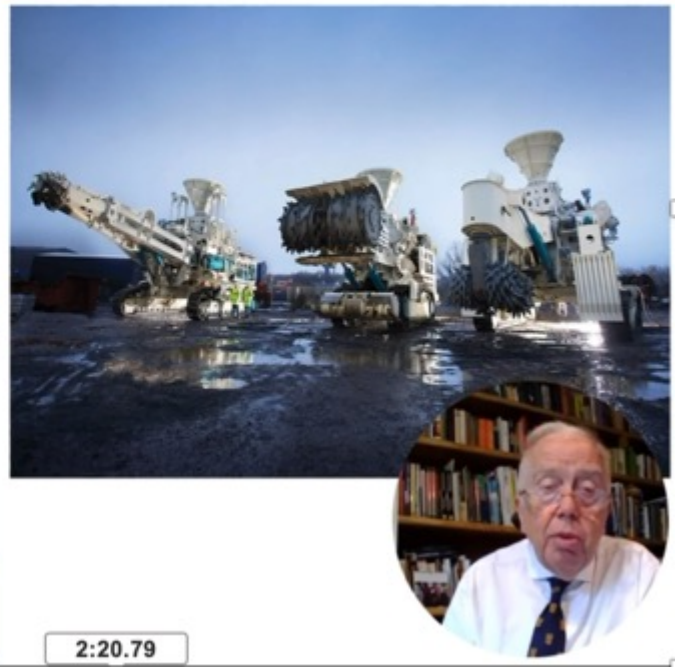
- The majority of proposed deep sea mining sites are near polymetallic nodules or active and extinct hydrothermal vents at 1,400 to 3,700 metres (4,600 to 12,100 ft) below the ocean's surface.

- The vents create globular or massive sulphide deposits which contain valuable metals such as silver, gold, c
manganese, cobalt and zinc.



1:40.17


Production Support Vessel
Barge/bulk carrier
Riser pipe
Return pipes
(filtered water)
POSSIBLE IMPACTS FROM
Lights
Noise
Operational discharges/emissions
Comparable to drill ships and dredgers
IMPACTS FROM
Loss of substrate
Seafloor compaction
Habitat removal
Plumes (mining-generated and return water)
Light - Noise - Vibration
Cobalt-rich crusts
on slopes and summits
of seamounts
Seafloor massive sulphides
on active and inactive
hydrothermal vents
Slurry lift pump
Subsurface plumes
from return water
Polymetallic nodules
on abyssal plains
Seafloor collector
VENTS
Depth : 1,000 - 4,000 metres
ABYSSAL PLAIN
Depth : 4,000 - 6,000 metres
SEAMOUNT


2:20.79

Serge Stinckwich: The positive value of a systems approach and AI

https://www.latamarte.com/en/articles/QtRJ/

Director of Research

United Nations University, Institute in Macau

UNU Macau

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

Towards a better understanding of the interface between digital tech and the physical environment How complex system and AI might help

- **Serge Stinckwich**
- Head of Research
- United Nations University
- Institute in Macau

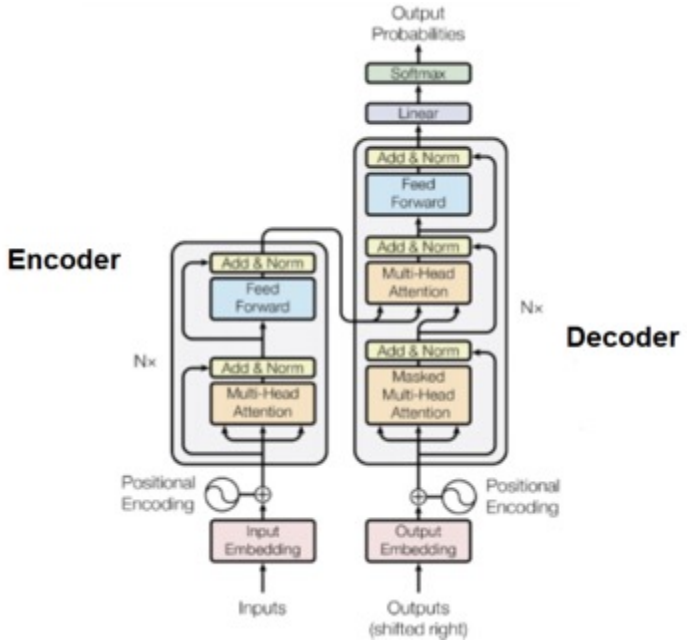
UNU Macau

17 United Nations' Sustainable Developments Goals

How Large Language Models are working?

- Suppose you ask your favorite LLMs: *"The first person to walk on the Moon was …"*
- What is the answer? **"Neil Armstrong"**
- How the model sees your question?
- *Given the statistical distribution of words in the vast public corpus of (English) text, what words are most likely to follow the sequence, "The first person to wa on the Moon was..."*

- **Language model task: predicts the most probable words following a series of words based on them.**



What are the risks of LLMs?

- ***Employment***: ChatGPT poses a potential risk to jobs in the creative industries, including skilled knowledge workers, and journalists, software developers and even academics.
- ***Academia***: Concerns that ChatGPT enables people without significant domain expertise to write scientific papers, thereby raising questions about the future of research production and the nature of authorship.
- ***Education***: ChatGPT can generate plausible essays across a wide range of topics. May encourage cheating and plagiarism. Student writing assignments could become obsolete. Some universities blocked access to ChatGPT.
- ***Compliance***: Major banks in the US have banned and blocked the use of ChatGPT on concerns that its use could result in data and information leaks, potentially breaching government regulations.
- ***Social cohesion***: ChatGPT's ability to generate plausible-sounding misinformation, disinformation and hate speech is seen to have potentially serious effects on the well-being of communities, and on democracy.
- **Transparency**: We don't know exactly details about the ChatGPT algorithm (**black box**), where the data come from and how it was curated.

- **- Environmental impacts**: Large Language model can have a huge impact on greenhouse gas emission.

How much is needed to train Large Language Models?

On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜

Emily M. Bender*
ebender@uw.edu
University of Washington
Seattle, WA, USA

Timnit Gebru*
timnit@blackinai.org
Black in AI
Palo Alto, CA, USA

Angelina McMillan-Major
aymm@uw.edu
University of Washington
Seattle, WA, USA

Shmargaret Shmitchell
shmargaret.shmitchell@gmail.com
The Aether

ABSTRACT

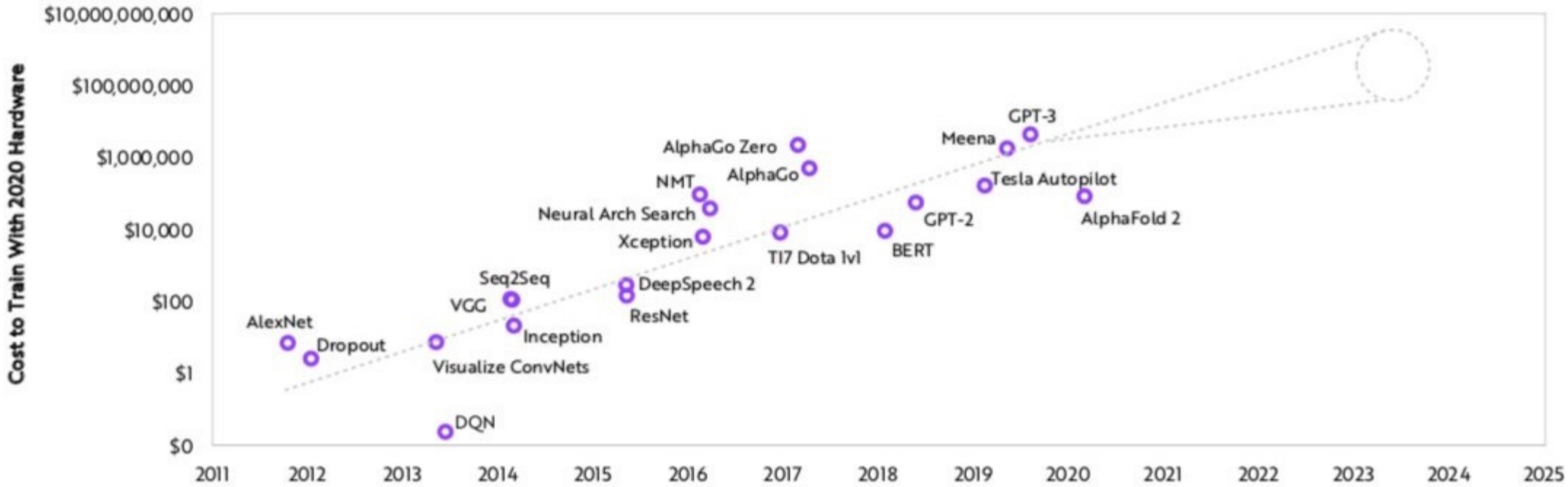
The past 3 years of work in NLP have been characterized by the development and deployment of ever larger language models, especially for English. BERT, its variants, GPT-2/3, and others, most recently Switch-C, have pushed the boundaries of the possible both through architectural innovations and through sheer size. Using these pretrained models and the methodology of fine-tuning them for specific tasks, researchers have extended the state of the art alone, we have seen the emergence of BERT and its variants [39, 70, 74, 113, 146], GPT-2 [106], T-NLG [112], GPT-3 [25], and most recently Switch-C [43], with institutions seemingly competing to produce ever larger LMs. While investigating properties of LMs and how they change with size holds scientific interest, and large LMs have shown improvements on various tasks (§2), we ask whether enough thought has been put into the potential risks associated with developing them and strategies to mitigate these risks.

Year	Model	# of Parameters	Dataset Size
2019	BERT [39]	3.4E+08	16GB
2019	DistilBERT [113]	6.60E+07	16GB
2019	ALBERT [70]	2.23E+08	16GB
2019	XLNet (Large) [150]	3.40E+08	126GB
2020	ERNIE-GEN (Large) [145]	3.40E+08	16GB
2019	RoBERTa (Large) [74]	3.55E+08	161GB
2019	MegatronLM [122]	8.30E+09	174GB
2020	T5-11B [107]	1.10E+10	745GB
2020	T-NLG [112]	1.70E+10	174GB
2020	GPT-3 [25]	1.75E+11	570GB
2020	GShard [73]	6.00E+11	–
2021	Switch-C [43]	1.57E+12	745GB

Table 1: Overview of recent large language models

Deep Learning Requires Boundless Computational Power

While advances in hardware and software have been driving down AI training costs by 37% per year, the size of AI models is growing much faster, 10x per year. As a result, total AI training costs continue to climb. We believe that state-of-the-art AI training model costs[1] are likely to increase 100-fold, from roughly $1 million today to more than $100 million by 2025.



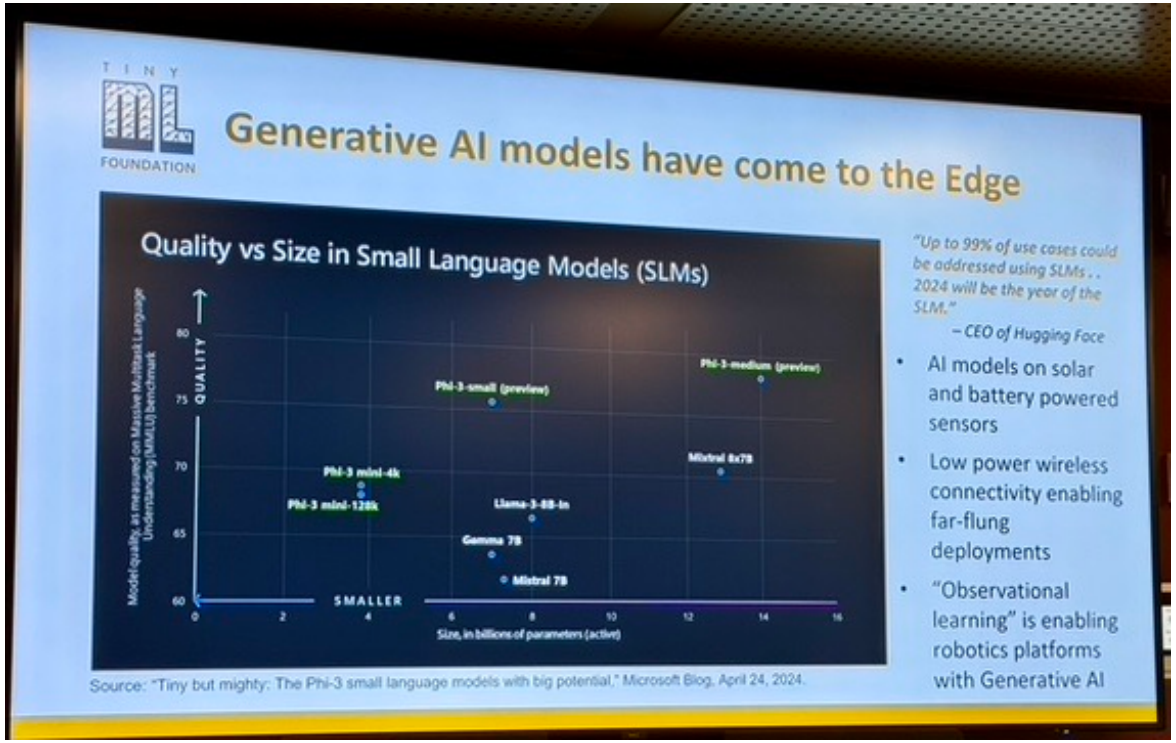
Reference: https://twitter.com/draecomino/status/1362051398041534468

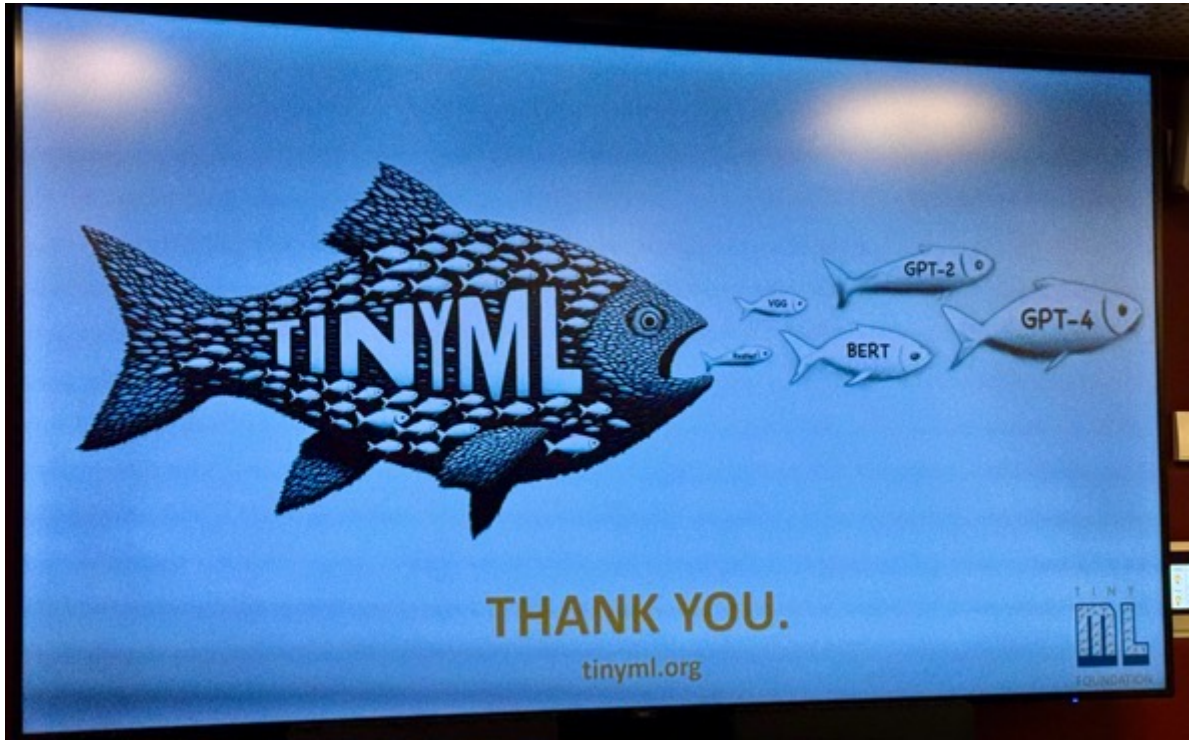
Greenhouse gas emission of Large Language model

- Difficult to know exactly because LLM are all own by tech companies, cost of training vs running.

- BERT (Bidirectional Encoder Representations from Transformers)
  - Google, 2019
  - Parameters: 300 millions
  - Training on a GPU is roughly equivalent to a trans-american flight
- BLOOM
  - Hugging Face, 2022
  - Training: 25 tons of carbon dioxide emissions (30 flights between London and NY)
  - But less than equivalent LLMs because use nuclear energy
- GPT-3
  - Training: 500 tons of carbon dioxide emissions (600 flights)

Towards Smaller Language Models





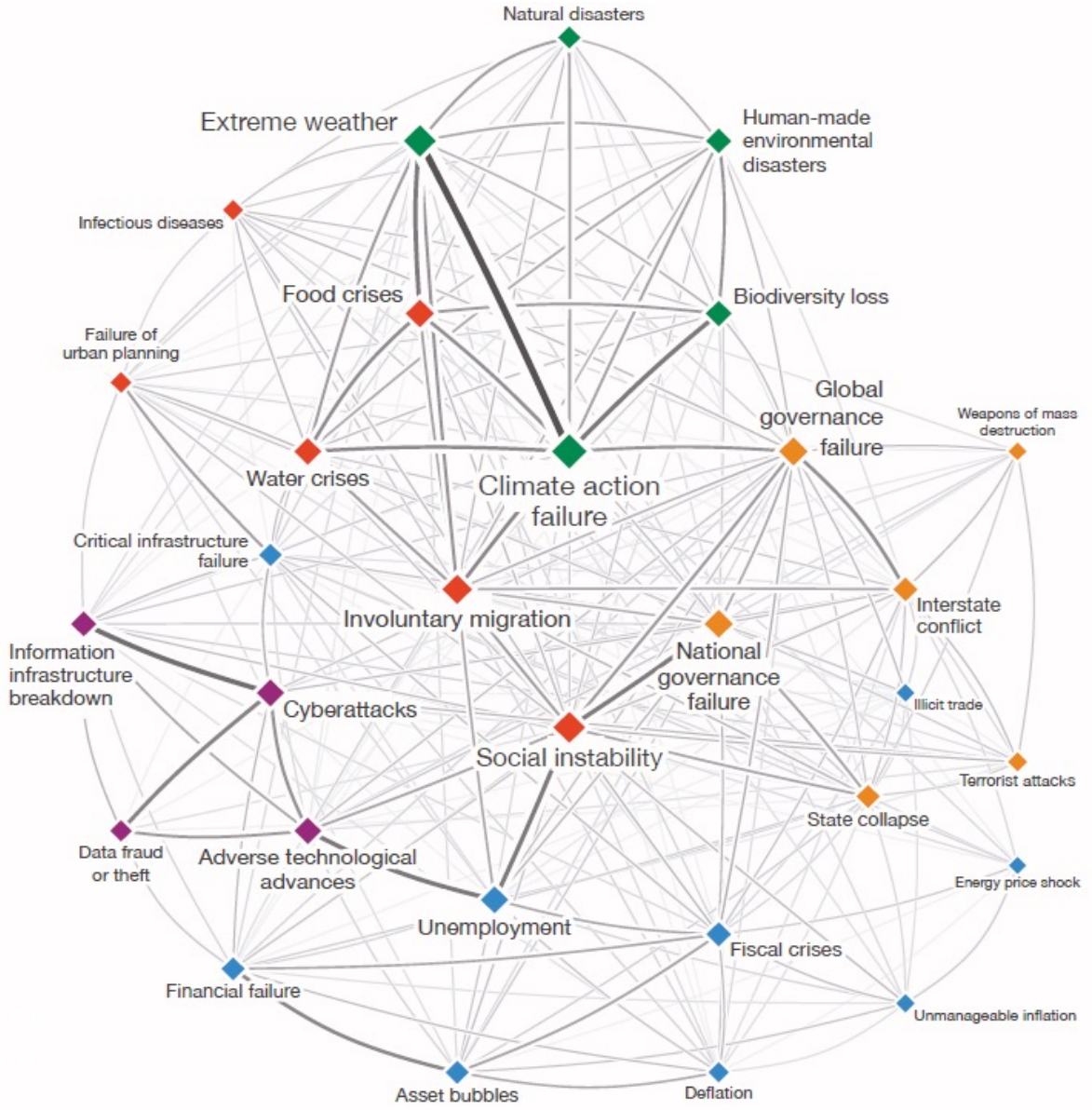
Using Complex Systems Thinking to achieve the SDGs

- Consider human-machines interactions as **socio-technical systems (STS)**

- **Complex systems:** (1) consists of many interacting agents/components and their environments in multiple ways. (2) Exhibits properties as whole often unexpected and very different from the behavior of individual components. (3) Tends to change theirs states dynamically often showing unpredictable long term behavior.

- How to develop an integrated/holistic approach in order to have a comprehensive view of the complex interactions between humans, technologies and environment at multiple levels?

- How to help decision-makers to understand complex relationships in SDG and inform the design of post-2030 **Agenda?**



Participatory Approach to bring more humane values in Digital Technologies

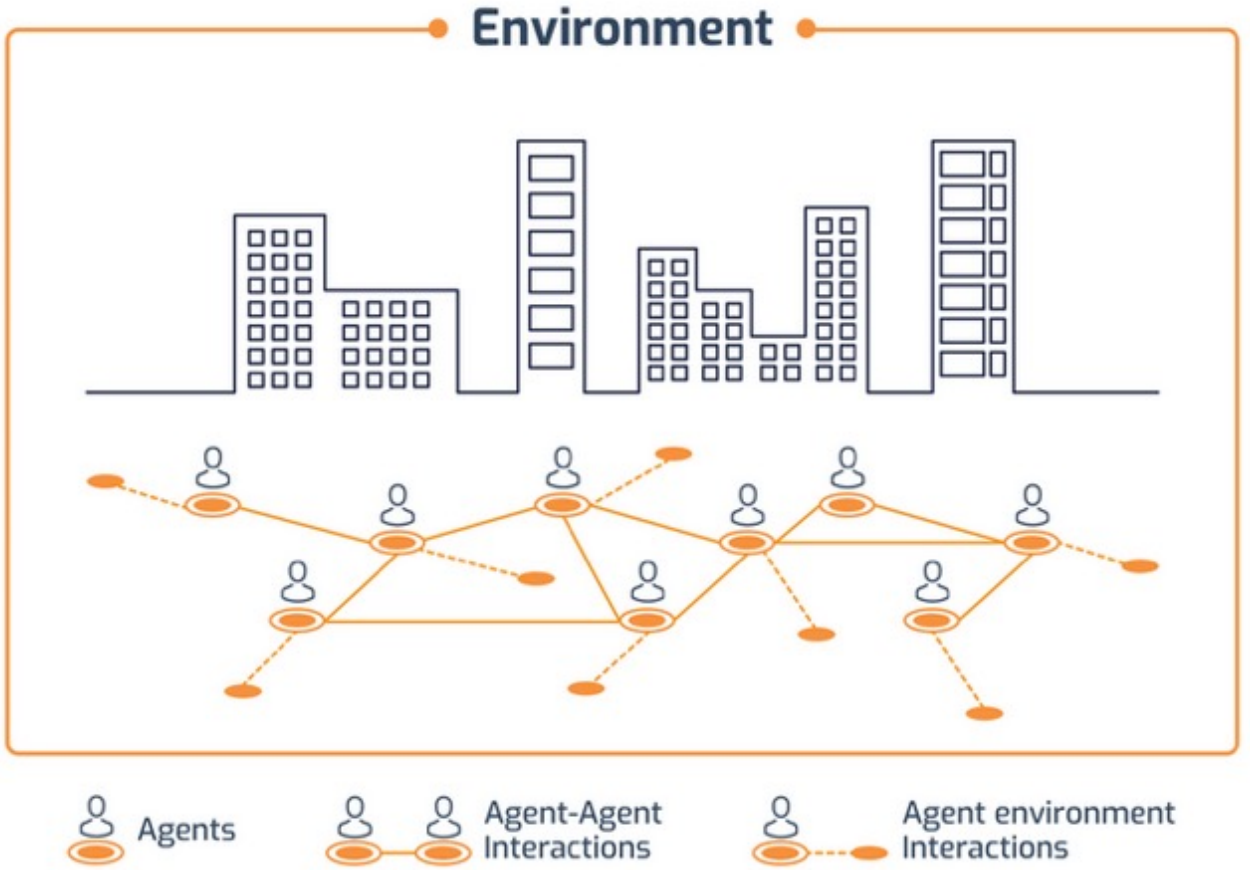
- **Citizen/policy & citizen/science nexus**
- **“Leave no one behind”**
- Digital technologies and AI have positive and negative impacts on the society/environment.
- How to engage citizen/stakeholders in the design of policies in order to have more humane technologies?
- How to not only have better science but also empower marginalised people at the same time?

Agent-based Simulations for Social Good

- **Social Simulation**
  - Apply computational methods to study issues in social science.

- **Agent-based model**
  - Agents are individuals, organisations or group of people
  - Agents have specific characteristics
  - They are spatialized and mimic human behaviors

More and more used for policy making understanding and implementation: waste recycling, climate social tipping point, adoption of electtric vehicles, …



Using AI voice to Make Collective Decision-Making more inclusive

- “Scale AI rescue the SDGs. […] What role will AI play in humanity’s future?”, Doreen Bogdan-Martin, Secretary General of the IUT

- AI systems can give voice to previously unheard stakeholders (marginalised populations and future generations of humans) and make collective devision-making processes more inclusive, **but only if they are designed thoughfully and deployed responsibility.**

- **AI Voice** (Angela Aristidou, Standford University) as an innovative means to insure the inclusion of diverse groups.

http://macau.unu.edu/

unumacau

Yuliya Morenets: A perspective from the world's youth

Yuliya was meant to be participating and moderating, but sadly has COVID. We would like to take this opportunity to wish her a speedy recovery

together against cybercrime TaC

Youth IGF

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

A short overview of YouthDESC

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

Youth DESC

@youthdesc

https://ict4d.org.uk

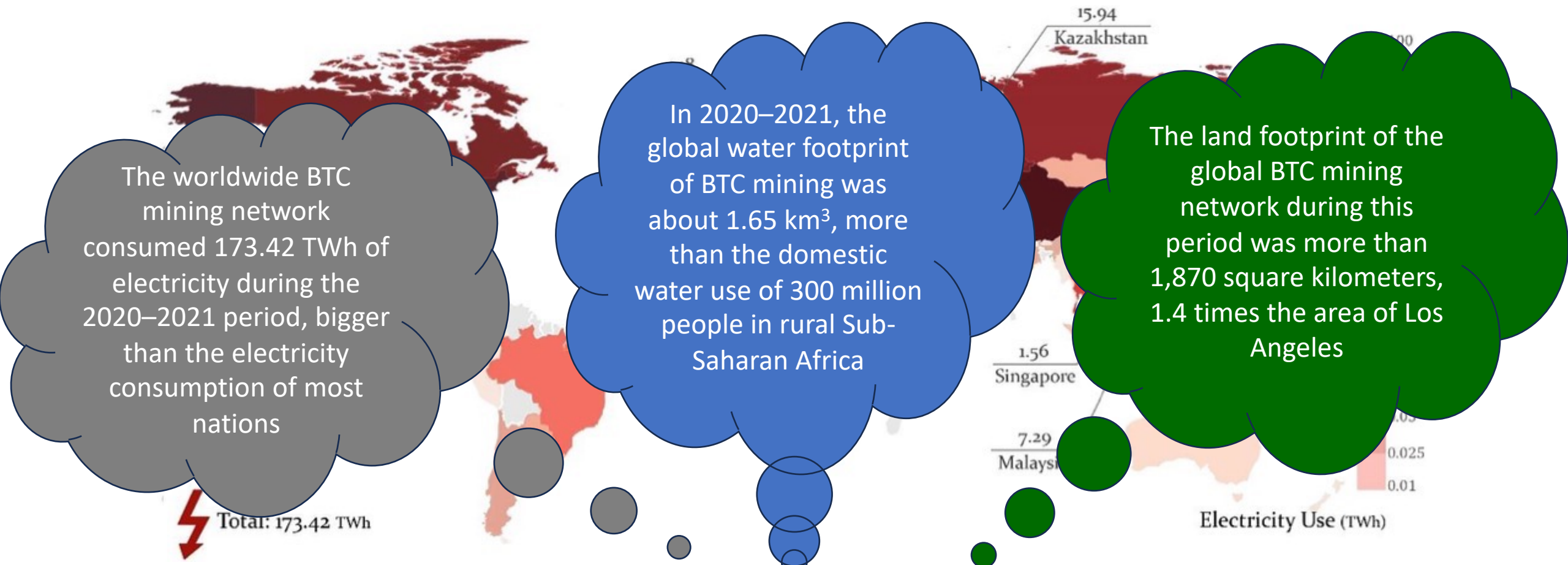
Towards the end…

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

…of the session!

A reminder: environmental impact of Bitcoin mining

WSIS+20 FORUM HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland



The worldwide BTC mining network consumed 173.42 TWh of electricity during the 2020–2021 period, bigger than the electricity consumption of most nations

In 2020–2021, the global water footprint of BTC mining was about 1.65 km^3, more than the domestic water use of 300 million people in rural Sub-Saharan Africa

The land footprint of the global BTC mining network during this period was more than 1,870 square kilometers, 1.4 times the area of Los Angeles

Sanaz Chamanara, S. Arman Ghaffarizadeh, Kaveh Madani (2023) https://doi.org/10.1029/2023EF003871

What needs to be done?

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

Questions and comments: how do we build the coalition?

ICT4D Collective

Final thoughts

WSIS+20 FORUM
HIGH-LEVEL EVENT
27-31 May 2024
Geneva, Switzerland

30 seconds each

ICT4D Collective