Bits & Bäume

SHAPING DIGITAL TRANSFORMATION FOR A SUSTAINABLE SOCIETY

Contributions from Bits & Bäume

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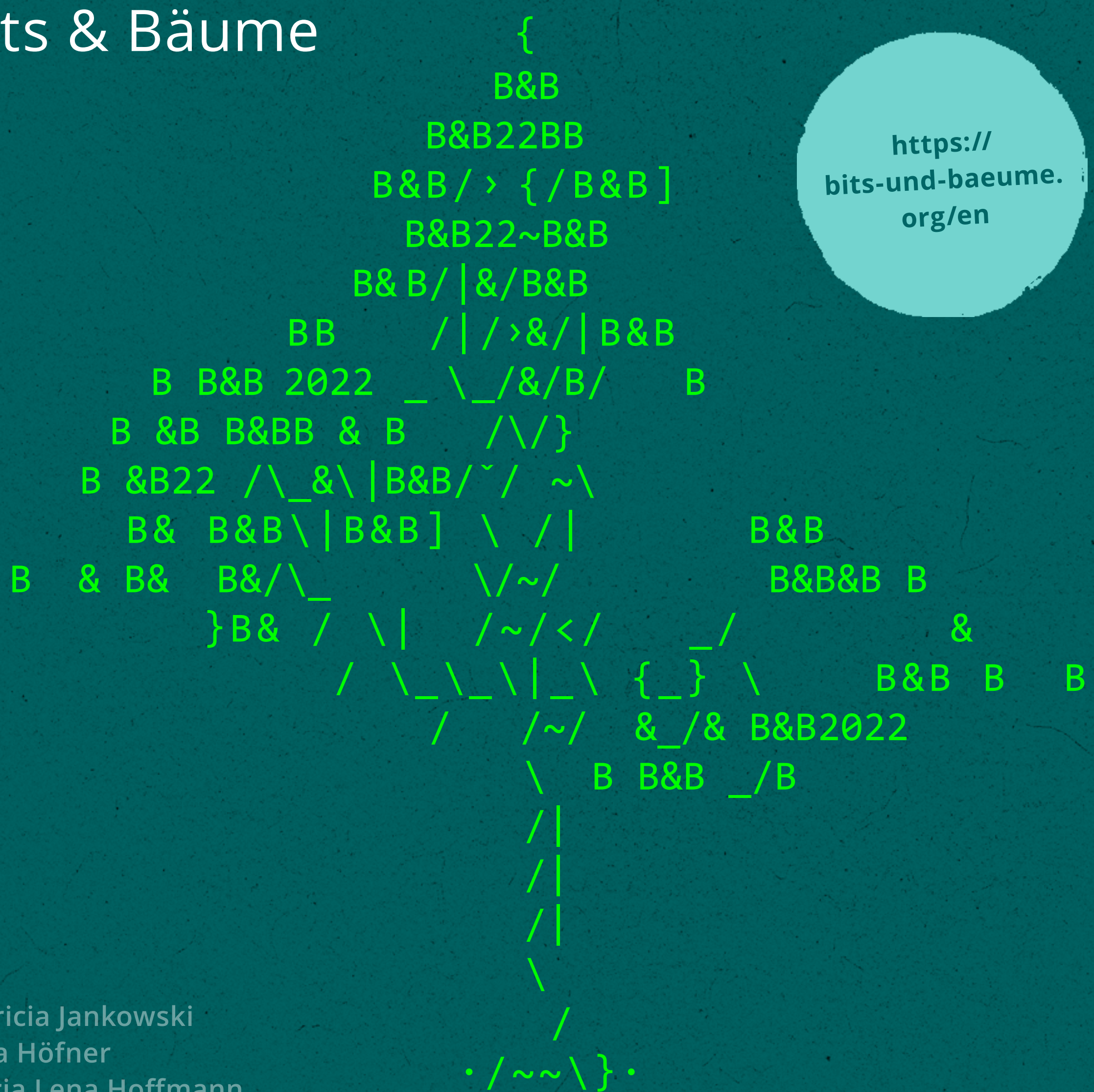

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TRANSFORMING...


Bits & Bäume

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STIFTUNG MERCATOR

THE BITS & BÄUME CONFERENCE 2022 WAS ORGANISED BY THE 13 HOSTING ORGANISATIONS:
Bund für Umwelt und Naturschutz Deutschland (BUND), Brot für die Welt, Chaos Computer Club (CCC), Deutscher Naturschutzring (DNR), Einstein Center Digital Future / Technische Universität Berlin, Forum InformatikerInnen für Frieden und gesellschaftliche Verantwortung e. V. (FIfF), Free Software Foundation Europe (FSFE), Germanwatch e.V., Institut für ökologische Wirtschaftsforschung (IÖW), Konzeptwerk Neue Ökonomie, Open Knowledge Foundation Deutschland e. V. (OKF), Weizenbaum Institut e.V.

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Conference documentation including more than 200 recordings.
https://bits-und-baeume.org/en/conference-2022

CONTENT

EDITORIAL

Dear reader,

in the face of aggregating planetary crises, the importance of aligning digitalisation and new technologies with sustainability is increasingly recognised in politics and society. Yet, the current design of digitalisation continues to fail societies and ecosystems on multiple fronts. To address these pressing issues, the critical tech community (‹Bits›) and environmental community (‹Bäume›) came together for the second Bits & Bäume conference in Berlin in autumn 2022. The conference served as a platform for researchers, practitioners, activists, government officials, hackers and many more to network, learn, collaborate and delve into scenarios and frameworks to shape digitalisation in the service of environmental and social sustainability. Simultaneously, the community-based organisation model of the conference proved that embracing unconventional approaches creates – notwithstanding any new challenges they might bring – a fruitful outcome and rewarding experience for all. With over 250 contributions, the conference programme spanned across the numerous and diverse interconnections between Bits & Bäume and all socio-political spheres. While the 2018 and 2022 conferences were milestones for connecting environmental and tech communities and raising key issues to the political agenda, Bits & Bäume is more than just a conference. We strive to be a movement and a community that is constructive, active, inclusive and solution-oriented. We believe that together we can take decisive action to achieve a social-ecological transformation where digital technologies and infrastructures serve rather than counteract sustainability.

This journal builds on the discussions that took place on the stages and the sidelines of the conference and intends to promote further exchange among participants and beyond. We are grateful and encouraged by the overwhelming response from practitioners and researchers to the call for papers. Nonetheless, the selection of contributions to this journal can only cover a fraction of the topics and viewpoints related to digitalisation and sustainability.

We want to offer solutions and continue not only to set the political agenda, but also directly influence political decisions to enable a democratic, socially just and ecologically sustainable digital transformation. By combining our political demands set by all 13 Bits & Bäume hosting organisations with the different perspectives of our more than 65 authors, we want to demonstrate that a different digitalisation is feasible. To help the discourse transcend national boundaries, we have made this journal accessible to a broad audience by publishing it free, digitally and in English. We hope that this publication offers you fresh perspectives, illuminates new pathways and inspires you to get or stay actively involved in the Bits & Bäume movement.

Patricia Jankowski, Anja Höfner & Marja Lena Hoffmann

HOW TO READ

The journal is organised into six chapters starting with a broad overview of the challenges at the intersection of sustainability and digitalisation. This makes sure everyone is on the same page, regardless of their background and previous knowledge. Our authors then dive into more concrete discussions, research areas and practical insights pointing towards the transformation a truly sustainable digital society needs.

To give you an idea of the nature of the articles, they are tagged as either of these:

RESEARCH ARTICLE
DEBATE ARTICLE
PRACTICAL PERSPECTIVE

However, we asked our authors to keep even the more complex topics accessible and hereby invite you to become familiar with both, the ‹Bits› and the ‹Bäume› side of digitalisation.

The first chapter is focussed on selected challenges of everyday digital technologies, including their current use and impact measurements. For the sake of transparency, our authors point to some of their societal and environmental implications. Chapter two questions current decision-making around digitalisation and lays a foundation for a socio-ecological transformation by introducing suitable values as guidance. The conceptual frameworks and concrete examples described in the third and fourth chapters provide further insights and evidence by showing how digitalisation is already lived sustainably. In the fifth chapter, our authors address developments in German and European policy-making. The thirteen hosting organisations of the Bits & Bäume conference 2022 then lay out their concrete demands for policy changes towards a digitalisation for all. To get these and other demands heard and quickly implemented, the last chapter stresses the importance of an active civil society. We therefore end with a call to action including practical advice on how you can get involved right now to contribute to the socio-ecological digital transformation we aim for.

Dive in!

{ Authors *Tilman Santarius & Nicolas Guenot*

PREFACE

Reasons for the Success of the Second Bits & Bäume Conference in 2022

The first ‹Bits & Bäume› Conference in November 2018 was a remarkable success. No wonder the conference caused a stir in politics and the public sphere: It was the first public civil society event – indeed in Germany, but probably worldwide – to address today's global environmental and social challenges in the face of rapidly advancing socio-technological change. After all, digitalisation does bring about nothing less than a restructuring of areas of social life, including economic production and consumption.

Who would have thought that the success of second Bits & Bäume Conference in 2022 would surpass that of the first? Wasn't it a bit daring to set up a follow-up event and risk that it would all too easily turn into a boring rip-off? Yet despite all the obstacles that confront those preparing another large public event, over and above those due to the wake of the COVID-19 pandemic, we decided to do it again. And we have been rewarded with an even bigger response. This time, more than 2,500 people participated in the conference. The programme covered close to 300 events over 18 stages and rooms. And the audience at the 2022 conference came from significantly more heterogenous communities: ones beyond Bits (i.e., ICT communities) and Bäume (‹trees› i.e., sustainability-minded communities). In fact, variety of backgrounds and approaches was one of the important goals of the diverse organisations that jointly hosted the conference, a diversity that clearly contributed to the conference's success.

///<quote>
How can digitalisation be designed and controlled in such a way that it contributes to a social and ecological transformation of society?
///</quote>

This extended circle of speakers and participants allowed us to spread the key question even further throughout society: *«How can digitalisation be designed and controlled in such a way that it contributes to a social and ecological transformation of society?»*

THREE GOALS GUIDED THE 2022 CONFERENCE

To diversify and increase the conference's breadth, the group of hosting organisations grew to 13 organisations in 2022. Yet more importantly, an open organisational model was chosen, allowing other individuals and additional organisations to participate in various working groups over the conference's two-year preparatory process.

To help the movement to expand and flourish, the hosting organisations had set themselves three goals. First, the cooperation between ‹Bits› and ‹Bäume› representatives should not only be consolidated but also broadened. In the aftermath of the 2018 conference, there were a number of follow-up activities, such as the ‹Forum Bits & Bäume› series of talks, two local groups and Bits & Bäume meet-up groups, and a local conference in Dresden in 2019. Nevertheless, for many actors, the exchange on issues relevant to everyday life and work remained relatively limited. Above all, there was still little coordination on addressing political processes, for example, with regard to the ongoing legislative processes around digital policy in the European Union (EU) or at national levels.

///<quote>
There is an urgent need for a strong civil society and academic discourse telling the story of a different digitalisation, one proposing concrete solutions democratically oriented towards the common good.
///</quote>

Accordingly, and thanks to a more general interest in sustainability and the 2022 conference's wider appeal and larger audience, a second goal of the conference was to explore the specifically sustainability-oriented design of digitalisation as a social and political process more closely. Unfortunately, it currently seems as if sustainability policy and digital policy are being negotiated on two different planets. There is an urgent need for a strong civil society and academic discourse telling the story of a different digitalisation, one proposing concrete solutions democratically oriented towards the common good.

To fulfil this second goal, the Bits & Bäume Conference in 2022 hosted a number of forums trying to bridge the gap between socio-ecological demands and realpolitik. For example, two state secretaries from the German Federal Ministry of Economics and the Ministry of the Environment, several parliamentarians from different parties, various employees from public authorities, and other decision-makers at the municipal level had an active exchange with academics and NGOs. At the same time, specific guidelines and control instruments were discussed at other events in order to push for a more sustainability-oriented digital governance.

Third, the Bits & Bäume 2022 Conference wanted to achieve not only political orientation but also networking between civil society and academia and representatives and founders of small and medium-sized companies. The focus was on companies developing cooperative and collaborative business models as alternatives to the dominant approach of digital capitalism. The conference offered room for a constructive and critical dialogue with such actors. Business models, applications and good practices were presented, which, as concrete success stories, help start a solution-oriented dialogue. Finally, a small competition was organised where new ideas and approaches were presented to a jury and awarded prizes.

A COMPREHENSIVE CATALOGUE OF POLITICAL DEMANDS

Even at the first Bits & Bäume Conference, common demands for a sustainable digitalisation were presented. Building on these relatively general demands, the 13 hosting organisations of the 2022 conference had developed much more specific and comprehensive proposals. These demands are based on an integrative understanding of the various sustainability dimensions – ecological, social, technical, political, economic – and are guided by the ambition to shape a future in which digital technology plays a positive role to support and protect human rights, livelihoods, and the environment.

The political demands of the Bits & Bäume Conference 2022 are presented in more detail in Chapter 5. Their bottom line is: Technological development must fit within planetary boundaries and ensure that it supports a globally fair and sustainable society (and economic system), including dimensions of both inter-national and intra-national justice.

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///</quote>

When creating this catalogue of demands, the Bits & Bäume hosting organisations were aware it would not cover all political changes necessary to shape a truly transformative, sustainable form of digitalisation. But it was not about completeness. The demands reflect the variety of organisations' backgrounds, interests, and approaches. Their diverse fields of expertise were useful in addressing the challenges arising at the interface of ecology, social justice, and economic transformation. In this respect, these demands offer a comprehensive normative framework of values, providing actors in but also beyond the Bits & Bäume movement with orientation for their actions. At the same time, they help in assessing current political and economic developments and in checking the implications of legislation's technological developments against a view of what the ‹common good› could be in a sustainable society.

FROM A CONFERENCE THROUGH A MOVEMENT TO AN ESTABLISHED COALITION

Compared to the Bits & Bäume Conference in 2018, the emphasis on the link between digitalisation and sustainability was no longer new in 2022. In civil society, but also in business and politics, a number of actors had already started dealing with it. For example, the 36th congress of the Chaos Computer Club (36C3) in December 2019 followed the motto ‹Resource Exhaustion›, and the re:publica conference in 2020 offered a stage for urgent challenges such as climate change and migration under the motto ‹As soon as possible›. Even the 2020 digital summit of the German Federal Ministry of Economics was devoted to sustainability.

However, the COVID-19 pandemic temporarily marginalised the topic again, and amid social distancing and lockdowns, the digitalisation process was accelerated. This process has often followed unreflected and largely uncontrolled economic interests instead of democratic ones. As a result, the digital divide between Global North and Global South, as well as that within the Global North, has continued to grow. Energy and resource consumption in the ICT sector have also steadily increased despite significant efficiency improvements. Finally, economic power has become even more concentrated through platforms and digital services in the hands of just a few corporations, which often act opaquely and are difficult to regulate but have a relevant impact on public opinion and political discourse.

Given some highly risky and socially problematic developments in digital markets, one publication at the Bits & Bäume conference called for a fundamental digital reset to redirect technological progress towards a deep social sustainability transformation **(see Digitalization for Sustainability (D4S), 2022).** Against this background, the voice of civil society is more important than ever in re-orientating digitalisation towards a sustainable future. The Bits & Bäume 2022 Conference managed to bring together a lot of momentum, creativity, and passion from many volunteers from the Bits & Bäume communities, who work together to shape a socially and environmentally just future. The conference released a lot of positive energy and motivation for taking on this challenge! It also strengthened the interest in establishing a solid network of organisations continuously pushing for a sustainable form of digitalisation. The Bits & Bäume movement is now building a more permanent structure, as a result of the success of this second conference, thus creating the basis for this struggle to be consolidated and intensified in the coming years.

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This journal presents a look back at the conference's topics, speakers, and discussions – but it also provides a treasure trove with proposals and concepts that propel the Bits & Bäume movement beyond 2022 and serve as a compass to fight the social and political challenges ahead. Another digitalisation is possible! The following chapters present mosaic pieces of a fair future in which technology serves the people, not the other way around. }

ABOUT THE AUTHORS

/// **Tilman Santarius** is a researcher and activist who has worked on topics such as climate policy, world trade, sustainable economics, global justice and digital transformation. He is a professor at the Technical University of Berlin and Einstein Centre Digital Future. He has initiated the first Bits & Bäume conference. He serves on the Board of Greenpeace Germany and is co-founder of the ‹communicty supported agriculture› project FrohLaWi.de. Tilman's latest book has been published at the 2022 Bits & Bäume conference: ‹Digital Reset. Redirecting Technologies for the Deep Sustainability Transformation›. More information at: www.santarius.de

/// **Nicolas Guenot** works for the Konzeptwerk Neue Ökonomie in Leipzig on the digital transformation and social-ecological critiques of digital capitalism. He holds a PhD in computer science and co-organised the Bits & Bäume conference in 2018 in Berlin and the Congress ‹Zukunft für alle› on utopia and transformation in 2020 in Leipzig.

1 Confronting the Challenges of Digitalisation and Sustainability

REDEFINING PROGRESS

The IPCC's Sixth Assessment Report has made it clear that ‹*the time to act is now*›. Drastic action is needed globally, and in all sectors, to halve greenhouse gas emissions by 2030 and prevent an even worse climate catastrophe. In addition to the threat of human-induced climate change, the world also faces massive species extinctions while social inequalities remain severe. To address these and many other challenges, digital technologies must contribute to improving, rather than hindering, living conditions and support the conservation of climate, biodiversity, and resources. Digitalisation must be designed to support a globally just and sustainable economic system and align technology development, education, and work in a way that strengthens social cohesion. To date, however, digitalisation still has many challenges to overcome. As long as its approach to identifying and addressing these challenges is comprehensive and inclusive, digitalisation can play an important role in a socio-ecological transformation.

The contributions in this chapter are intended to provide a brief insight into the challenges of today's digitalised world. First, an illustration is presented that highlights social and environmental issues arising from current forms of digitalisation. These are recurring themes targeted by Bits & Bäume. Next, our authors identify selected challenges. Fröberg describes how your data is being used by large technology corporations to make predictions about others and how this affects them. In the article, Fröberg argues that regulation should focus more on the social implications of data. The unsustainable use of digital technologies such as blockchain and artificial intelligence poses further issues. Robben and Hildebrandt explain why blockchain technology is part of the problem and not the often glorified solution to the challenges of organising society and, most importantly, saving the climate. Rehak then defines, classifies, and theorizes AI technology before contextualizing his analysis politically in regard to sustainability. The challenge of hidden resource wastage is the topic of Petri and Ruhenstroth's article, in which they present a method for measuring the abstract environmental impacts of app use and suggest ways to reduce it. A different methodological approach is taken by Kruijer, Tarara and Schulze, who present a concept for using the method of ‹life-cycle assessments› (LCAs) to measure the resource consumption of software in order to make its environmental impact comparable and more transparent.

Marja Lena Hoffmann

Friederike Rohde & Patricia Jankowski

WHY WORRY?

DIGITALISATION AND SUSTAINABILITY

The entanglements of digital technologies with our planet and our societies are multidimensional and complex. Before our authors dive deeper into the topic, this graphic provides an overview of some key issues, challenges and risks of the current forms of digitalisation.

DIGITAL INFRASTRUCTURES CAUSE RESOURCE AND ENERGY CONSUMPTION

- **Resource extraction has social & environmental consequences**
  - Poor working conditions in the Global South
  - Resource scarcity
  - Destruction of flora and fauna
- **Energy consumption**
  - For the production of hardware
  - For computing power
  - For data streams: often unnecessary, e.g.personalised advertising
  - Climate consequences of unsustainable energy generation

USE AND IMPLEMENTATION HAVE SOCIETAL CONSEQUENCES

- **Privacy risks, e.g. due to linking of personalised data**
- **Endangering democracy, e.g. through election interference, microtargeting or filter bubbles**
- **Perpetuating structural disadvantages and discrimination**
- **Deterioration of social and occupational health**

TECHNOLOGY DESIGN:

- **Software-induced hardware obsolescence**
- **Lack of user involvement in the development process**
- **Dependencies, lock-in effects**
- **Monopolistic structures**

Author Lieke Fröberg

RESEARCH ARTICLE

WHAT YOUR DATA DISCLOSES ABOUT OTHERS

Is Europe getting a hold on tech? New legislation such as the General Data Protection Regulation (GDPR), the Digital Services Act, and the Digital Markets Act have followed each other in rapid succession, and the Artificial Intelligence (AI) Act is in the pipeline. Internationally, Brussels is hailed as setting a high global standard that ripples through the world, with different countries adopting the European blueprint **(Bendiek and Römer, 2019).**

Beyond rules on paper, European lawyers are winning major lawsuits. Recently, based on the GDPR, it was ruled that social media giant Meta has to ask in a yes/no question for permission to show personalised advertisements **(Milmo, 2023; noyb, 2023).** While a major win for digital autonomy advocates, that ruling also exemplifies the focus on individual choice in reining in the fourth industrial revolution. Yet, there is another dimension to this story, one that is at the heart of the profitability of Big Tech yet remains inconspicuous to the public eye – the impact on others of sharing one's data.

IT IS NOT JUST ABOUT YOU

Current data regulation (the laws regulating how data can be extracted, stored, and shared by, for instance, companies) needs to be revised **(Micheli et al., 2020; Pike, 2020)**, as current buzzwords such as transparency, consent, and personal data protection distract from the real deal **(Affeldt and Krüger, 2020; Bietti, 2020; Finck and Pallas, 2020; Graef et al., 2018; Søe et al., 2021).**

In her recent publication ‹Relational Theory of Data› **(2021)**, US law scholar Salomé Viljoen calls attention to the social meaning of our data and the value it holds for data collectors such as Meta, Alphabet, and Amazon. Viljoen, who specialises in the political economy of social data, proposes an informational framework that distinguishes a horizontal and a vertical dimension **(2021, p. 607).** The vertical dimension delineates the connection between the data subject and data collector **[Image 1].** It captures the technical aspect of how data flows as well as legal considerations of the contract under which the data extraction takes place (‹terms and conditions›). This relation plays a key role in current regulation: Is privacy breached? Is there genuine consent? But also, how could individuals financially profit from the value of their data?

Then there is the horizontal dimension, which looks at the links between different data subjects **[Image 1].** The data collectors connect individuals' data and use the patterns that emerge to predict behaviour for an even bigger group. This informational infrastructure is at the heart of the digital economy today because it can express social meaning through data **(Viljoen, 2021, p. 607).**

Take for instance AI that helps smooth job application processes. The idea is simple: based on parameters important to the company, AI will filter out job applicants. However, often such AI is based on the profile of current successful (white male) employees **(Dastin, 2018; Drage and Mackereth, 2022).** This information is used to train the algorithm to find the best prospective candidate. As such, data about one group of people is extrapolated to determine whether new applicants will be successful in their future jobs. Hence, the significance of the employees' data lies not in what it tells about them but instead in what it can predict about others.

///<quote>
In the upcoming European AI Act algorithms used during recruitment are flagged as high risk.
///</quote>

Let's imagine Alex, Bo, and Charlie. Alex is a successful employee at the company to which Bo and Charlie are applying. This company uses AI to filter through its many applications and selects Bo as a potential candidate but not Charlie, even though Charlie and Bo have very similar credentials – the only difference is their gender. Like the infamous Amazon hiring algorithm **(Dastin, 2018),** the AI determined that CVs with gendered words such as ‹women's college› or ‹women's chess club› indicated a smaller likeliness to fit the company because the CVs of successful employees, such as Alex, did not contain such words. Societal concerns about biased programmes are being voiced and are starting to be picked up in legislation. In the upcoming European AI Act, for example, algorithms used during recruitment are flagged as high risk **(Joyner, 2023).** Still, these regulations are yet to address fully the relation dynamic of the data's value.

COLOURING SOMEONE ELSE'S IMAGE

It is important to emphasise that the population-based connections are a problem not because they are incidental to the way our data economy works. Rather, they are an issue because, even though they are the crux of the data economy **(Viljoen, 2021, pp. 586–589),** they stay out of the limelight. For instance, a recent study for the European Parliament finds that the money Amazon makes from selling data about the people who browse its website does not stem from personal data at all. Instead, it uses anonymised data to create abstract profiles describing groups of people **(Mildebrath, 2022).**

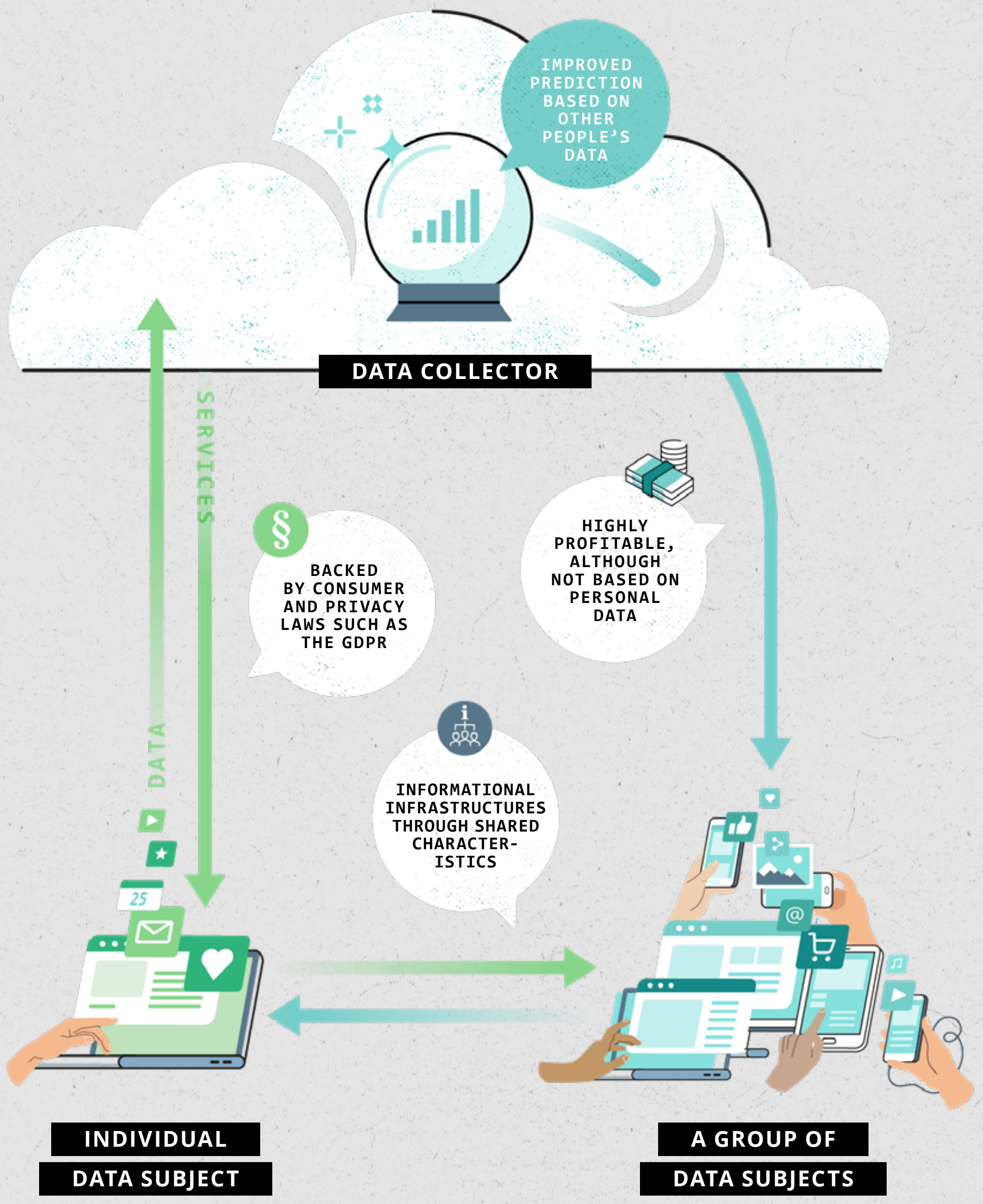
The Cambridge Analytica scandal is a notorious example of how the data of a few is used to predict and steer the behaviour of many others. The political consulting firm used social media data to create psychological profiles **(Illing, 2017).** Using those profiles, it targeted particular groups with specific election advertisements that were predicted to nudge their political views. By doing so, Cambridge Analytica is said to have influenced several elections **(Amer and Noujaim, 2019).**

The crucial angle Viljoen's analysis provides is that it shows what mechanisms are at play – and how these remain unregulated. During the 2016 US elections, the data shared by a quarter million people enabled Cambridge Analytica to target 800 times as many users **(Viljoen, 2021, p. 605).** So, the protection of an individual's right to consent to data sharing becomes toothless when risks arise not so much for the individual who shares the data but for others.

Image 1 *Own Illustration*

HOW DOES IT WORK?

DATA ECONOMY

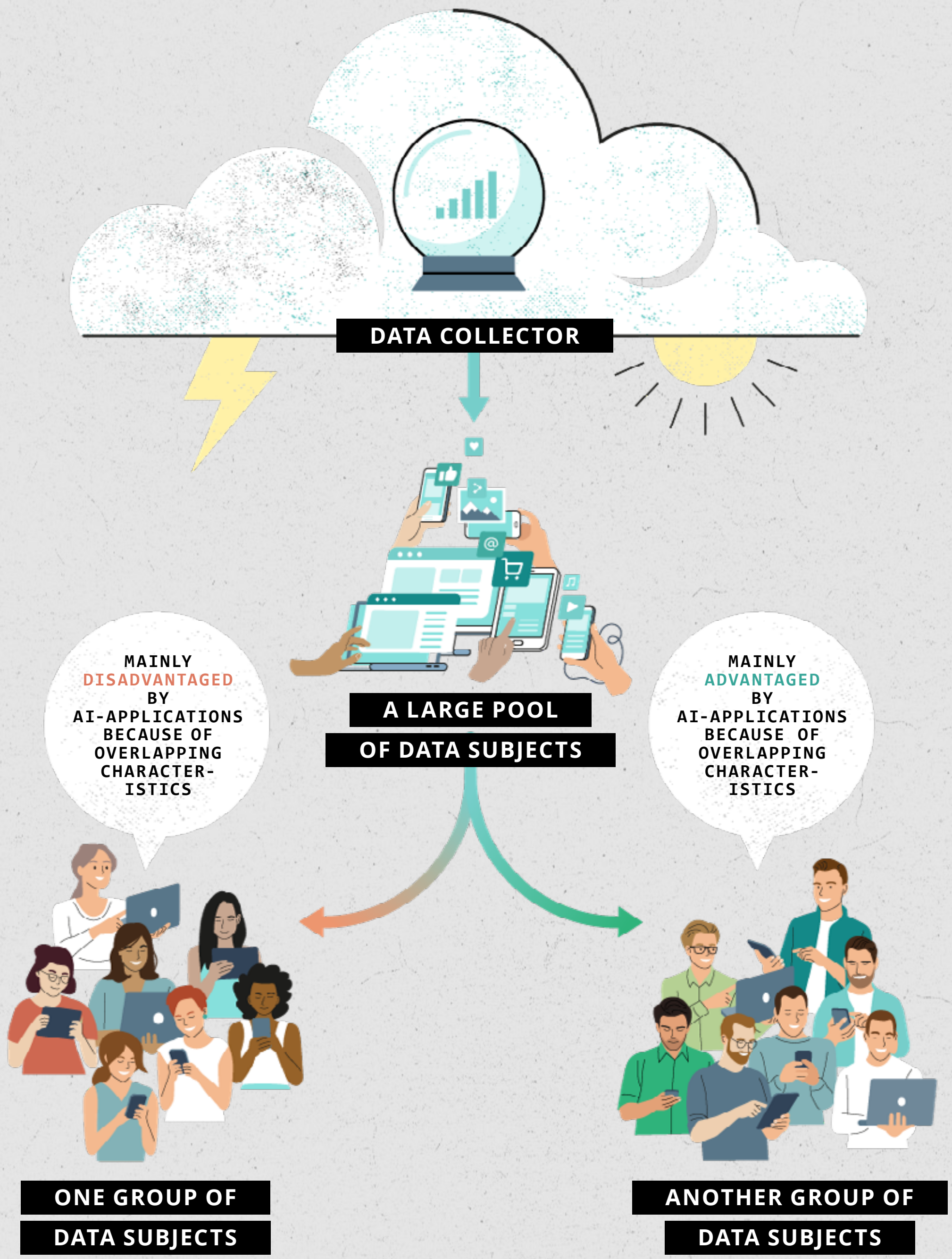


A schematic representation of the data economy based on Viljoen's **(2021)** distinction between horizontal and vertical data relations. An individual data subject shares her data with the data collector in exchange for services. This is backed by consumer and privacy law. However, her data is not only mirrored back to her, but most profitably used to improve predictions of the behaviour of other people through the commonalities and differences in their data.

[Image 2 *Own Illustration*

HOW DOES IT IMPACT ME?

SOCIETAL RISK OF HORIZONTAL DATA RELATIONS



A simplified illustration of the societal risk of horizontal data relations as introduced by Viljoen **(2021)**. Depending on the social group, one can face structural advantages or disadvantages of data-driven applications. The crux is that the risk of being disadvantaged is not evenly distributed across society.

The new ruling by the European Data Protection Authorities against Meta does add a second step of protection: Instagram and Facebook users now have a right to choose whether they want to be shown personalised ads **(Milmo, 2023; noyb, 2023).** Although this right is an important improvement, it still overly focuses on the individual. It asserts the worth of choice but does not address the collective and societal harms of, for instance, influenced elections. Collective harms occur when the interests of a group of people are lain aside (as might for instance be the case in AI-aided application processes) whereas societal harms refer to societal interests, such as equality, democracy, or the rule of law **(Smuha, 2021).** Often, we only become aware of injustices when they reach the court. In Finland, for example, a bank was fined for denying a man a loan based on his similarity to the creditworthiness of others due to his mother tongue and the neighbourhood in which he lived **(Orwat, 2020, pp. 38–39)**. In Pennsylvania, an algorithm determined the risk of child abuse based on a data set of families who use public services. And although the social workers handling this algorithm acknowledged its limitations, they let it overrule their own expertise **(Eubanks, 2017)**.

APPLIED ETHICS

Current data regulations such as the GDPR focus primarily on the link between the data source and data processor, with a heavy emphasis on personal data and personal choice. However, this emphasis does not capture the impact one person's data might have on someone else. So, beyond privacy and surveillance concerns, there is a more fundamentally social dilemma when we decide to share our data: we do not know in what way our data is used to make predictions that could disadvantage other people. Socially more advantaged groups can agree to share data that will unknowingly benefit them but put other people at risk **(Viljoen, 2021, pp. 613–615).**

We run the risk of overlooking or misconceiving injustices that arise on a collective or societal level, especially since the spread of the risks and benefits of AI applications across society is uneven: if you have the ‹better› mother tongue, live in a well-off neighbourhood, and never rely on public services, you would, for instance, not run into the same problems when applying for a loan or are less likely to be flagged as a member of a family where child abuse may occur. Such characteristics do not randomly influence the outcome of a computation but will consistently affect the same groups in society.

What this persistent differentiation shows us is that, over time, when data-driven applications become more and more entrenched in our society, different groups of people with different characteristics (such as gender, race, or wealth) will have fundamentally distinct experiences with AI. Researcher Frank Pasquale **(2018)**, for instance, has found that wealthy people face less privacy breaches than poor people, whereas it is people of colour who are structurally set back by AI in health care or the judicial system **(Obermeyer et al., 2019; Green, 2020).**

///<quote>
It is the tech that facilitates a further divide in society.
///</quote>

Thus, with some groups enjoying the benefits and others facing recurring increased risks, these applications will affect the social fabric of our societies in the sense that it is the tech that facilitates a further divide in society **[image 2].** People's lived experience with these data-driven applications will become so unalike that it might become more difficult to find common ground for ethical regulation.

Think for instance about the question of how to make digital systems trustworthy for everyone. If you assume some societal groups experience huge advantages, then obviously there is reason for them to trust these machines and the regulations that govern them. But you must then also assume that other groups have good reason to distrust such AI: those which, non-coincidentally, have less access to the public debate and less influence on policy-making and which are the ones most held back by such innovations. So, to acknowledge the differentiated risks societal groups are facing and to ensure technological developments constitute progress for everyone, regulation must focus less on individual rights and more on the social implications of data. }

ABOUT THE AUTHOR

/// **Lieke Fröberg** is passionate about inclusive and sustainable technological progress. She is a graduate of the Politics, Economics and Philosophy Master of Science at the University of Hamburg. This text is based on her thesis ‹Trust and Data Governance› on the ethics and justice of trustworthy data governance.

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DEBATE ARTICLE

NO BLOCKCHAINS ON A DEAD PLANET

«We are fighting huge battles in all sectors of our economy to tackle climate change. (…) And suddenly a technology appears that consumes an enormous amount of energy (…). I haven't heard that it solves any real-world problem or caters to basic needs (…) in the climate movement, we just laugh about it»
Pauline Brünger, Activist with Fridays for Future Germany **(BUND, 2022)**

///<quote>
Blockchain technology promises absolute decentralised transparency, independence from Big Tech, a revolution of the financial system, and the digitalisation of contracts and assets.
///</quote>

Blockchain technology has been around nearly as long as the iPhone, longer than Windows 7 or the Google Chrome browser. Still, it is often discussed as a supposedly revolutionary futuristic tool for manipulation-free policy enforcement. It promises absolute decentralised transparency, independence from Big Tech, a revolution of the financial system, and the digitalisation of contracts and assets. The opposing critiques are even more passionate: the unequal distribution of power in the cryptocurrency community[1], human rights violations, and especially the negative climate impact. Two successful panels of the Bits & Bäume Conference connected digital and environmental civil society actors to discuss the topic, showing the importance of a joint critique **(Rehak, 2022; BUND 2022).** This article highlights the main criticisms of blockchain technology.

[1] *Cryptocurrencies store transactions on a blockchain. Like an accounting book, the blockchain keeps track of the transactions **[Box 1]**.*

ENVIRONMENTAL IMPACT OF THE BLOCKCHAIN TECHNOLOGY

A blockchain is based on simple technical principles that can be used and programmed with basic informatics skills. Therefore, there is no comprehensive overview of the application areas of blockchain technology. However, the biggest blockchain uses, based on their energy consumption, are cryptocurrencies, especially Bitcoin and Ethereum **(CBECI, 2022)**.

Although CO_2 emissions of cryptocurrencies are widely known to be high, estimates of the related energy consumption are rough, with broad estimates that cryptocurrencies account for 25% of global data centre power consumption **(Hintemann and Hinterholzer, 2021)**. For 2021, most sources estimate the annual energy consumption of the Bitcoin system alone at 131 TWh/year **(CBECI, 2022)**, producing yearly emissions responsible for about 19,000 future climate deaths **(Turby et al., 2022)**.

The second environmental impact of blockchains is the high resource consumption of the hardware required for the computing power. To compete in the proof-of-work process **[see Box 1]**, chips have to be replaced every 1.5 years by the next generation **(Ramesohl et al., 2021)**. The production of these chips requires various newly mined raw materials **(BUND, 2021)**, and reusing the highly specialised chips is often impossible. Mining these raw materials often causes environmental damage and human rights violations. It is estimated that every Bitcoin transaction equals more than half an iPhone in electronic waste **(Ramesohl et al., 2021)**.

There are different ways to tackle the problem of high-energy consumption and environmental impacts. One prominent policy suggestion is the use of renewable energy for the computing power of the ‹proof-of-work process› **[see Box 1]**. However, two thirds of cryptocurrency miners' costs are related to energy consumption. Therefore, the miners often rely on cheap fossil energy **(de Vries, 2019)**. The most prominent example is the re-commissioning of coal-fired power plants for mining bitcoins in New York and Montana **(Spegele and Ostroff, 2021)**. In addition, renewable energies make up only 29% of the global electricity mix and their use is therefore limited **(International Energy Agency, 2022)**.

Another option is to change the blockchain consensus process **[see Box 1]**. This change makes the technology more climate- and resource-friendly. In mid-2022, the second-largest cryptocurrency, Ethereum, switched to the ‹proof-of-stake process›: Consensus is no longer determined on the basis of computing power but according to the share in the blockchain. Resultingly, Ethereum's energy consumption dropped by over 99%, and resource consumption is also estimated to have dropped rapidly as most mining devices have become obsolete **(Turby et al., 2022)**. This change makes the system more environmentally friendly but the consensus process becomes more exclusive: To participate in the consensus process, users had to own 32 ether, equivalent to 38,000 € in December 2022. In addition, the cryptocurrency system now has a central gatekeeper again.

LACK OF REAL-WORLD APPLICATIONS AND THE ISSUE OF POWER AND INEQUALITY

Environmental impact aside, an increasing number of reports have questioned the benefits of blockchains. Although the word ‹blockchain› appeared 23 times in the

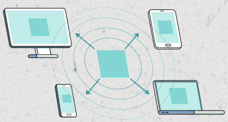
Box 1 *Own Illustration*

HOW DOES IT WORK?

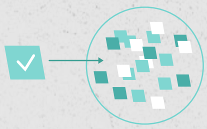
BLOCKCHAIN TECHNOLOGY

BLOCKCHAIN BREAKDOWN

1 A USER INITIATES A TRANSACTION BY CREATING A DIGITAL RECORD OF IT.

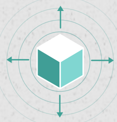


2 THE TRANSACTION IS BROADCASTED TO THE NETWORK OF ‹NODES›.

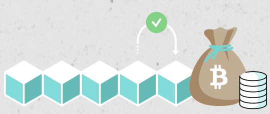


3 NODES VERIFY THE TRANSACTION'S VALIDITY AND STORE THEM IN A ‹MEMORY POOL›.

4 EACH ‹MINER› CHOSES A SET OF TRANSACTIONS FROM THE POOL AND INITIATES A NEW BLOCK.



5 ALL ‹MINERS› UNDERGO A CONSENSUS PROCEDURE (POW, POS ETC.) AND THE WINNER BROADCASTS THE NEW BLOCK TO THE NETWORK.



6 THE BLOCK IS NOW PART OF THE BLOCKCHAIN AND CAN BE VALIDATED, THE WINNER RECEIVES A REWARD.

7 AFTER A WHILE, TRANSACTIONS IN THIS BLOCK ARE CONSIDERED SUCCESSFUL.

A blockchain is a decentralised way to store data. The technical foundations have been in use since the 1990s. However, it first attracted worldwide attention with the white paper on the cryptocurrency Bitcoin, authored by the presumed pseudonymous person (or persons) Satoshi Nakamoto in 2008 **(Nakamoto, 2008)**. After the financial crisis, the aim was to create a currency that would function independently of large financial institutions. The basis of this independence was the storage of information on transactions on a blockchain. The central informatics properties that blockchains aim to provide are:

TRANSPARENCY

Information on the blockchain is present simultaneously in many places and transactions can be validated from everywhere.

DECENTRALISED CONSENSUS

There is no central instance (such as a central bank) as the root of new, correct information. The information, e.g., a certain number of payment transactions, is stored in data blocks. Each block is produced in a ‹consensus procedure›. After reaching consensus, the block is stored on all decentralised storage locations.
The most well-known consensus procedures are:

PROOF-OF-WORK

Many blockchain participants solve a mathematical problem in a race. The speed depends on the participants' computing power. This dependency means that entire data centres are involved in the proof-of-work process. Whoever solves the riddle first and therefore proves that some work has been done, publishes the block and gets a reward, e.g. newly created Bitcoins.

PROOF-OF-STAKE

This mechanism is based on the shares in the blockchain. Weighted according to shares in the blockchain, a central entity randomly selects participants to conclude new blocks.

INALTERABILITY

Once a block is signed and approved, the information in that block cannot be changed. Since each new block secures all previous blocks, the whole chain is secured.

2018 German government digital strategy, the new 2022 strategy completely ignores blockchains as a tool. This omission could be due to the many ambitious government projects that were supposed to be implemented with blockchains but which failed due to violation of privacy rights or a lack of practicability.[2] Evaluating the efforts of German start-ups and the private sector, a report by the German ICT industry association, Bitkom, concludes: *«There is a lack [...] of examples on the market of successfully implemented Blockchain applications [besides cryptocurrencies]»* **(Bitkom, 2019)**.

[2] *Prominent examples are the attempt to store vaccination records during the Covid19 pandemic on a blockchain* ***(Biselli, 2020)****, the failed implementation of blockchain-based drivers licences and ID* ***(Biselli, 2021)*** *and the much criticised project FLORA, which attempts to store migration data on a blockchain* ***(Biselli and Köver, 2019)****.*

Globally, one of the most notable applications of blockchains in the public sector is the introduction of Bitcoin as a means of payment in El Salvador. Although expectations were high, most El Salvadorians did not use Bitcoins due to the cryptocurrency's high volatility **(Sigalos and Kharpal, 2022)**. This lack of use highlights the elephant in the cryptocurrency room: Bitcoins are not useful as a means of payment; they are more suited to financial speculation.

///<quote>
Cryptocurrencies and related blockchain-based financial products are a zero-sum game.
///</quote>

Cryptocurrencies and related blockchain-based financial products are a zero-sum game: *«Any money anyone wants to pull out, someone else has to put in»* **(tante, 2022)**. Users with particularly large amounts of cryptocurrency are motivated to bring new people with real money into the system, but private investors who invest too late lose most of their money. Accusations of cryptocurrencies being a Ponzi scheme are increasing, often due to examples such as the crash of the crypto exchange Bitconnect, the fraud of the crypto exchange FTX, and the crypto crash in early 2022.

///<quote>
Participants have no means of democratically controlling or influencing the cryptocurrency system.
///</quote>

These examples also show the problematic distribution of power and wealth in the cryptocurrency system: Participants have no means of democratically controlling or influencing the cryptocurrency system. Power in the system depends on the amount of money or computing power users can invest **(Rehak, 2019)**. The inequality in the system becomes clear when considering that 100 users own 17.3% of all Bitcoins. In the case of Ether, this figure is 40% **(Kharif, 2017)**.

CONCLUSION

Although politicians, start-ups, and established companies have spent the past years highlighting the disruptive potential of blockchain technology, until today it has not met these expectations. Besides cryptocurrencies, no other public or private sector use case has proven to be widely successful or useful. Furthermore, the biggest use cases keep destroying the environment. Although implementing the proof-of-stake-process in the Ethereum blockchain lowered both emissions and raw material usage, there remains a tendency to increase power imbalances in the crypto system, promoting wealthy users and raising the question whether cryptocurrencies hold up their promise of being an egalitarian and decentral financial system or if they are just creating more inequality.

Although there might be a few useful applications in the future, in the light of the climate crisis and the need for a sufficient and sustainable use of digital technology, policy-makers and civil society should focus on other solutions and debates. }

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Author Rainer Rehak

RESEARCH ARTICLE

ARTIFICIAL INTELLIGENCE FOR REAL SUSTAINABILITY?

What is Artificial Intelligence and Can it Help with the Sustainability Transformation?

The discussion about the disruptive possibilities of a technology called artificial intelligence (AI) is on everyone's lips. Companies and countries alike are running multi-billion-dollar research programmes to ensure they do not miss out on the global innovation hunt. Among many other applications, AI is also supposed to aid the large-scale changes needed to achieve sustainable societies. To assess those possibilities, this article briefly explains, classifies, and theorises AI technology and then politically contextualises that analysis in light of the sustainability discourse.

Like few other technologies, AI is surrounded by almost magical promises **(Weizenbaum, 1993)**, aligning well with the long-standing narrative of the imminent digital revolution described by a seemingly recent quote from Hubert L. Dreyfus **(1972:xxvii)**: *«Every day we read that digital computers play chess, translate languages, recognize patterns, and will soon be able to take over our jobs. In fact, this now seems like child's play».* The fact that the quote is from 1972 shows how necessary a nuanced analysis of the ‹AI field› is.

Originally, the term ‹AI› referred to a field of computer science, which initially had the dry name ‹automata theory›. However, computer scientists John McCarthy and Marvin Minsky believed the term ‹artificial intelligence› would be more fitting, particularly in terms of the popularity and fundability of the field, so they renamed it for a workshop in 1955. AI is not a single technology in itself but rather a diverse field within computer science. For a long time, AI systems explicitly represented knowledge or ‹symbolised› it, enabling logical reasoning and decision trees **(Bonsiepen, 1994)**. These symbolic approaches allow formal conclusions such as ‹all sweet things are sticky and jam is sweet, therefore jam is sticky›.

Later in the 1980s, the so-called sub-symbolic approaches emerged, such as artificial neural networks (ANNs), genetic algorithms, or other statistical and heuristic approximations. These approaches require pre-configuration with large amounts of data in many iterations, often called ‹training›, in which knowledge is only implicitly represented and difficult to verify **(Mitchell, 1997; Rehak 2021a)**. Current image recognition, large language models, and translation systems work in this way.

THREE TYPES OF AI

In the academic AI discourse, two types of AI are usually distinguished: strong AI and weak AI. However, I would like to add a third type, which I call Zeitgeist AI.

Strong AI, also known as Artificial General Intelligence (AGI), refers to a system that possesses general and flexible intelligence, can ask questions, and exhibits genuine creativity, perhaps even consciousness. Such a system could act independently, potentially have its own goals, and would, therefore, need to assume responsibility for its agency. This type of AI exists only in the realm of science fiction, and there are no signs in technical AI research that this will change in the foreseeable future **(Kurzweil, 2005; Rehak, 2021a)**.

///<quote>
It cannot change domains or set its own goals; it is a tool, albeit a very complex one.
///</quote>

Weak AI, also known as Artificial Narrow Intelligence (ANI), refers to a system that can only perform narrowly defined, highly specialised, and domain-specific tasks. It cannot change domains or set its own goals; it is a tool, albeit a very complex one. This category includes systems that recognise patterns (visual and acoustic object recognition or data analysis such as optimising resource use, e.g., electricity and water consumption) or automatically perform other domain-specific tasks with clear objectives (e.g., playing Go, producing derived text or images). All current AI systems fall into this category, including the current large language models **(Bender et al., 2021)**.

Thirdly, I would like to define Zeitgeist AI as a discursive phenomenon where political, societal, and even academic actors refer to ‹AI› when they actually mean anything related to complex digital technologies such as algorithms, big data, software, programmes, computer systems, automation, IT, actual AI, statistics, and even digitalisation in general **(Council for Social Principles of Human-centric AI, 2019)**. With such a vague AI concept, serious and fruitful AI debates are difficult, which is why they regularly need to be reined in **(Butollo, 2018; Eyert et al., 2020)**.

PRECISE LANGUAGE

Moreover, great caution is needed in the choice of language when discussing AI, as many of the prevailing technical terms historically referenced human activities and abilities but should not be understood as analogies. The terms ‹act›, ‹decide›, ‹recognise›, ‹understand›, ‹(self-)learn›, ‹know›, ‹train›, ‹autonomy›, ‹predict›, and even ‹intelligence› are highly misleading. Incorrect terms evoke false associations, fuel unfounded technology fictions, and imply nonsensical or even (societally) harmful applications **(Weizenbaum, 1978)**. Appropriate terms have been suggested, e.g.,

///<quote>
Incorrect terms evoke false associations.
///</quote>

‹move›, ‹execute›, ‹detect›, ‹conform to expectations›, ‹dynamic configuration›, ‹data/information›, ‹pre-configuration›, ‹automation›, ‹projection›, and ‹complex data/information processing› **(Rehak, 2021a; Olson, 2021)**. Such terms are especially relevant in interdisciplinary contexts or in science communication.

WHAT AI CANNOT DO (WELL)

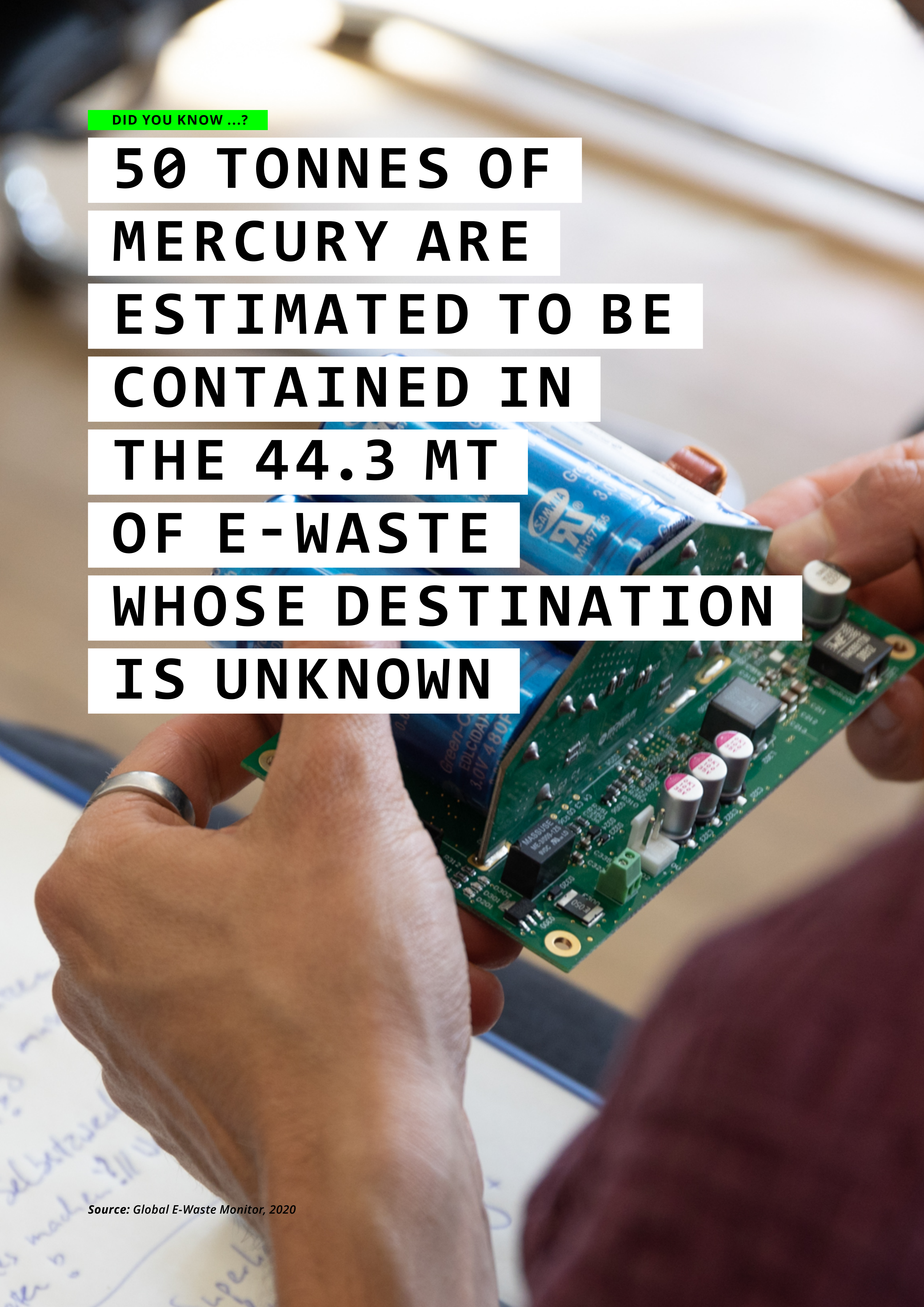
AI systems can effectively do specific tasks that have clear rules, adequate models, specific goals, and suitable data available. These tasks include predictive technical maintenance (e.g., for rotating parts), resource consumption optimisation (e.g., water usage in agriculture, energy consumption in data centres), voice/image detection (e.g., speech, landmarks, and animals), and speech/image synthesis. Moreover, AI can be used to search any data for patterns (compartmentalisation, clustering, etc.). There are also impressive generative AI applications in the fields of image, language, and music, but they do not solve specific tasks and are so far of explorative value.

///<quote>
Many of the characteristics attributed to AI are often classic computer science methods or even just human labour in the Global South.
///</quote>

Many of the characteristics attributed to AI are often classic computer science methods **(Narayanan, 2019)**, precisely Zeitgeist AI, or even just human labour in the Global South **(Solon, 2018)**. But to discuss the potential of AI properly, we need to differentiate what we are talking about. Two insightful examples:

1 The core of automated driving (AD) is not AI, as AI is so far only responsible for image recognition (e.g., traffic sign detection), the rest is not AI; therefore funding AI would not necessarily improve AD.
2 AI systems cannot generate predictions per se. What AI can do is statistically analyse past data and calculate a mathematical projection from it. But whether the calculated result is a meaningful prediction depends heavily on the subject area **(Dreyfus, 1972)**. Weather data is fundamentally different from social data **(Lopez, 2021)**. Thus, ‹predictions› in the social domain only work when social physics is assumed, which is highly controversial in theory and practice **(Eyert and Lopez, 2023)**. Not only in the crime domain, e.g., predictive policing or recidivism, have such predictive attempts generally failed. So, we still have to understand the subject area before applying AI.

Even if the area is mathematically well-understood, we, as a society, often do not even want to make correct ‹unbiased› predictions based on the past as the basis for our actions. A purely mathematically justified credit allocation based on income, for example, would, if correctly applied, simply reproduce the gender pay gap and systematically grant lower loans to women. In this case, mathematically correct results would be unfair, and fair results would be mathematically incorrect **(Eyert and Lopez, 2021; Mühlhoff, 2020)**. To put it vividly: Making predictions with AI is like driving a car while looking exclusively in the rear-view mirror. Despite great anti-bias work in the field, there is a principal limit regarding the neutrality and fairness promise of AI **(Kleinberg et al., 2017)**.



DID YOU KNOW ...?

50 TONNES OF MERCURY ARE ESTIMATED TO BE CONTAINED IN THE 44.3 MT OF E-WASTE WHOSE DESTINATION IS UNKNOWN

Source: *Global E-Waste Monitor, 2020*

AI AND DIGITALISATION AS ORGANISATIONAL TOOLS

In light of the reflections on the possibilities of AI, it becomes clear that the commonly raised topic of ‹human versus machine› in the context of AI is a pseudo-problem only present in science fiction. Currently existing and conceivable AI has no personal goals or motivations – even when appearing in robotic form – and must therefore be understood as a complex tool.

///<quote>
Tools are used by actors to pursue interests and objectives, potentially against other organisations or individuals.
///</quote>

However, viewing AI as a powerful tool necessitates expanding the scope of analysis from focusing solely on specific AI techniques, as interesting and unique as they may be, to the organisations that develop, implement, and disseminate them **(Mühlhoff, 2020)**. Tools are used by actors to pursue interests and objectives, potentially against other organisations or individuals.

Zeitgeist AI (including AI) is always an extension of an organisation. If anywhere, AI conflicts arise along the line of ‹organisation versus organisation›, which is why the interests of the involved actors should always be at the centre of AI analyses **(Marx, 2023)**. So, if an organisation's interest does not include sustainability, AI will not be used for that (or run into the rebound effect).

This organisational view is especially important and specific to AI since AI generally encompasses data-intensive technologies and, thus – the comparison with nuclear power comes to mind – has a power-centralising effect. The fact that large companies make their AI frameworks and services freely available does not change the fact that AI can have little real benefit without the appropriate and immense data foundations. AI is, therefore, just the latest development of digital feudalism with only a few large AI providers renting out their service.

AI FOR SUSTAINABILITY

It is, in principle, desirable when AI is applied for sustainability, ‹societal and ecological well-being› (EU High-level expert group on artificial intelligence, nd.) or for nature conservation **(Grundgesetz, Art. 20a)**. However, a holistic consideration must be made for every thoughtful use of technology, especially for such resource-intensive and centralising technologies as those covered by the umbrella term AI. The whole life cycle of AI must not create a large(r) ecological footprint elsewhere on the planet **(van Wynsberghe, 2021)**. Otherwise, the AI application itself would, despite good intentions, contribute to destroying our livelihoods. Consequently, a net positive benefit must always be sought, even if this can sometimes hardly be evaluated conclusively.

///<quote>
Will new data from AI close an information gap and therefore allow action?
///</quote>

There are many examples of how specific AI systems can be used concretely for conserving resources, biodiversity, and nature **(BfN, 2023)**, and with a broad understanding of sustainability, additional applications can be added **(Rehak, 2021b)**. In those areas, good results lie ahead. However, if the AI promise of a sustainability game changer is to be fulfilled, a sincere litmus-test questions must always be asked: Is AI the best solution for moving forward on a given problem? Do we currently know too little about the exact number of certain insects, the best way to park cars in cities, or the power intake of data centres? Will new data from AI close an information gap and therefore allow action?

If yes, then we should go ahead. But if the answer is that we already know enough regarding the given domain, then applying AI just uses up vital resources, diverts political focus, and eventually acts as an excuse for inaction while time is running out. Finally, an AGI with true intelligence would probably recommend we quickly do many things we already know **(Lem, 1981)**, from 100% renewable energy use and bike cities to consequent decolonisation; so why not take a shortcut and start doing them already? }

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DID YOU KNOW ...?

THE DATA CENTRES IN GERMANY NEEDED MORE ELECTRICITY IN 2020 THAN ALL OF BERLIN

Source: Borderstep Institute, 2021

{ Authors *Florian Petri & Miriam Ruhenstroth*

RESEARCH ARTICLE

THE INVISIBLE ENVIRONMENTAL IMPACT OF MOBILE APPS

Understanding the environmental impact of air travel or the steak on your plate is relatively easy. For the software on electronic devices, the connection is less obvious – however, it is no less important.

///<quote>
Data centres and data transmission networks currently consume about 2% to 3% of total global electricity.
///</quote>

Demand for digital services is growing rapidly. Since 2010, the internet's global user base has more than doubled while global internet traffic has increased by a factor of 20. So far, ongoing efficiency gains have not been able to compensate for the steep rise in demand, leading to a constant increase in energy consumption. Data centres and data transmission networks currently consume about 2% to 3% of total global electricity **(IEA, 2022)**. With the advance of AI applications, cloud storage, and the Internet of Things, the increasing demand for data centres is not expected to slow down any time soon.

Similarly, global mobile network data traffic has grown exponentially over the last ten years. While well below 10 EB[1] permonth in 2015, it surpassed the threshold of 100 EB per month in 2022, almost doubling in the last two years alone. This trend is fuelled by increasing smartphone subscriptions globally, as well as by a continuous rise in the average data usage per smartphone. The latter is expected to increase, tripling from about 15 GB per month in 2022 to 46 GB per month in 2028 **(Ericsson, 2022)**.

We have developed a tool that highlights a specific aspect of the data traffic of mobile apps. It allows the necessary traffic enabling the app's core function to be separated from unnecessary traffic used for advertisement and tracking services (ATS). The traffic data can subsequently be shown as energy consumption and emissions. This information makes the abstract environmental impact of app usage relatable for consumers and developers alike while simultaneously visualising concrete implications for decreasing emissions.

[1] *EB = exabyte or one billion gigabytes*

THE ENERGY CONSUMPTION OF SMARTPHONE USAGE

Using a smartphone consumes energy on three different levels: the phone itself, the data centres, and the data transmission networks.[2] The most obvious one is the phone itself, i.e., the battery draining during use. The energy consumption of a smartphone varies depending on the model and apps. In our lab, we use a Google Pixel 2, which requires about 10 watt-hours of energy to be fully charged. This amount of energy is roughly equal to that consumed by an LED lamp with medium brightness in one hour **(Eartheasy, 2023)**.

[2] *The production and disposal of ICT equipment such as smartphones is another major source of emissions. However, here only the usage phase is considered.*

Except for offline apps, apps usually connect to a data centre. Here, different data storage or processing services can be performed, ranging from retrieving account information to streaming video contents or ad-banners. Different services require different amounts of energy. One hour of Full-HD video streaming consumes about 2.3 watt-hours in the data centre **(Gröger et al., 2021)**.

Finally, the large infrastructure of data transmission networks requires energy for the data traffic from the smartphone to the data centre and vice versa. For many applications, the power consumption of data networks makes up the largest share of energy consumption of smartphone use, especially when using mobile data. According to a study by the German Federal Environmental Agency **(Gröger et al., 2021)**, one hour of Full-HD streaming consumes about 18 watt-hours using mobile 4G LTE. Streaming through Wi-Fi reduces this energy consumption to about 1 to 3 watt-hours.[3]

[3] *This applies to a resolution of 1080p, corresponding to approx. 2 GB/h, and the 2020 technology generation of network infrastructure.*

There is an ongoing debate on how to exactly allocate the energy use of data networks to the data transmitted. While many of the initial discrepancies have been resolved, estimates still vary depending on the approach and the boundaries of the network being considered **(Aslan et al., 2018; Coroama, 2021; Stephens et al., 2021)**. Estimates are subject to specific assumptions and limitations, and technical progress quickly outdates them. Nevertheless, the maxim holds: the lower the data traffic, the lower the environmental impact.

TRAFFIC OF ADVERTISEMENT AND TRACKING SERVICES

When it comes to options for reducing mobile data traffic, an obvious starting point is advertising. A study commissioned in 2021 for the European Parliament estimated that ATS alone causes 30 to 50 billion GB of traffic on smartphones in Europe. The resulting emissions from data centres and transmission networks are estimated to be as high as 5 to 14 megatons of CO_2 equivalents **(Uijttewaal, 2021)**. This corresponded to about 1% to 2% of Germany's total emissions in 2021 **(UBA, 2022)**.

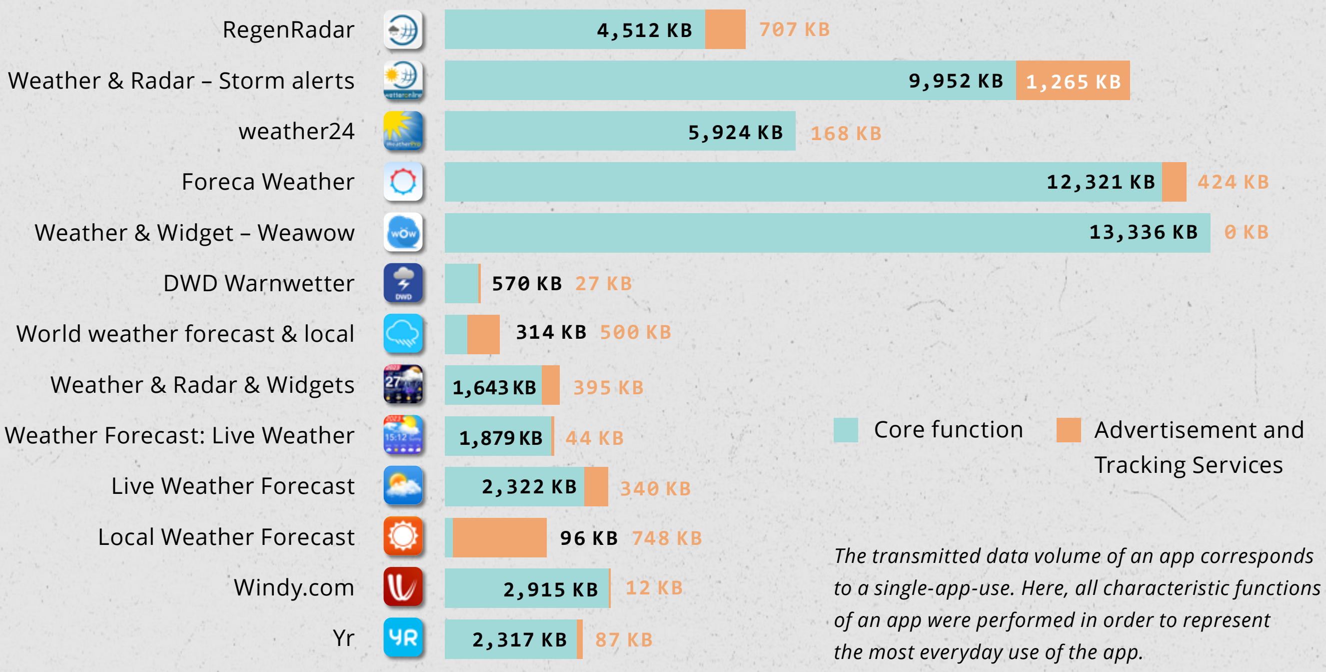
Especially for mobile apps, it is common for app publishers to earn money by selling ad-space – e.g., ad-banners – or by collecting and selling user data to third parties. Since ATS providers often incorporate software modules into numerous apps, user data can be tracked across apps and detailed user profiles can be built. Therefore, even apps that do not display ads can still use implemented trackers. This information can include, e.g., the types of apps used regularly, visited websites, or favourite music artists etc.

This business is lucrative since ad-supported free apps are downloaded about 50 times more often than ad-free paid apps and bring in up to ten times as much

Figure 1 *Own Figure*

FIGURES AND NUMBERS

DATA TRANSMITTED FOR CORE FUNCTION AND ATS OF WEATHER APPS



revenue **(Chen et al., 2016; Pärssinen, et al., 2018)**. Since it is not apparent to the user which company collects which data and for what purpose, the user privacy and data protection issues of this process are highly problematic. In our database of 30,000 apps from Google Playstore, we found that about three-quarters had implemented advertisement, while about 90% had at least one integrated tracker.

MEASUREMENTS IN THE LAB: GAMES AND WEATHER APPS

We measured the data sending behaviour of numerous apps from multiple categories. As expected, apps that download large files – e.g., maps – or stream media generally transfer the highest data volume. However, apps from these categories tend to have lower ATS traffic. Contrastingly, mobile games and apps for music creation have high ATS traffic, sometimes well above 50% of total traffic.

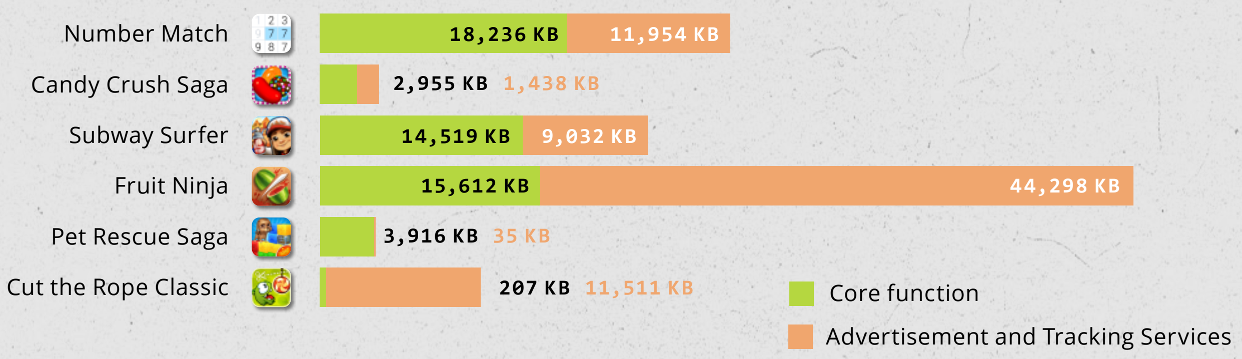
For a clearer picture of the data transferred – and the share that is required for ATS traffic – we compared two app categories for which we recorded the respective data transmission behaviour while in use: weather and games **[Figures 1 and 2]**. For the weather apps, the transmitted data volume of a single app-use lay between 0.5 and 13 MB, with ATS shares mostly ranging between 4% and 15%. Transmitted data for the games was between 4 and 60 MB, and ATS shares were generally above 30%.

Different approaches can be employed to transform those data transmission levels into energy consumption and emissions. For example, using data from Gröger et

[**Figure 2** *Own Figure*

FIGURES AND NUMBERS

DATA TRANSMITTED FOR CORE FUNCTION AND ATS OF GAMES APPS



al. **(2021)** on the energy use of data networks and the emissions intensity of the German energy mix **(Icha and Lauf, 2022)**, a single app use leads to emissions of between tens to hundreds of milligrams of CO_2 equivalents. For apps with high data transmission levels, the emissions correspond to those of driving a few metres in a car.[4] Here, switching from 4G to Wi-Fi reduces emissions by a factor of 5. The issue at stake becomes clear when user bases are taken into account: Games such as Fruit Ninja or Candy Crush have half a billion to a billion downloads. Scaling in this factor sometimes adds up to emissions of hundreds of tons of CO_2 equivalents – i.e., several hundred thousand kilometres by car – that are caused solely by advertisement and tracking.

[4] *Here, it is assumed that a car emits an average of 131 g CO2 per kilometer* ***(Allekotte et al., 2020)***

WHAT CAN BE DONE?

Since the demand for data centres and data transmission is expected to increase sharply over the next few years, its environmental impacts cannot be neglected. A number of policies and processes are already addressing this issue. Among these are general infrastructure improvements, e.g., expanding energy efficient fibre-optic cables and 5G networks **(Köhn et al., 2020)**. Germany already took an important step in this direction by switching off the energy-inefficient 3G-mobile network in 2021.

Further possibilities exist. For consumer devices, video streams should automatically adjust to screen size instead of using the best quality available. This adjustment could save considerable data exchange while the difference is often not perceivable on smartphones and tablets **(Köhn et al., 2020)**. Since videos made up about 70% of all internet data traffic in 2022, this change could save considerable amounts of energy while having few downsides **(Ericsson, 2022)**. Cell phone contracts are further starting points for potential regulation as they often incentivise excessive data consumption by offering flat-rates with unreasonably large data packages **(Köhn et al., 2020)**.

Our app measurements suggest further measures. Consumers should primarily use data-intensive functions when connected to Wi-Fi. To minimise unnecessary traffic, choosing apps without advertisements and with as little tracking as possible are further options.[5] In terms of data traffic, environmental protection here also means privacy protection.

Software developers should implement data sufficiency as a principle, especially for smartphone apps, where data traffic via mobile networks is more energy intensive. Data sufficiency can entail data traffic monitoring and optimising during development, also for implemented third-party services such as ATS. Further, developers have to enable conscious consumption of their products by including data-saving features. These could come in the form of an offline mode allowing the user to download large files via Wi-Fi before using them on the road, a low-resolution mode for streaming contents, or, when connected to mobile networks, a simple warning if a certain function requires large amounts of data.

For these measures to be effective, they have to be implemented by developers and deployed by a relevant share of users. Therefore, the overarching goal in meeting this challenge should be the development of a general critical awareness of the environmental impact of digital services such as mobile apps.

[5] *The Google Play Store displays whether apps have implemented advertisement. For a detailed database of the implemented tracking services of mobile apps, visit: https://appcheck.mobilsicher.de/*

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RESEARCH ARTICLE

TRANSPARENCY FOR SOFTWARE CLIMATE IMPACT

Concepts Towards a Life Cycle Assessment of Software

The information and communication technology (ICT) sector is estimated to currently contribute to ~1.5–4% of global greenhouse gas (GHG) emissions **(Bieser et al., 2023)**. Accordingly, the energy efficiency of hardware, for example in data centres, has already been well studied **(Schödwell et al., 2018; Hintemann and Hinterholzer, 2022)**. Software, on the other hand, as an immaterial good, actually has no direct energy consumption **(Hilty, 2019)**.

///<quote>
The software determines how and for what kind of computations the hardware is used and influences the energy
///</quote>

It is the hardware that consumes the electricity in the ICT area and the software that utilises this hardware. The software determines how and for what kind of computations the hardware is used and influences the energy consumption of the hardware for a certain task. **[Figure 1]** shows an example from Gröger et al. **(2018)** with different resources and therefore different energy consumptions for various software products performing the same task.

In our approach, we are guided by the methodology of life cycle assessments (LCA) and view software as the main target for the energy used by the hardware itself but also for the environmental impacts generated from manufacturing the hardware. The environmental impacts of energy consumption stem from the way energy is currently produced, which generally entails large CO_2 emissions **(bp, 2021)**. Furthermore, the manufacturing of hardware causes CO_2 emissions through mineral mining, plastics and metals production, and the factories required to execute the related processes **(Boavizta, 2023)**.

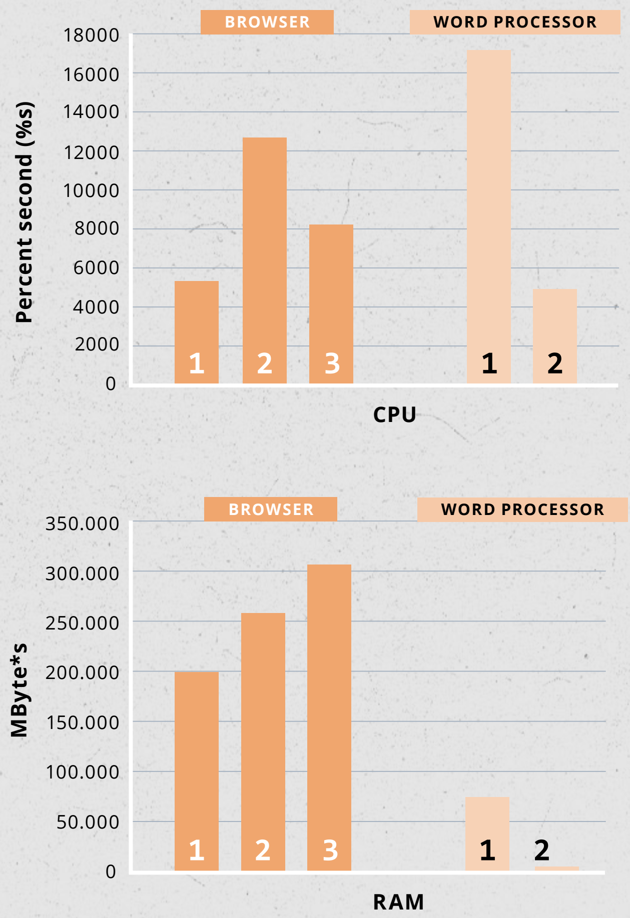
Another factor influencing energy consumption is the ‹software bloat› effect, in which software products continue to grow. However, the additional functionality they acquire entail using increasing resources since more processor performance, memory, and hard disk space are required. Software thus becomes more unspecific over time. But beyond the overhead from additional functionality, some more resource consumption also comes from a relatively unspecific growth of the code over time, for example, from adding additional software packages or from increasing abstraction. This growth in overhead is almost natural as the number of developers increases the longer the software is in use and, in many cases, developers bring their own preferences in libraries and frameworks.

To be able to manage the environmental impact of the digital sector in a targeted manner, we split the resource consumption of software into ‹digital resource primitives›. These primitives make it possible to map software in the different phases of its life-cycle (Manufacturing/Development, Distribution, Usage, Disposal/Removal) to its environmental impact. A LCA requires solutions to perform an inventory analysis of resource usage and environmental impacts. We show how to perform this analysis in our ‹double conversion model› using digital resource primitives in a detailed example for the software usage phase. In this article, we consider only the usage phase of software and focus on determining the embedded environmental impacts and resource use of ICT equipment as well as the primary energy use. The described process and model can easily be extended to the other life-cycle phases.

[**Figure 1** *Own Figure, data from study of Gröger et al. (2018)*

FIGURES AND NUMBERS

DIFFERENT PROCESSOR AND MEMORY USAGES



Different processor and memory usage of various browser and word processing products for defined standard procedures.

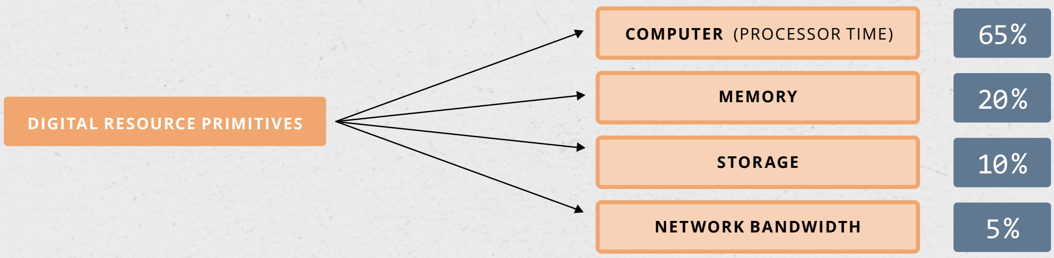
CONDUCTING AN INTEGRATED LCA

Digital Resource Primitives (DRPs) are defined as the low-level digital resources required to operate digital products and services. They can be seen as the fuel that powers software applications **[Figure 2]**. They allow a direct mapping onto a physical hardware resource.

[**Figure 2** *Own Figure, SDIA e.V. (2022)*

MAPPING THE IMPACT

DIGITAL RESOURCE PRIMITIVES



Digital Resource Primitives and their Impact Weighting.

A central processing unit (CPU) is a digital resource that a software can consume. CPU utilisation has the most significant correlation to power consumption, e.g., a utilisation of 80% is responsible for a similar percentage of energy use. The other digital resources are memory capacity, storage capacity, and network capacity. Through these units, we can assign the environmental impact of the value chain of the physical equipment (server, cables, rack, data centre equipment, building) that is converting energy into digital resources to each unit (e.g., 1 kg CO_2-eq from producing a server for 1 GB of memory capacity).

///<quote>
CPU utilisation has the most significant correlation to power consumption.
///</quote>

AN EXAMPLE

A generic server might have a ‹digital resource production› capacity of 48 CPU cores (producing CPU cycles per second), 100 Gbit of network capacity, 128 GB of memory capacity, and 2 TB of storage capacity. For this server to operate and be able to produce these resources, the environmental impact from manufacturing, transporting, operating and disposing of the server should be attributed to each digital resource unit the server produces, for example,

- Cabling
- Silicon production of chips
- Power supply, network chips, and cards (for internet connectivity)
- Cooling systems, such as fans and conductive metals (to transport the generated heat away)
- The environmental impact of the energy used when the server was manufactured.

The total environmental impact of the server is then attributed to each digital resource the server produces using a time-share model, whereby the maximum digital resource output is determined over the expected lifetime of the hardware.

The only exception is the primary energy consumption, which is determined based on the actual digital resource utilisation of the software (e.g., software may occupy 30% of all the digital resources of one server over its lifetime).

As an example: If we know the environmental impact of manufacturing 1 GB of memory that we plan to use for 4 years, and the environmental impact of the electricity for a use/hour, and we have a software application that is using 500 MB (50%) of memory over a period of an hour, we can attribute 50% of the environmental impact of the energy consumption and 50%* (1 hour / 4 years) of the impact of the production of that 1 GB of memory to the application.

This double conversion from equipment to digital resources and from digital resources to software is necessary as software itself only consumes digital resources, not physical resources as would be required to perform a Life Cycle Inventory – CPU cycles, memory capacity, storage capacity, and network capacity.

We are proposing to perform a LCA of ICT equipment first and then loading the entire environmental impact (spread over the lifetime of the equipment) onto the energy-to-digital-resource conversion machine. Using conversion and by observing the digital resource usage of software, we can determine the environmental impact pro-rata.

When doing the pro-rata assignment, however, it must be kept in mind that different DRPs are responsible for different ratios of the energy use. For example, a CPU is responsible for the majority of the power consumption, whereas an SSD storage disk might cause a bigger impact through its manufacturing. As a rule of thumb, we have defined baseline ratios that have been developed using data from other research as described in SDIA **(2022) [Figure 2]**.

However, modern approaches allow a real measurement of many of these DRPs and a far more precise and fair attribution. We discuss these developments in the following section and, while only demonstrating the usage phase, describe how the same method can be re-used in all other LCA phases.

TECHNICAL IMPLEMENTATION

To provide the needed data to perform a LCA, a measurement setup must be installed that can reliably capture the metrics needed to assess DRP consumption to the required granularity level. The electricity consumption and the exclusive usage time for every relevant software component (database, webserver, caching-layer, browser, etc.) as well as for every hardware component (CPU, RAM, HDD, GPU, etc.) must be determined.

Since modern software is typically designed in a microservice architecture, the existing segmentation can be used, which in turn benefits from the reusability of the infrastructure as code that is already available. The typical technology here is the containerisation in form of the industry standard, a ‹Docker (compatible) container›. Many client-side applications today rely on server-side infrastructure to function, hence we use the server side as our main reference point for this article.

To construct the final application, our measurement tool needs to be able to set-up both the containers and their network connections. The Docker technology uses concepts from the Linux kernel that allow already existing performance metric endpoints to be captured for all hardware components. These metrics are aggregated separately for every container, which we deem as the needed maximum granularity for our LCA.

The use of a software is typically well defined and is already present as either a unit test or an end-to-end test and can thus also be reused or, as Gröger et al. **(2018)** have shown, easily constructed for arbitrary software. **[Figure 3a]** shows an example of a possible usage pattern for a PDF reader that we could leverage to measure its typical resource consumption. **[Figure 3b]** shows the corresponding measurement of the energy consumption of the CPU over time when this usage pattern is executed.

///<quote>
To generate reliable measurements, a special prepared system is needed.
///</quote>

To generate reliable measurements, a special prepared system is needed that does not generate any noise during the measurement. We use a standard Ubuntu operating system and turn off every functionality that typically caters for automatic updates, the NMI watchdog, cronjobs etc.

[Figure 3 A+B *Own Figure, Green Coding Berlin GmbH (2022)*

FIGURES AND NUMBERS

CPU ENERGY CONSUMPTION

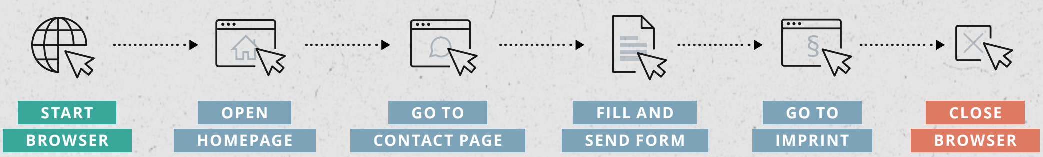


Figure 3a: *Usage Scenario for a User Interaction with a Web Page.*

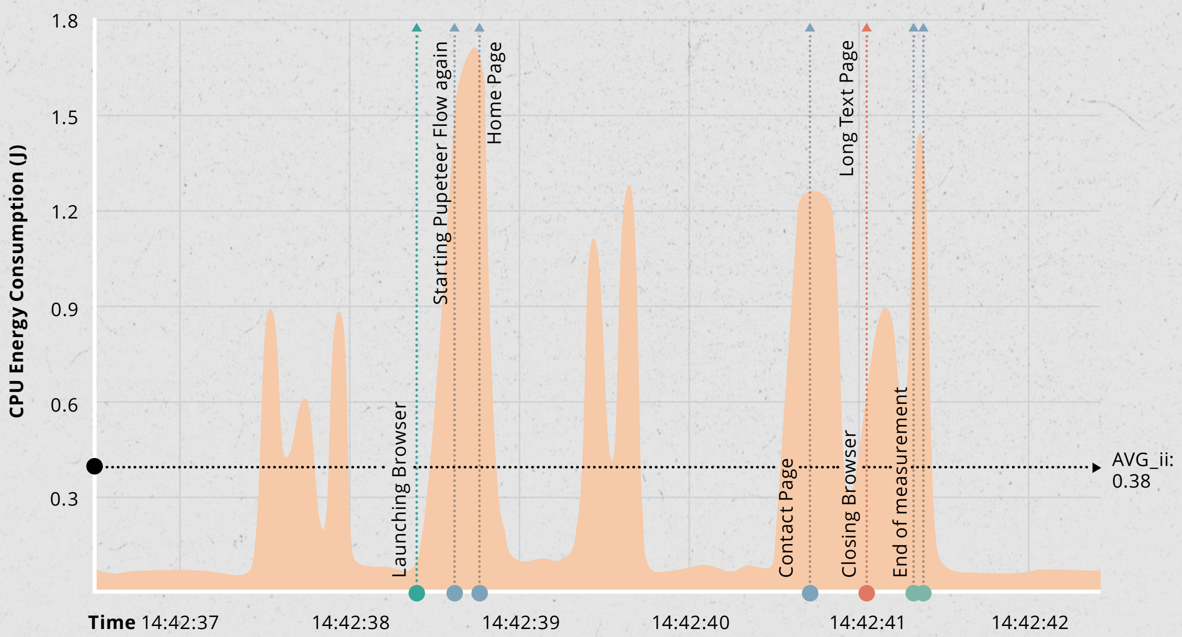


Figure 3b: *CPU Energy Consumption in Joule over Time for User Interaction with Web Page as shown in 3a.*

The measurement of the development phase, which consists of writing the software and testing it, can leverage the same tools as those used in the usage phase. Here we use the resource consumption on a process level and accumulate the resource consumption of all associated processes needed for developing and testing the development phase. The same holds true for the removal and distribution phase, where typically a process is responsible for removing/creating software artefacts on the hard disk, caches etc.

OUTLOOK

For those responsible for software development, this measurability by re-using existing infrastructure layouts allows us to understand and manage the environmental impact of software and how different development and usage approaches affect energy consumption. With the resulting transparency, software developers can thus design their software to be more resource-efficient.

For the end users, transparency is created when they can see how much energy their software consumes and compare different products. On the basis of these measurements, one could, for example, build an open platform that makes the data available to everyone and can help consumers make more conscious decisions in terms of climate protection when purchasing software. In addition, this information can help policymakers enact legislation to establish sustainability standards for software.

We see the creation of more transparency in ICT as an enormously important element in the future. And this importance is not only related to a development towards more resource efficiency but also to more digital participation and finally rebalancing technological power means for all areas of sustainable digitalisation. }

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2 Foundation for a Socio-ecological Digitalisation

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VALUES FOR TRANS-FORMATION

Promises of quick technofixes and ground-breaking digital innovations saving the world as we know it are persisting narratives in climate change discussions. These beliefs are based on values of competition and innovation leading to development and unlimited economic growth. Yet, almost daily floods, wildfires and droughts, hitting the Global South the hardest, are proof that these beliefs are flawed. In addition, the division of societies through microtargeting and other digitally perpetuated structural disadvantages is advancing online, e.g., on social media, digital platforms, and alike.

Despite these challenges, a digitalisation that respects ecological boundaries, promotes human rights and strengthens social cohesion is feasible. Exposing current pitfalls, as we did in Chapter 1, is a first step towards this end. What is needed next is a shared foundation, that guides decision-making and enables behavioural change: a moral compass. But can such a value-based digitalisation overwrite the growth paradigm and monopolistic trends, that hold our data and human rights hostage?

In this chapter Völkle and Lindinger explore how feminist thinking can shape a just and future-ready digitalisation, counteracting current power asymmetries and social inequalities. Further, Franke and Pentzien challenge the unsustainable practices and paradigms of the platform economy by demonstrating what platforms based on federative structures and cooperation can – and cannot – do to reverse capitalism's harm. Frick et al. and Hasecke and Hierweck reveal the vulnerability of our data in the hands of monopolies. They call for digital sovereignty and the democratisation of digital infrastructure to overcome BigTech dependencies and community capitalism. Finally, Wijers ends on a practical approach to assess and *re-value* our own digital infrastructure.

Patricia Jankowski

{ Authors *Hanna Völkle & Elisa Lindinger*

DEBATE ARTICLE

A FEMINIST REMINDER IN TIMES OF DIGITALISATION

Socio-ecological and digital transformation share an underlying challenge: To avoid reproducing social inequalities and persisting power asymmetries, decision-makers must evaluate proposed action cautiously and critically. To make things more complicated, they need to successfully do so across demographics, across academic disciplines, and on a global scale. What would digitalisation look and feel like if it were centred on social and environmental justice?

Too often, our analyses focus on only one isolated topic while disregarding others that are interconnected: social challenges of the digital transformation vs. ecological challenges; digital technologies as potential solutions for climate change vs. the societal impact of sourcing hardware and running software. Why is it necessary to consider (planetary and social) boundaries in times of digitalisation? There is a rich treasure trove of feminist thinking and practice that already addresses underlying issues of digital transformation, albeit in different contexts. Feminist thought has created tools to criticise power asymmetries and inequalities of the dynamics of digitalisation. Too often, the digital transformation is presented as essentially new, its challenges so far unheard of. *What can we learn from feminist heritage to respond to them?*

///<quote>
Feminist thought has created tools to criticise power asymmetries and inequalities of the dynamics of digitalisation.
///</quote>

REPRODUCTIVE BOUNDARIES IN TIMES OF SPATIAL AND TEMPORAL INDEPENDENCE

Especially in times of transformation, it is important to be sensitive to the different individual impacts change might have. For digitalisation, this would mean addressing two questions: For ‹whom› does a digital transformation open opportunities, and ‹who› is able to compete within a paradigm of tech-driven effectiveness? Technical artefacts are mostly created from androcentric perspectives. These perspectives marginalise the fact that humans are not only social beings and thus embedded in a specific socio-ecological context but also limited through bodies that are not independent of others, get tired, get sick, and die. In other words: In times of a digital transformation destined for ubiquity, planetary and social limits must be considered.

Those marginalised and invisibilised boundaries are topics of feminist research and activism. Yet the digital transformation is not the first tech-driven revolution that ignores power asymmetries and ecological limits. Many ecofeminists, such as Maria Mies **(1986)**, Val Plumwood **(1993)**, and Marry Mellor **(1997)** (to name but a few), started research on those topics decades ago. Their findings are highly relevant for today's digital transformation. Human beings are ‹embedded› in social and also ecological circumstances; thus, social as well as ecological reproductive processes matter.

Although, in times of digitalisation, there have been many ways to stay connected (e.g., social media) or to work remotely (e.g., working from home), social and ecological reproduction remain dependent on particular contexts: It is impossible to fast-up friendship or to plant a tree without using real soil; even though humans trade carbon emissions on the stock market, it is impossible to decouple those emissions from a specific temporal and spatial context. Simultaneously, we cannot externalise the costs of reproduction to the digital void; human existence and its messiness cannot be delegated to (server) clouds. Material-feminist questions of power asymmetries or intra- and intergenerational justice remain highly relevant, even, and especially, in a digital context.

Recently several feminist projects and initiatives have emerged that build on these ideas and perspectives Big Tech tends to overlook. Groups marginalised in the tech sector have long understood that the main approach to opening the field is bound to fail: Add women[1] and stir. Simply hiring more women to change the system has not worked in other sectors: neither when fighting corruption **(Sim et al., 2017)** nor in foreign policy, where feminist values necessarily clash with nation-state interests **(Guerrina et al., 2018)**. In tech, this approach comes with claims to open a financially highly rewarding field of work, while it is mostly intended to solve the labour shortage in programming and software development. All those endeavours share one underlying problem: They do not address root causes of inequity and do not take into account intersectionalities that exacerbate exclusion. This misleading strategy leads, at best, to limited access for some but not for all. Even if including women in the digital transformation is the most visible practice, it is not feminist. The criticism from Guerrina et al. **(2018)** is, thus, relevant: *«Feminism should challenge social inequalities in which gender intersects with other dimensions of power (race, class, sexuality, different ability). Its purpose is to transform a system that reifies men, and masculinities, as the norm».*

[1] *Women* means all people who identify themselves as women.*

Instead of trying to make tech a little more diverse, feminist practitioners have chosen a different path: Building their own set of rules and guiding principles, and even their own tech. In 2014, a group of 50 people drafted the first set of ‹feminist principles of the internet›, with the goal to *«provide a framework for women's movements to articulate and explore issues related to technology»,* and created the necessary groundwork for criticism from outside tech's current power structures. The organisation ‹Feminist Internet› explores new ways to advance equalities online, ranging from queering technologies to making discrimination and abuse visible. ‹Coding Rights› published a card deck, the Oracle for Transfeminist Technologies, to break open common tech narratives and reframe them from a feminist view point. In 2022, ‹SUPERRR Lab› launched the feminist tech principles, meant as a set of guidelines for tech policy-making and technology creation.

INGREDIENTS OF A FUTURE-READY AND HUMAN-CENTRED DIGITALISATION

Our vision of a future-ready and just digitalisation needs ‹universal rights› instead of power for the few. Rights that enable participation and combat power asymmetries. In particular, remaining inequalities within decision-making processes are harmful for the vision of including a broad spectrum of perspectives and life realities. To date, especially, white cis-male (privileged) perspectives dominate decision-making within the digital transformation. So, there is a need for a feminist digital strategy. Feminist digital rights include a power critical and structural analysis of actual policy-making. We need to scrutinise critically who is (unconsciously) considered to be part of a digitalised, future-ready society and who is marginalised in this vision.

///<quote>
Our vision of a future-ready and just digitalisation needs ‹universal rights› instead of power for the few.
///</quote>

Legal rights are essential for a just transition. To continue from a feminist perspective, ‹material resources› are needed: resources to enable individuals and marginalised communities to have their seats at the table. We ask for barrier-free access instead of exclusive circles or networks that reproduce (social) inequalities. These inequalities could also affect future generations as their opportunities to live a good life are limited by the resource-intensive lifestyle of recent generations. A decision by the German Federal Constitutional Court decreed that intergenerational justice must be included in current (climate) policy-making **(BVerfG, 2021)** to protect the life and physical integrity of future generations. We need to ask the following question: With whose resources are we trying to get digitalisation off the ground? This is also a question that includes intragenerational aspects of justice and responsibility. To frame ecological resources as proper material legal subjects is ‹one› answer of the Global South to growth-driven extractivism (by the Global North), as put forward in a referendum in Chile in 2022 **(Diaz, 2022)**.

Key to including those multiple perspectives are all relevant decision-makers. As gate keepers, they make a difference. Thus, implementing human-centred digital politics does not only mean meeting tech and sustainability goals. As far as the ‹representation› of women in tech is concerned, we see a constant gender gap, as well as other lacking representations of marginalised groups, which might explain rather tech-enthusiastic innovation politics. Instead of tech-only impact assessment, any such assessment should also consider societal and environmental embeddedness of digitalisation; bottom-up participation and top-linked civic involvement are key. These considerations require civic society being able to impact policy-making as activists, representatives, stakeholders, or citizens. Alison Powell suggests (urban) collective action and grassroot movements should be revived to share experience-based knowledge: *«We should be able to retain rights and capacities to hybridize – to transform and evolve our ways of knowing as the world we inhabit continuously becomes less certain and less easy to narrow and optimize»* **(Powell, 2021)**. For policy-makers, this transformation implies providing the resources necessary for actual civic participation as well as making decision-making as transparent and explainable as possible. }

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Authors *Greta Franke & Jonas Pentzien*

RESEARCH ARTICLE

HOW TO GROW ALTERNATIVE PLATFORMS (FAST)

Shopping on Amazon or instant messaging through Twitter – digital platforms are significantly impacting our daily lives. Platform companies use technology in the form of protocols, websites, or apps to act as an intermediary between diverse user groups. In doing so, they establish and expand digital marketplaces, lowering transaction costs and disrupting established markets **(Srnicek, 2017)**. From a socio-ecological viewpoint, the global growth of the platform model is dual-edged: platforms can promote lifestyles focused on sufficiency, particularly within the context of the ‹sharing economy›, but they also benefit from exploiting user data, profit from market concentration, and legitimise insecure gig-based employment structures **(Gossen et al., 2019)**. For some, the platform model must therefore be understood as the driving force behind a new, even more exploitative phase of capitalism **(Staab, 2019)**.

THE RISE OF COOPERATIVE PLATFORMS

Marketisation dynamics, however, are often accompanied by counter-movements that aim at re-embedding economic activity **(Polanyi et al., 2010)**. The platform economy is no exception. Over the past decade, the platform cooperativism movement in particular – consisting of over 500 actors in more than 40 countries, including cooperative streaming services, e-commerce marketplaces, and delivery platforms – has brought attention to alternative, democratically governed platform models. The movement's objective is simple: to enhance collective ownership and democratic governance in the platform economy, thereby redirecting platforms towards the public good rather than towards private gain **(Schneider and Scholz, 2017)**.

The main challenge of such platform alternatives, however, lies in maintaining democratic governance at scale. In recent years, scholars have explored this difficulty, with one key insight being that, to grow, alternative platforms need to be part of networks that support resource sharing **(Mello Rose, 2021; Pentzien, 2021; Vercher-Chaptal et al., 2021)**. The catch: Building such larger cooperative networks demands additional resources, something that small organisations often lack. How then can this dilemma be resolved? Based on the example of the CoopCycle federation and one of its member organisations, Mensakas, this article highlights a particularly promising strategy: building cooperative ‹federations›.

MENSAKAS: FROM UNION ACTIVISM TO COOPERATIVE ENTREPRENEURSHIP

In 2017, tensions surrounding working conditions in the gig economy in Europe reached a peak. After years of growing discontent, workers across the continent began organising and advocating for better rights.[1] Spain became a centre for this activism, in part due to the formation of a union branch called ‹RidersXDerechos› (Riders4Rights) by a group of Deliveroo riders. Unhappy with these developments, Deliveroo responded by firing the union activists. Instead of retreating, however, the riders took a different approach and created their own platform. Shortly after, Mensakas was born.

[1] *The findings presented here are based on qualitative interviews conducted in 2022 as part of the ‹Teilgabe› research project, funded by the German Federal Ministry of Education and Research.*

It did not take long for the former riders to become aware of the challenges associated with cooperative entrepreneurship in the platform economy. First among them, the problem of acquiring a viable software. Here, Mensakas opted for arguably the most difficult approach: coding from scratch. In fact, trying to simultaneously write code and build a business proved to be too much of a challenge, and the co-op struggled to acquire clients. The result: two years later, in 2020, the co-op re-evaluated its course and decided to join the CoopCycle network, which provides a platform infrastructure to local food delivery collectives.

///<quote>
Platform co-ops need to join forces with actors that share similar values and goals and build on existing structures.
///</quote>

The move was a success. Not only was the co-op suddenly able to invest its limited resources into building up its own business (rather than the software infrastructure), but it also more than doubled in size. Today, Mensakas offers last-mile and food delivery services by bike in the Barcelona area, and all orders are managed through the CoopCycle app. Unlike its proprietary counterparts, however, riders at Mensakas are both workers and owners, giving them access to social security and the ability to make collective decisions on platform development.

What does Mensakas teach us about alternative models in the platform economy? Most importantly, we learn that, rather than carving out solitary paths, platform co-ops need to join forces with actors that share similar values and goals and build on existing structures. Moreover, wherever possible, we see that tasks need to be externalised to other nodes of the networks. The greater the network, the easier it is to mediate the various demands on the platform business. But what could such networks look like? And how could they themselves be managed democratically? Insights can be gained by taking a closer look at the CoopCycle federation.

COOPCYCLE: SCALING ALTERNATIVES REGION BY REGION

«We socialize bike delivery» – this is how CoopCycle greets visitors on its website. Established in Paris in 2017 in light of the Nuit Debout protests, CoopCycle and Mensakas share a similar objective: empowering platform workers in the bike delivery industry. However, instead of establishing a local delivery platform, CoopCycle focuses on developing software and disseminating this software through its network. There are two key aspects to understanding CoopCycle's approach:

- First, the code developed by the organisation is licensed under a special reciprocal ‹Coopyleft License›. The commercial use of the code is subject to two main requirements: the organisation must be employee-led, so couriers cannot be self-employed, and member organisations must meet the EU's criteria for the social economy, ensuring a shared value system between CoopCycle and its member organisations.
- Second, CoopCycle is organised as a collective, with all member organisations contributing both money and expertise. By pooling resources, the federation aims to promote mutual empowerment and self-determination. These aims have multiple benefits, such as allowing new member organisations to join without financial contributions during the start-up phase, promoting cross-organisational learning, and allowing members to participate in decision-making processes concerning the federation's future and software development and thus ensuring that the platform is tailored to local needs.

In recent years, the CoopCycle model has been relatively successful, as reflected by its growing membership. In 2022, the federation consisted of more than 70 member organisations spanning Europe, South America, Canada, and Australia, with members providing services as varied as last-mile logistics, food delivery, and e-commerce for local retailers, all by bike.

FEDERATING TOWARDS ‹PLATFORM SOCIALISM›?

Can federated structures such as CoopCycle offer viable alternatives to big tech companies? Might they even lead to ‹platform socialism› as Muldoon **(2022)** suggests? We argue that these could be the wrong questions to ask. Answering the first question appears too simple: due to the lack of resources in the field, it is unlikely that small co-ops will ever be able to compete with venture-capital-backed unicorns. The initial struggle of Mensakas in developing a viable platform by itself is indicative of this. Answering the second question and convincingly characterising organisations such as CoopCycle as harbingers of platform socialism would require demonstrating that such federative structures could also be replicated in other, more capital-intensive sectors. This replication has yet to be achieved.

However, the impact of federative structures should not be ignored. Rather, we believe that these structures demonstrate *something else.* In fact, CoopCycle shows that the platform model can be used for socio-ecological purposes, promoting transparency, democratic decision-making, and sustainability (e.g., by reducing car traffic through the use of bikes in the logistics sector). Additionally, the federative approach shows that there is more than one way of conceptualising growth in the platform economy. In fact, instead of focusing on scale, CoopCycle aims to achieve growth through ‹replication›. Rather than trying to provide standardised services across the globe, the CoopCycle app is ‹brought to life› by local rider co-ops that are able to respond to context-specific demands.

This emerging federation and its focus on replication, in turn, have political implications. All across Europe, policy-makers are currently looking for ways to build ‹digital sovereignty›. Moreover, municipalities increasingly struggle with proprietary platforms assuming the role of digital infrastructures. Against this backdrop, cooperative platform federations such as CoopCycle provide something that these actors need: a vision for how democratic accountability could be conceived of in the digital realm. While alternative platforms might therefore ultimately be unable to solve the problem of ‹platform capitalism›, they nevertheless have the potential to bring heterogeneous stakeholders – such as policy-makers, entrepreneurs, and union activists – together under the shared aim of wanting to move towards a more democratic, sustainability-oriented platform economy. And if the creation of such an economy is the goal, then federative structures are the most promising way to get there (fast).

///<quote>
There is potential to bring heterogeneous stakeholders together.
///</quote>

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DID YOU KNOW …?

WORLDWIDE MEN ARE 21% MORE LIKELY TO HAVE INTERNET ACCESS THAN WOMEN

Source: *Internet Health Report 2020, Mozilla Foundation*

Authors *Vivian Frick, Rena Tangens, David Ayers, Estelle Goebel-Aribaud, Lisa Kostrzewa, Christian Lautermann & Andreas Flock*

DEBATE ARTICLE

AN OFFICE WITHOUT GAFAM?

Sustainable Infrastructures as Corporate Digital Responsibility

From large corporations to small businesses, IT systems, software, and social media have become indispensable for companies. They are dependent on digital services provided by only a few IT corporations, e. g., Google, Amazon, Facebook, Apple, or Microsoft (GAFAM). 85% of companies in Germany use Microsoft's Office software, another 9% use Google's – only 2% use the open alternative Libre Office **(Statista, 2022a)**.

THE GAFAM DEPENDENCY OF GERMAN COMPANIES

In Germany, companies **(Statista, 2022a)** and the state **(Bitkom, 2021)** are highly dependent on imported digital services and expertise provided by very few IT corporations. The market for cloud services, for example, is strongly concentrated: Amazon Web Services (AWS), Microsoft, and Google alone share two-thirds of the market and have asserted their lead worldwide **(ISG, 2018; Statista 2022b)**. Such dominant providers mainly offer closed solutions based on proprietary use, i.e., manufacturer-specific standards, leading to a high dependency on their services due to high switching costs or lack of viable alternatives **(Schauf and Neuburger, 2021; PwC, 2019)**.

The de facto dependence on foreign IT corporations is countered by German companies' desire for digital sovereignty. Four of five German companies agree that Germany is too dependent on foreign countries **(Bitkom, 2021)**. They also find data sovereignty particularly important **(BMWK, 2021)**. Digital sovereignty is therefore a key strategic goal for companies, out of self-interest and out of a desire to live up to their social responsibility. Yet although more and more companies are committed to corporate digital responsibility, their sustainability reporting rarely mentions this goal or related measures **(Lautermann and Frick, 2023)**.

WHAT ARE THE RISKS OF GAFAM DEPENDENCY?

In the current energy crisis, it has become drastically clear that independence, resilience, and security are essential features of dependable infrastructures. Relying on the services of a few large companies that have oligo- or even monopolistic structures poses risks for digital infrastructures. It also results in a power imbalance: Companies fully depend on their provider's services, who can discontinue or change the services at will. Companies should be aware that, when they outsource cloud computing, they relinquish sovereignty over their infrastructure.

///<quote>
Companies should be aware that, when they outsource cloud computing, they relinquish sovereignty over their infrastructure.
///</quote>

GAFAM services also have surveillance issues. Microsoft, for example, can track which colleagues, projects, and programmes employees interact with when, how, and for how long **(Lang, 2021; Microsoft, 2023)**. Further, the companies' user assurances that their servers are located in Europe is meaningless as the location of the headquarters determines most of the legal framework for data protection and surveillance. All US-based companies, such as Google, Microsoft, and Zoom, are subject to the Foreign Intelligence Surveillance Act (FISA), which allows US intelligence agencies to access data of non-US citizens – regardless of a companies' privacy policy or server location **(Vladeck, 2021)**. Nevertheless, most German companies entrust sensitive data to these infrastructures, not only exposing their own business details but also putting their customers' and employees' data at risk.

SUSTAINABLE ALTERNATIVES ARE AVAILABLE BUT RARE

To reach digital sovereignty, viable alternatives to GAFAM services must be available. Free or Libre open source software (FLOSS)[1] and platforms are such sustainable alternatives **(Pohl et al., 2021)**. FLOSS is more sustainable because its code is openly accessible to everyone. Software projects can be developed co-operatively and no license fees are incurred when using FLOSS. A federated FLOSS-based infrastructure guarantees individuals, companies, and the public sector control over access to their information. Such FLOSS alternatives include:

Linux instead of → *Microsoft or Apple:* an operating system used in several companies.

JitsiMeet instead of → *Zoom, Skype or Webex:* video conferencing application suited to quick exchanges in small groups (approx. 20 participants), easily started in the browser and shared via a link.

BigBlueButton instead of → *MS Teams, Zoom or Webex:* a video conferencing for larger groups, often applied in the education sector. It runs browser-based and allows the assignment of presenter or moderator roles and breakout sessions.

Nextcloud instead of → *Dropbox, Google Docs, OneDrive or iCloud:* documents can be stored and managed by different user groups. It can be integrated into the desktop.

nuudel or **Termino** instead of → *Doodle:* data-secure, non-tracking tools to schedule events or conduct a survey.

RocketChat or **jabber** instead of → *WhatsApp, Slack or Telegram:* an open-source messenger with an extensive range of functions for web and smartphones that does not copy the address book to the server and protects privacy.

[1] *On the difference between Open Source and Free Software: https://libreplanet.org/wiki/What_is_the_difference_between_Open_Source_and_Free_Software%3F*

The demand for these alternatives exists: Especially governmental organisations, the NGO sector, and church organisations have an interest in guaranteeing data protection, as they could otherwise be putting members, employees, or activists at risk.

RESOURCE AND POWER DISTRIBUTION ARE THE PROBLEM – BUT ALSO THE SOLUTION

Yet still, better solutions remain niche. Convenience is a main reason: Employees use Google because it is easy, Zoom because they got used to it during the pandemic, Microsoft because it allows full compatibility with other companies' infrastructures. Also, most employees have been acquainted with GAFAM programmes since childhood – schools and universities primarily use these services as well – while the alternative services are not well known.

FLOSS cannot compete with proprietary software financially, either. GAFAM offer valuable applications for free, cross-financing them with advertising. Google, in fact, finances more than 81% of its business through advertising **(Coafono, 2023)**. In comparison, less money is going into FLOSS development, maintenance, and marketing. Sustainable and open-source alternatives urgently need investment, whether to improve usability or other features. Efficient, reliable, and data-secure infrastructure comes at a price – and it is high time companies start asking themselves whether they prefer to pay that price with money or by giving up (not only their) digital sovereignty and privacy. More sustainable business and payment models are needed to provide user-friendly sustainable digital services **(Frick et al., 2021)**. Investing in, using, and developing these services should be a core strategy of corporate digital responsibility.

///<quote>
Employees use Google because it is easy.
///</quote>

A CALL TO POLITICAL, CIVIC AND ENTREPRENEURIAL ACTION

The US companies that dominate the digital market today with proprietary software have grown with the help of government funding **(Mazzucato, 2013)**. The ‹public money, public code›[2] has the following demand: if software development is funded with public money, then the product must also be available to the public. In other words, it should be open-source software. If this stipulation were a precondition for public funding, at the EU or German level, then the tide would turn in favour of sustainable and decentralised alternatives and the companies that offer them. Additionally, encouraging the education system to integrate FLOSS services into their teaching could create a broad competence basis for FLOSS implementation.

[2] *See also: Free Software Foundation Europe https://fsfe.org/activities/publiccode/index.de.html*

///<quote>
The oligopoly structure of IT infrastructures represents a fundamental and global market failure.
///</quote>

The oligopoly structure of IT infrastructures represents a fundamental and global market failure. This failure can only be countered by regulation and antitrust law. To reverse monopolisation tendencies and decentralise power structures, policies should also foster technical federalism. Further regulation is needed to shift the balance of power: Tracking and personalisation in online advertising is not only

GAFAM's main source of revenue but also has various harmful effects[3] and should therefore be restricted **(McCann et al., 2021).**

We conclude with a call to action – companies, politics, and civic society need to actively democratise our digital infrastructure, which means reducing GAFAM dependency. For digitalisation to be sustainable, it will take more than switching to green electricity or recycling computers. Sustainability goals also require a sovereign, resilient, and decentralised infrastructure, a central component of which is free or open-source software.

[3] *See Tracking-free Ads Coalition – A group of a coalition of political leaders, civil society organisations, and companies from across the EU that are committed to putting an end to the pervasive tracking advertising industry that dominates the internet today. https://trackingfreeads.eu/the-costs-of-tracking-ads/*

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PRACTICAL PERSPECTIVE

INFRASTRUCTURE AS COMMONS

How We're Taking Back the Internet

DON'T BE AN MDAU!

Over the last two decades, free and open source software has won one victory after another. According to surveys by W3Tech2 **(n.d.)** and W3Cook **(2015)**, the market share of Linux operating systems in the server market is between 70% and 96.5%, depending on the data source. Linux dominates the supercomputer market **(Statista, 2021)**. As for smartphones, 75.26% of them run the Android operating system, which is based on Linux **(StatCounter, 2023)**.

///<quote>
The dystopia of the Hollywood film Matrix has become reality in a frighteningly banal way. No red pill will get us out of that reality.
///</quote>

But the triumph of free software has been a Pyrrhic victory. It has given birth to an oligarchy of tech companies. Free software has turned garage companies into the most powerful stock market giants of all times in just a few years. With the help of free software, those companies managed to turn people and their privacy into a precious commodity for downright dizzying profit maximisation. The dystopia of the Hollywood film Matrix has become reality in a frighteningly banal way. While we play at surfing the internet and doing cool things, in reality we feed tech capitalism with our data. And no red pill will get us out of that reality.

The Twitter take-over by tech capitalist Elon Musk was an eye-opener in many ways. The price tag of US$ 44 billion revealed the enormous value generated by the platform users. When the American multi-billionaire bought the social media platform, it had 237.8 million mDAUs **(Twitter, 2022)**. In its earnings report presentation for the first quarter of 2019, Twitter Inc. **(2019)** defined an mDAU as follows: *«We define ‹monetizable daily active› usage or users (mDAU) as Twitter users who logged in or were otherwise authenticated and accessed Twitter on any given day through Twitter.com or Twitter applications ‹that are able to show ads›»*. An mDAU generates monetisable information through all kinds of activities (following, liking, sharing, commenting) and makes it available to Twitter Inc. free of charge for commercial purposes (‹show ads›). User-created content, information, and metadata are the assets that Musk has acquired for US$ 44 billion. However, those who created the value never saw a single penny. All the money flowed to the shareholders of Twitter Inc. Apologists of digital capitalism often claim that data is the oil of the 21st century, but that is ‹foolishness›.[1] With social media, capitalism has found a way to minimise marginal production costs nearly to zero. Only a small number of paid staff are needed to herd the productive giant army of mDAUs.

On the other hand, thanks to Musk's erratic decisions, mDAUs are leaving the platform in droves, discovering the free and decentralised network of the Fediverse, with Mastodon as loadstar. The game of producing value by volunteers may be over soon, at least in social media if we choose to no longer be mDAUs.

///<quote>
The game of producing value by volunteers may be over soon, at least in social media if we choose to no longer be mDAUs.
///</quote>

[1] *In German, DAU is the acronym for ‹Dümmster anzunehmender User› (most foolish user conceivable)*

COMMUNITY CAPITALISM: EXPLOITING SOCIAL NEEDS

The generation of value by exploiting a community is not limited to social media. In their book ‹Community-Kapitalismus› **(Dyk and Haubner, 2021)**, sociologists Silke van Dyk and Tine Haubner shape the notion ‹Community Capitalism› to describe the phenomenon in a much broader sense:

> *«Community capitalism unfolds its significance precisely because it seems to offer an answer to the longing for community and solidarity and because it offers connection points for actors of the most diverse political backgrounds. In the process, capitalism once again manages to reorganise itself successfully through its crisis effects: The longing for security and support in social communities, which is nourished precisely by the dismantling of social security and a competitively increased isolation, in turn becomes a resource and is exploited in crisis-ridden capitalism as an alternative to social rights». (Translation by Hasecke/Hierweck)*

Van Dyk and Haubner refer to the crisis of social reproduction triggered by demographic change, women's employment, and the withdrawal of the state from social security systems. Under the reign of community capitalism, social ‹rights› guaranteed by constitutions and laws become social ‹gifts›. The volunteers are sacralised into everyday heroism, and the de-economisation of care work is mythologised. Volunteering creates an incurable structural instability in the system and, thus, ensures a constantly reproduced need for volunteering. Social security from the welfare state, actually a unique social achievement, is discredited as cold and anonymous. Instead of guaranteed social rights, the exchange of voluntary benefits is based on informal reciprocity expectations within the framework of personal dependencies and sympathies.

This sounds familiar in our context as, up to now, the Fediverse has been operated by self-exploitation, used parasitically, and is financed by handouts. Van Dyk and Haubner call for «a systematic analysis of the configuration we call community capitalism», and they demand the consistent posing of the property question, while taking seriously the downsides of communal and voluntary structures, and ask about the power to shape society.

In our context, this call means we have to overcome the division between those who care for a decentralised internet, such as the Fediverse, and those who economically and politically shape the digitalisation of the society.

COMMUNITY COMMONISM: PRINCIPLES TO REORGANISE THE ECONOMY

In ‹Neoliberalism and the ideological construction of equity beliefs› **(Goudarzi et al., 2022)**, the authors discovered the materialist foundations of equity beliefs in our societies.

> *«Our results, in which higher than average (within-countries) levels of neoliberalism tend to be followed by higher than average (within-countries) levels of belief in equity, suggest that 4 years is sufficient for – as Thatcher put it – systems to change ‹souls›».*

Margaret Thatcher, the mother of neoliberalism, changed our beliefs about social justice by changing the economy, thus proving that materialist theorists were right. If we want to roll back neoliberalism, we have to change the economy.

Basically, there are two alternatives to privately owned infrastructure. We can run digital infrastructure as a public service like, e.g., public radio and television broadcasters. But if digital infrastructure were public property, politicians would shape the digitalisation. If we, the users, want to shape it, we have to choose the alternative and organise digital infrastructure as a common.

///<quote>
If digital infrastructure were public property, politicians would shape the digitalisation.
///</quote>

The American economist and Nobel prize laureate Elinor Ostrom identified eight design principles of stable local common pool resource management. In her works, Ostrom **(1990; 2010)** characterises stable commons as follows:

1. Boundaries of users and resource are clear
2. Congruence between benefits and costs
3. Users had procedures for making own rules
4. Regular monitoring of users and resource conditions
5. Graduated sanctions
6. Conflict resolution mechanisms
7. Minimal recognition of rights by government
8. Nested enterprises and polycentric governance.

Some of these characteristics apply to consumer cooperatives, such as housing cooperatives, or retail cooperatives, such as DENIC eG, the German domain registry. Cooperatives are a relatively elaborate association of natural and legal persons, proven in practice for decades. Real consumer cooperatives have clear boundaries as only members can use the pool resources. They are democratically structured with implemented processes for collective decision-making, graduated sanctions according to their bylaws, and mechanisms of conflict resolution. And in most states, self-determination of cooperatives is recognised by state authorities and legislation.

DECENTRALISING COMMUNITY CLOUDS WITHOUT HYPERSCALING

The legal form of a cooperative is a good umbrella for socialising technical infrastructure in the pragmatic, decentralised, bottom-up manner proposed by Ostrom. Fighting community capitalism based on mDAU-powered private profits requires a decentralised cloud infrastructure under user control.

But can we economically implement the technical infrastructure for cloud services within small and medium-sized cooperatives? Can we set aside the usual assumption that clouds can only be economically attractive if they are big enough to profit from economies of scale? Hierweck **(2019)** showed that, by using local storage and reducing complexity, a scalable infrastructure can be operated economically with as few as two physical servers. This alternative makes it possible to operate digital infrastructure through small and medium cooperatives decentrally and thus more resiliently than with the large hyperscalers. Hostsharing eG has implemented such a cloud solution entirely with open source software components and standard server technology. Through virtualisation, it achieves scalability and hardware independence on a scale that is sufficient for the majority of business models. Redundant hardware and storage replication ensure high availability. As ‹Cooperative Community Cloud›, the solution has been successfully operated since 2020. To sum up, we have the economic and legal umbrella of cooperatives and the corresponding technology to take back the internet and create a decentralised and more resilient web owned by us, the people. }

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PRACTICAL PERSPECTIVE

THE DIGITAL POWERWASH

Are the Digital Tools You Employ Reflecting Your Values?

The process of digitalisation in organisations leads to numerous questions. For example, how well will a (software) tool perform its required functionality? How does it integrate with established processes? How much money does it cost to implement? And what about maintenance?

Yet one question often seems to be forgotten: *Does the (software) tool, as we employ it, reflect the values of our organisation?*

This question has become increasingly important with the rampant data gathering, hoarding, and, frankly, abuse of technology by big multinational technology corporations. Do we really want to employ digital tools created by companies with values often diametrically opposed to those of our own organisation?

FINDING OUT IF SOFTWARE TOOLS REFLECT YOUR VALUES

This question may not be a top priority for private commercial organisations yet, but it is a very valid and important question for public organisations with responsibilities beyond profit making. These organisations, which we term «values-led organizations» **(Bogaerts et al., 2023)**, include municipal governments, state agencies, public broadcasters, educational (research) institutions, libraries, archives, healthcare institutions, cultural organisations, and NGOs. They are expected and often required by law to commit to, uphold, and protect values such as transparency and accountability.

///<quote>
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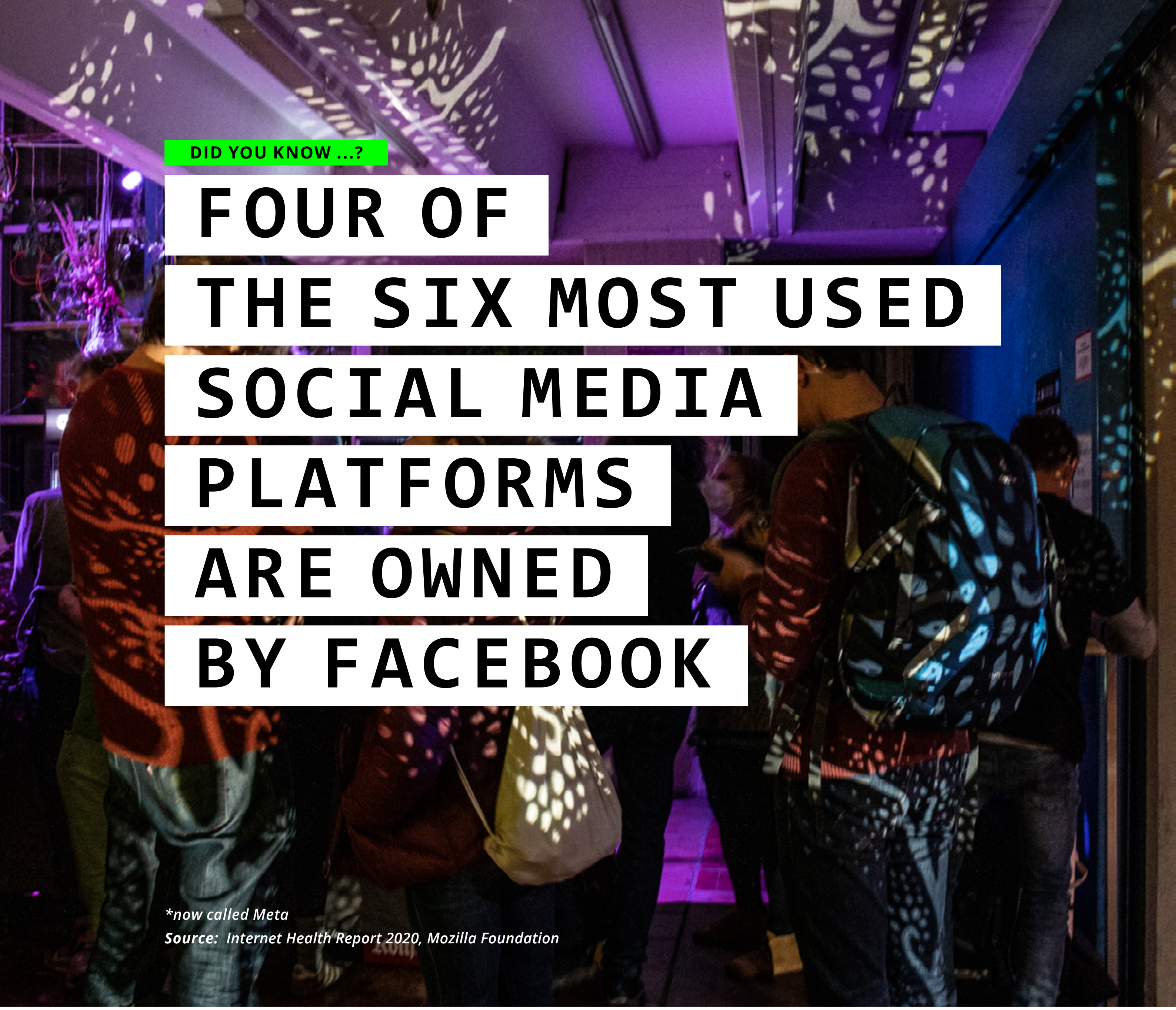
///</quote>

‹The Digital Powerwash› is the name of a practical approach striving to ‹quantify› how well a pre-determined set of public values is reflected in a (software) tool. It originated from the Dutch public broadcaster VPRO and is currently being developed by PublicSpaces, a non-profit foundation in The Netherlands consisting of more than forty different organisations. At the moment, 17 organisations have used the approach to investigate more than 40 different (software) tools: e.g., for content management, videoconferencing, and data analysis.



DID YOU KNOW ...?

FOUR OF THE SIX MOST USED SOCIAL MEDIA PLATFORMS ARE OWNED BY FACEBOOK

**now called Meta*
Source: *Internet Health Report 2020, Mozilla Foundation*

HOW ‹THE DIGITAL POWERWASH› WORKS

Angela Zuyderwijk, IT project manager at The Amsterdam Public Library (OBA) has been using ‹The Digital Powerwash› to support the library's mission for a year now:

«As a library with 27 locations throughout Amsterdam and limited resources, we are always looking for instruments that can help us achieve our mission: to ensure all inhabitants can participate in our information society and no one is left behind» **(A. Zuyderwijk, personal communication, January 28, 2023)**

‹The Digital Powerwash› consists of three elements: a questionnaire with 25 questions (PublicSpaces, n.d.), a website to publicly share results, and a digital badge to publicly display participation in the ‹The Digital Powerwash›. It builds upon the PublicSpaces manifesto, which, among other things, describes a set of five public values: ‹Openness›, ‹Transparency›, ‹Accountability›, ‹Sovereignty›, and ‹User Centrism› **(PublicSpaces, 2021).** Organisations choose one or more (software) tools to self-audit using the questionnaire. Each audit results in a score indicating how well a tested (software) tool aligns with the described values.

«We already have a set application landscape with numerous agreements with suppliers. It will not be possible to turn this whole landscape upside down overnight. There are situations in which we cannot see any other option than to use products or services from Bigtech. We can, however, measure to what extent the values of the application correspond to those of the OBA, start conversations with existing suppliers, test every possible new application, be as transparent as possible about our choices and open for suggestions.»
(A. Zuyderwijk, personal communication, January 28, 2023)

Test results must be shared with PublicSpaces and are published on ‹The Digital Powerwash› website. After having tested and published the results of at least one (software) tool, a participating organisation may display the PublicSpaces badge. Participation is mandatory for organisations that are part of the PublicSpaces coalition.

«Participation in ‹The Digital Powerwash› has contributed to more responsible application use. We've noticed an increase in knowledge and awareness. It enables us to make an informed decision per application and thus slowly reshape our architecture.»
(A. Zuyderwijk, personal communication, January 28, 2023)

LESSONS LEARNED AND NEXT STEPS

‹The Digital Powerwash› helps in raising awareness and starting conversations within an organisation about (software) tools and how these relate to the values of the organisation. It does not yet function as an instrument ‹quantifying› how well a certain pre-determined set of public values is reflected in a (software) tool, which would be useful when selecting value-based (software) tools or as a benchmark, two of PublicSpaces' goals.

///<quote>
The Digital Powerwash helps in raising awareness.
///</quote>

We have set up an open and public process to revise the questionnaire into two tools: a conversation starter and an instrument striving to ‹quantify› how well a certain pre-determined set of public values is reflected in a (software) tool. We would like to investigate how we may adjust or extend the current set of five public values. We have started conversations with academic institutions in Utrecht interested in the approach and strive towards collaborating with them.

Ultimately, PublicSpaces' goal with ‹The Digital Powerwash› is to help public organisations transform their digital environment into healthy public-values-based digital environments. }

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New Concepts and Paradigms to Upgrade Current Socio-technical Structures

TRANS-FORMATIVE CHANGE

As digitalisation has become increasingly indispensable, more and more actors have recognised the need to actively shape its path. This has led to the emergence of a variety of sustainable digital alternatives. They are based on visions from civil society, such as democratic control, equitable access, and commons-based models for operating digital infrastructures. However, these alternatives often remain niche due to dominant narratives and socio-technical structures that benefit private, larger corporations focusing on profits rather than the common good.

This chapter therefore explores how transformative change can be pursued in different ways and at different societal levels. Contributors recognise that practices need to change, and so do our existing mindsets, paradigms and underlying structures. As Nesterova, Beyeler and Niessen point out, change processes are dynamic and processual. We need non-binary thinking and a fruitful dialogue, that includes different approaches such as degrowth, sufficiency und circularity. New circular economy practices that enable us to reuse, repair, and recycle products are an important aspect of driving change, as Zimmermann and Voigt demonstrate for open source hardware. The same holds true when implementing a sustainable digital infrastructure, as Sørensen and Laser argue, where new practices, for example on the organisational level, are necessary. Stürmer, Tiede, Nussbaumer, and Wäspi highlight the need for structural changes, such as the provision of infrastructures and suitable long-term financing mechanisms to create public digital goods. The structural transformation must also include reducing social inequalities that are reproduced in the digital age, as Rahman illustrates. She introduces a new concept of how start-ups and large technology companies can work together constructively to reduce global inequalities.

Friederike Rohde & Vivian Frick

{ Authors *Lars Zimmermann & Maximilian Voigt*

DEBATE ARTICLE

OPEN SOURCE HARDWARE AND OPEN DESIGN

Enablers of a Sustainable Circular Economy

The circular economy is on the rise. This conclusion is permissible in light of the EU Commission's actions, which put ideas of a circular economy prominently into the European Green Deal and thus direct our attention to extracting and reusing resources. The goal is to keep those resources in the system. This goal is relevant for sustainability since the environment is harmed by extracting new resources and disposing of products. It is also of strategic interest for security of supply, not just in times of crisis. But the question is how do we get there? How do we have to change our way of producing, of doing business, of living so that true cycles can emerge?

///<quote>
Refuse; rethink; reuse; repair; refurbish; remanufacture; repurpose; recycle.
///</quote>

Before we get into this, let's take a brief look at the circular economy debate. It presents itself primarily as a discussion of actions. Verbs such as ‹refuse›, ‹rethink›, ‹reuse›, ‹repair›, ‹refurbish›, ‹remanufacture›, ‹repurpose›, and ‹recycle› are the focus of attention **(Kirchherr et al. 2017).**

We might imagine, for example, that we travel less and therefore don't need a suitcase (refuse); we conduct our meetings online instead of on-site (rethink); If we travel, we don't buy a new suitcase, we buy one second-hand (reuse). Or maybe we replace a broken wheel (repair) before we start our journey, or we take an old suitcase with just a handle and upgrade it by adding wheels (refurbish). Maybe we buy a suitcase from a company that does just that, refurbishing, on a large scale (remanufacture). And when we no longer travel but settle in, we don't throw the suitcase away but use its shell as drawers in a cabinet (repurpose). And we make sure that the suitcase is made of materials that can be recovered cheaply and without loss of quality (recycling).

The more concrete and detailed the discussion about a circular economy becomes, the more unresolved questions on its implementation arise. How must such a repairable suitcase be designed? How is it manufactured? Can the practices also be applied to smartphones? The circular economy presents us with complex problems. It needs new forms of cooperation between the different actors in our economy –

for instance, recycling facilities need to know how the products they seek to recycle can be disassembled and which materials they may extract. Or repair shops might need information on the product design to accomplish their task.

Digital technology can play an important role in dealing with some of these issues through implementing new forms of cooperation. It has fundamentally changed the way we work together. The question is which tools from the digital realm are suitable for circularity? A growing number of scientists, hardware developers, and activists **(e.g., Bonvoisin, 2017; Undheim, 2022)** believe that the methods developed in the cosmos of open source hardware and open design have received far too little attention although they actually seem to be the methods with the most potential.

If we look at the different practices of the circular economy described above, ranging from rethinking to reusing, repairing, and recycling, some questions arise: Who shall perform them? And how? What needs to be in place to make them possible and likely? We argue that these actions need to be supported by:

- **The design of a product**
  e.g., Can the case be opened for repair without damage?
- **The intellectual property rights with regards to a product**
  e.g., Can spare parts be produced by everyone or are they design-protected?
- **Transparency**
  e.g., Is the information necessary for efficient and effective recycling available?
- **Infrastructure**
  e.g., Are facilities and institutions available for recycling or repair?
- **The mindset of people**
  e.g., Do people think about repairing or repurposing?
- **Legislation**
  e.g., Can recovered materials be used in new buildings?

As yet, few of the areas mentioned are at such a level that they can support circular practices. Repair cafés regularly encounter all these problems. They are initiatives in which volunteers get together with the mission to make broken things work again. A toaster cannot be repaired because you cannot open its casing, no one produces spare parts for it, or the information needed to repair it cannot be found. Establishing a circular economy entails an incredibly complex and intertwined set of problems. Open hardware and open design can help to deal with this.

OPENNESS TO REDUCE COMPLEXITY

Open source hardware and open design are methods that have emerged in the digital age. Both have the goal of involving more people in designing and producing physical objects. The core of open source is therefore ‹cooperation›.

///<quote>
With open technologies, the normally vertical production system focused on individual companies or groups of companies will be opened up and aligned horizontally.
///</quote>

Open source hardware focuses on sharing blueprints for products that anyone can use commercially for any purpose. *«Open source hardware is hardware whose design is made publicly available so that anyone can study, modify, distribute, make,*

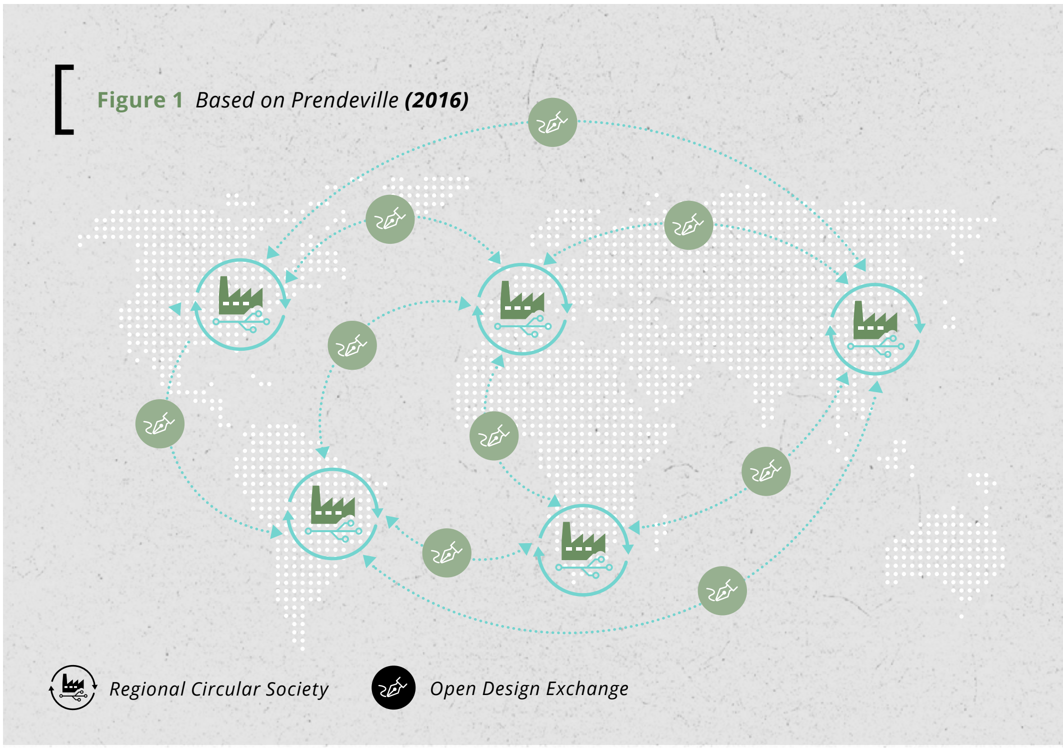

Figure 1 *Based on Prendeville* ***(2016)***

and sell the design or hardware based on that design».[1] At its core, open hardware is a publicly available and freely licensed documentation that allows reuse. The documentation contains all the important information about a specific item needed for reproduction.

[1] *Open hardware definition, by Open Source Hardware Association: https://www.oshwa.org/definition/ (visited: 23.03.2023)*

Open design focuses on the question of how to design products to make collaboration as easy as possible. There is an emphasis on design that is simple and easy to understand and that can be manufactured with widely available tools and parts. In the definition of open source hardware, this emphasis sounds like this: *«Ideally, open source hardware uses readily available components and materials, standard processes, open infrastructure, unrestricted content, and open-source design tools to maximise the ability of individuals to make and use hardware»*. Open design thus facilitates collaboration through the construction and design of an object, which also includes a modular structure that simplifies the detachment of components.

If we follow these suggestions, the pool of people that can work with a product increases. Ensuring more people can work with products will include circularity practices: Available documentation and the use of standard parts make repair, repurposing, remanufacturing, and even recycling easier and therefore more likely. A toaster that follows the guidelines of open source hardware and open design does not pose a challenge to any repair café. Maybe it doesn't even need a repair café because you can simply repair it yourself right at home. For example, with open hardware it may be possible to replicate spare parts easily and independently of the manufacturer when they are needed. Studies show that the probability of repair increases when the spare part is quickly available. A 3D printer that can be found directly at the repair location, combined with freely available CAD drawings, therefore increases this probability **(Chekurov & Salmi 2017)**.

But it's not just about repair, it's also about local production. Open digital designs that can be easily shared over the internet enable a global innovation and production system focused on local opportunities. The maker movement's saying, ‹design global, manufacture local›, gets to the heart of this **[Figure 1]**. With open technologies, the normally vertical production system focused on individual companies or groups of companies will be opened up and aligned horizontally. Horizontal means that anyone can become part of these networks, including companies, research institutions, or civil society actors. Open networks will be created that can easily cooperate with each other through freely available information and without knowing each other.

Building this kind of circular economy is challenging. We – the open hardware community – were accused of making the approach even more complex with our proposal of an ‹open-source-enabled circular economy›. In this article, we argue that the opposite is the case. We believe that open source is the only way to deal with the existing complexity. Break it down and make it manageable. Supporting and promoting open source is therefore an inevitable part of any initiative – whether from business, politics, or civil society – that really wants to make a circular economy happen, to build a circular society in which everyone can participate.

To implement this economy, design specifications are needed in addition to information (e.g., digital product passports). The current EU draft for revising the ecodesign requirements already contains important aspects, such as the specification of modular construction or the possibility of ‹upgrading›.[2] However, the decisive factor is how these aspects will be implemented and applied to product areas. To design openly, we need concrete specifications, and we must be provided with design files. In addition to design specifications, however, what are needed are incentives and support for those who are testing new business models geared to open technologies. Numerous people have already set out on this path and are leading by example. Supporting them should become the focus. These actors are among the most innovative of our time if innovation means designing things to be participatory, fixable, and changeable. }

[2] *Proposal for a Regulation of the European Parliament and of the Council establishing a framework for setting ecodesign requirements for sustainable products and repealing Directive 2009/125/EC https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELE%3A52022PC0142*

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RESEARCH ARTICLE

ON DIGITAL SUSTAINABILITY AND DIGITAL PUBLIC GOODS

Several 2022 reports from government and academic organisations contain the key message that sustainable development can be achieved using digital technologies. The report ‹Digital Reset› **(Digitalization for Sustainability, 2022)** calls for using digital technologies to reduce greenhouse gas emissions and resource waste in the agriculture, mobility, industry, and energy sectors. The researchers see digitalisation as a means to an end for sustainable transformation. Similarly, the report by the Coalition for Digital Environmental Sustainability **(CODES, 2022)**, presents an action plan that includes impact initiatives to «*achieve a sustainable planet in the digital age*». The EU argues that digital technologies must play a key role in achieving climate neutrality in the EU by 2050 **(Muench et al., 2022)**. The authors call for a ‹twin transition›, managing digital and green transitions simultaneously so that they reinforce each other.

ALIGNING DIGITALISATION WITH ENVIRONMENTAL AND SOCIAL SUSTAINABILITY

Aiming for ‹sustainable digitalisation› and aligning digitalisation more closely with environmental and social sustainability means two things. First, the negative effects of producing and using digital technology have to be minimised by improving hardware production, reducing energy consumption, decreasing electronic waste, and avoiding the need for frequent replacement of devices altogether. Second, the positive impact of digital technology must be maximised by using it to achieve the goals and targets of the United Nations Agenda 2030.

///<quote>
First, the negative effects of producing and using digital technology have to be minimised.
Second, the positive impact of digital technology must be maximised by using it to achieve the goals and targets of the United Nations Agenda 2030.
///</quote>

In the short term, these two objectives can be accomplished by any type of technology, independent of intellectual property rights. It does not matter whether a company provides a proprietary software product or the software's source code is available under an open source license. It is the resulting software tool or the benefits of a data analysis that matter, not the accessibility of the algorithms or the openness of the raw data.

However, decision-makers and sustainability experts, and even digitalisation experts, sometimes erroneously forget that, in the long run, it is essential to have access to the original source code of an algorithm and to reuse a programme without the need to purchase the relevant software license. Contrary to some beliefs, in the long term, intellectual property is crucial. Imagine a company developing a system that helps a city optimise traffic to reduce greenhouse gas emissions. The city that buys the services benefits from improved mobility management and reduced air pollution. However, other governments might either not be able to afford the licensing costs or do not want to be dependent on technology companies. Resultingly, due to intellectual property laws, the positive effect of this proprietary digital technology on green transition is limited and important public sector institutions are hindered in benefitting from digital transformation.

///<quote>
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///</quote>

THE VALUE OF DIGITAL PUBLIC GOODS

The UN recognised the value of openly available digital artefacts for sustainable development in the 2020 UN Roadmap for Digital Cooperation (UN Secretary General, 2020). The report points out that ‹digital public goods› are essential in unlocking the full potential of digital technologies and data for reaching the Sustainable Development Goals (SDGs). The concept of ‹digital public goods› builds on the economic understanding of public goods that are non-excludable (everybody has access to them) and non-rivalrous (using such goods does not decrease the value for others).

///<quote>
The concept of ‹digital public goods› builds on the economic understanding of public goods that are non-excludable and non-rivalrous.
///</quote>

According to the UN, digital public goods include open-licensed digital artefacts such as open source software, open data, open artificial intelligence (AI) models, open standards, and open content. Additionally, digital public goods must also adhere to further requirements **(Pomerantz and Peek, 2016)**. The Digital Public Goods Alliance (Digital Public Goods Alliance n.d.) has defined nine indicators that determine whether a software programme, a data repository, an AI model, or a data standard can be considered a digital public good. According to the alliance's ‹Digital Public Goods Standard› (DPGS, Digital Public Goods Alliance, n.d.), a digital public good **(1)** advances the SDGs, **(2)** uses an approved open license, **(3)** has clear ownership, **(4)** is independent of proprietary components, **(5)** involves good documentation, **(6)** allows extraction of data,

(7) adheres to privacy laws, **(8)** is aligned with technical standards and best practices, and **(9)** does no harm by design. With this definition, digital public goods have potential for sustainable development within the public sector.

Using digital public goods, governments are able to build their own digital public infrastructure such as electronic identification (E-ID) or data exchange platforms, increasing their digital sovereignty and lowering vendor lock-in **(Nordhaug and Harris, 2021)**. Within the boundaries of the DPGS criteria, no restrictions exist on how public institutions or the private sector may use and advance those goods. The DPGS criteria enable government actors, researchers, entrepreneurs, journalists, and citizens to access the technical architecture and reuse existing digital public goods for sustainable transformation. For example, the District Health Information System (DHIS2) is an open source software used in many developing countries to increase efficiency and transparency in the health and education sector. The software supports several SDGs and is portrayed in the Digital Public Goods Registry as it fulfils all the requirements listed above. The researchers developing this platform at the University of Oslo have elaborated in detail how this digital technology relates closely to the concept of a digital public good **(Nicholson et al., 2022)**. An overview of how DHIS2 complies with the nine requirements of the DGPS is provided on the website **(Digital Public Goods Alliance, n.d.)**. For example, thorough documentation (Indicator 5) is provided on GitHub in various languages and for various target audiences, including medical staff and software developers.

DIGITAL PUBLIC GOODS AND DIGITAL SUSTAINABILITY

New concepts and calls for action in the context of digital public goods are emerging. For example, the Digital Impact Alliance **(2022)** launched the Digital Public Goods Charter. It provides recommendations on how organisations should start and maintain digital public goods on financial, operational, and communicational levels. Interestingly, it picks up aspects of digital public goods that have already been developed in the context of digital sustainability and sustainability research **(Stuermer et al., 2017)**: Funding long-term maintenance effort, disseminating knowledge, building a diverse ecosystem, and implementing a governance framework to mitigate risks and maximise benefits.

The concept of ‹digital sustainability› **(Stuermer et al., 2017)** encompasses three levels of interaction: the digital artefact, the surrounding ecosystem, and the implications for society and the planet. There are four conditions that must be met for a digital artefact to be named as ‹digitally sustainable›: **(1)** elaborateness (quality of the software or data), **(2)** transparent structures, **(3)** semantic data (data is machine-readable including metadata), and **(4)** distributed location. In addition, the individuals and organisations producing and using the digital artefacts have to fulfil five additional conditions: **(5)** open licensing regime, **(6)** shared tacit knowledge, **(7)** participatory culture, **(8)** good governance, and **(9)** diversified funding. Finally, the combination of the digital artefact and its ecosystem has to **(10)** contribute to sustainable development.

That understanding of digital sustainability fits well with the concept of ‹digital public goods›: Both advance the SDGs, both require open licenses, and both expect high quality and best practices. In addition, the DPGS adds ownership, independence of proprietary components, good documentation, possibility of data extraction, compliance with privacy laws, and no harm by design; digital sustainability adds characteristics of a healthy community such as a broad organisation- independent distribution of skills and experience, facilitation of participation, and good governance mechanisms.

TOWARDS A COMPREHENSIVE UNDERSTANDING OF DIGITAL SUSTAINABILITY

Research focusing on a consolidated model of ‹digital sustainability› and ‹digital public goods›establishes a coherent framework with the characteristics of both concepts. This framework fulfils the definition of open technologies serving the planet and emphasises the benefits of freely available digital artefacts for our society. The framework also helps to transfer activities from one type of digital artefact to another. For example, the ‹Public Money Public Code› campaign by the Free Software Foundation Europe **(n.d.)** has inspired many advocates of Free Software to promote the campaign in politics. Similarly, Wikimedia Germany is pursuing a campaign to open up the educational content of public broadcasting **(Wikimedia, 2022)**. These activities support policy-making processes (e.g., in the Swiss parliament) and provide a line of thought for political discussion. By joining the features of digital sustainability and digital public goods, governmental adoption of those features can be accelerated, increasing the benefits of digitalisation for society and the planet. }

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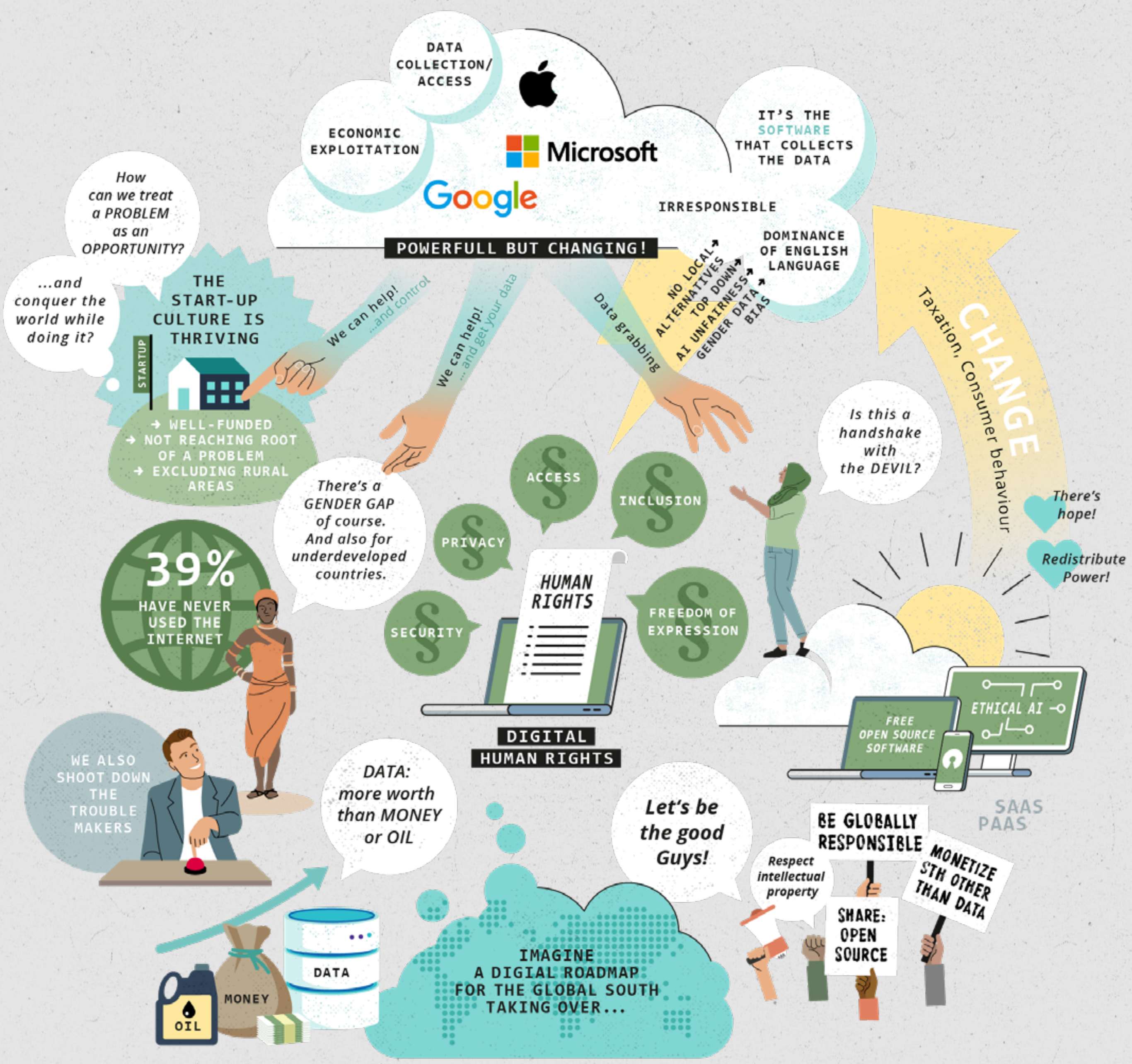
Image 1 *Ka Schmitz, based on Rahman (2022)*

WHAT'S THE MATTER?

BIG TECH AND THE GLOBAL SOUTH



{ Author Nayyara Rahman

RESEARCH ARTICLE

FROM DIGITAL CANNIBALISM TO A NEW FOOD PYRAMID

How Can Realistic Accountability Frameworks Change Big Tech's Relationship with Startups in the Global South?

When Pakistan was named the world's fourth-largest exporter of freelance technology services in 2019, local stakeholders rejoiced. It was seen as a triumph and a validation of the quality of Pakistan's technology talent **(The News International, 2019)**. Yet most, if not all, of these exports were only made possible with Big Tech (BT) products – ranging from shared server space, to operating systems, ‹free› email, and more. Many of these exports qualify as ‹low tech› or ‹support skills› in the tech-ecosystem. The very nature of these technology exports, sold as gigs on free-lancing platforms or as structured output from BPO (Business Process Outsourcing) houses translates into high-volume, low-priced skills: Lowest bidders win, and buyers benefit from la-bour-price arbitrage. Countries with weak local currencies will remain attractive technology trade destinations for BT buyers in the Global North. Furthermore, since 2019, the skills in ques-tion have been on the path to at least some automation **(Thompson, 2022)**. But, has enough been done to address the imminent displacement **(Holzer, 2022)** automation will cause? What is BT's role in all this? Is it just an intermediary in this seemingly short-term, cannibalistic exchange?

THE IMPACT OF BIG TECH ON THE GLOBAL SOUTH

The role of Big Tech in the Global South Startup (GSS)'s tech ecosystems extends beyond intermediary participation. The currency-labour-cost-arbitrage makes GSSs attractive for BT, which can buy support services such as telemarketing, etc. Theoretically, this cooperation provides an attractive bridge for technology transfer, local jobs, and much more. However, there are considerable downsides in the collaboration: Big Tech is a seller, buyer, influencer, and driver. Its current role not only threatens to widen the North-South gap but also to deepen socio-economic fissures. If extrapolated unchecked, fair use of technology may become limited to a small club of moneyed, well-informed users and builders, and something that is paid for and built on data and resources of the excluded global majority **(Amnesty International, 2021)**. Club membership will be like a pyramid scheme where, to gain access, each stratum tolerates data exploitation, poorly designed products, and experience.

///<quote>
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Its current role not only threatens to widen the North-South gap but also to deepen socio-economic fissures.
///</quote>

BT's privacy abuses and concerns about its role in commercial surveillance **(Amnesty International, 2021; Ovide, 2021)**, unapologetic neglect **(Stecklow et al., 2023)**, and a ‹Not In My Backyard› data management approach in the Global North **(Ashford, 2013)** raise additional questions about how it abets censorship and uses personal data in the Global South **(Biddle, 2022; Pham, 2022)**. More damagingly, non-representative governments collaborate with BT to push self-serving agendas at the expense of citizens **(Janjua, 2018)**. Thereby, BT's irreverent attitude **(Stewart, 2018)** towards regulators as purchasable **(Lorenz and Harwell, 2022)**, technologically irrelevant obstacles to innovation is often copied in the Global South. Its insensitivity towards social priorities **(Ho and Farthing, 2021)**, financial misdemeanours in taxation, shareholder wealth, and monopoly-seeking behaviour **(Neate, 2021)** also set unhealthy precedents for GSSs, where local entrepreneurs also influence public policy to further anti-competitive practices **(Tirmizi, 2020)**, short-termism **(Mangi and Zhang, 2023)**, and financial mismanagement **(Nadeem, 2022)**.

A GUIDE TO RESTRUCTURING RELATIONSHIPS

Nevertheless, the role of BT is not entirely negative and the GSSs are not just victims of a hegemonic system. With some basic principles, the relationship between BT and GSS can be restructured in a way that does not increase the North-South divide and contributes to a healthier technology ecosystem of GSSs.

1. START BY FIXING WHAT'S ACTUALLY BROKEN: ADDRESSING TECHNOLOGY EXCLUSION

As of 2021, 2.9 billion people had no internet access, almost 96% of whom were in developing countries **(ITU, 2021)**. Now add non-native digital users, mostly ageing populations **(Smith, 2014; Kebede et al., 2022)**, monolingual and low-literacy populations **(A4AI, 2022)**, and those who live in territories with non-representative governments **(Shahbaz et al., 2022)**. These communities are influenced and used by technology, e.g., in gigs for collecting data for large language models, but do not receive its fair benefits.

GSSs have a better understanding of these problems thanks to a territorial and cultural intimacy. Their understanding of the language, design, and experience that resonates with local users, especially in vulnerable groups, is powerful. For instance, nearly 50% of Pakistan's population cannot read English, limiting its socio-political participation. Here, Pakistan's Citizen's Portal offers a rare success story: Within two years it enrolled 4 million citizens, and of the 4.933 million complaints registered on the portal, 4.821 million have actually been resolved (PMDU, nd), mainly by making the portal bilingual and simplifying enrolment. This success shows that GSSs are better placed than BT to mirror socio-economic shifts in evolving product journeys and user experience. And given their local immersion, their approach, even towards problems such as censorship and internet shutdown, is pragmatic **(Nadeem, 2020)**.

However, GSS clusters are organised around what will be funded (and by whom) rather than what is needed. When Venture Capital funding runs out, so does the focus on building ‹fairer› products **(Geall, 2014)**. Innovation takes top-down dictation in product development from investors, who are not always focused on how to make a lasting user experience for those who cannot pay or those who need to cross a hardware/technological/digital literacy bridge to become users in the first place. Furthermore, in the Global South, efforts to build awareness on digital civil rights usually focuses on those who already have access to technological resources and who are probably multilingual urban residents **(Digital Rights Foundation, 2023)**.

2. FOCUS ON BUILDING MARKET WIDTH. DEPTH WILL FOLLOW

The market for creating said bridges is as big as the figures above indicate. Such bridges have been proven to enable fairer economic participation. Many GSSs are already active in widening the market with EdTech and FemTech **(Kpilaakaa, 2022)**. But how to make them scalable? One way is to replace their positioning from grant-dependent ‹CSR/good-to-have initiatives› to time-bound, BT-partnered ‹self-sustaining solutions›. The recipients are, then, reconfigured from passive beneficiaries of charity to active participants and co-creators accountable for ‹trickling down› digital benefits to their communities via advocacy and capacity enhancement (see, e.g., Grameen Foundation). It may also help to team up with BT to further popularise Free and Open Source Software (FOSS) initiatives (e.g., Microsoft/GitHub[1]). Its emergent talent may be a valuable addition to the ‹traditional› tech-space in more ways than one **(Thankachan and Moore, 2017; UNCTAD, 2003)**.

[1] *The Microsoft FOSS Fund provides a direct way for Microsoft engineers to participate in the nomination and selection process to help communities and projects they are passionate about.*

3. DE-GROWTH AND DECENTRALISATION AS TOOLS FOR MORE EFFICIENT MARKETS

BT has come under fire for irresponsibly ‹dumping› digital waste and ‹amassing› data. Both problems appear to have a common root: BT sees infinite *ownership, production, and control* rather than management as the way towards long-term profitability. But let's explore the opposite route with de-growth: De-growth cuts down on unsustainable value chains. And here, BT and GSSs can create a new tech-ecosystem actor responsible for redesigning the entire value chain in terms of recyclability, reusability, and responsible consumption. For example, in Pakistan, acquiring any government-issued document takes weeks and multiple visits to crowded government offices. One would expect that issuance of COVID-19 immunisation cards would follow suit. But the government collaborated with micro-businesses, authorising them as eSahulat participants. These eSahulat franchises accessed the national database to instantly print certificates on

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> BT and GSSs can create a new tech-ecosystem actor responsible for redesigning the entire value.
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demand **(Tanveer, 2022)** while also improving accessibility, lowering pressure on public resources, and maintaining data integrity and privacy.

4. CIRCULATORY PARTICIPATORY REGULATION

Generally, the Global South has been slow to join the Responsible Tech movement. Of the 75 countries analysed in the Center for Artificial Intelligence and Digital Policy's Artificial Intelligence and Democratic Values Index 2022, Tiers 1 and 2 had no countries from South Asia or Africa **(CAIDP, 2022)**. Given the local dearth of representative institutions, sufficient techno-legal talent **(Anderson, 2023)**, and poor regulatory enforcement **(Deutsch, 2022)**, GSSs have little incentive to deploy resources towards protecting digital civil rights. **(Ghosh, 2021)**; it is treated as an afterthought. This treatment may be interpreted as part of a general attitude of mistrust towards legal processes, borne of witnessing acts of impunity by the socio-political elite and the state **(Express Tribune, 2022)**.

///<quote>
But what if we changed the role and composition of the regulator?
///</quote>

But what if we changed the role and composition of the regulator? Can formulating, debating, and implementing technology laws become a participatory process? A multi-stakeholder regulator with government, GSS, BT, and civil society actors equitably represented would go a long way towards diluting hegemonic control, paying intellectual property its dues, overcoming exclusionary factors, mitigating displacement **(Mickle, 2022)**, and enforcing mutual accountability. Yet, it is important to pre-emptively prevent stakeholder cartelisation. This collaboration must be built on the following value-checklist: *Simplicity, Time-bound Mandates, Outcome Over Solutionism, and Translatability Over Scalability.*

To paraphrase Peter Drucker: we cannot predict the future. But we can see what's visible and not yet seen **(Forbes, 1997)**. For those ready to co-create it, a collaborative, equitable, inclusive tech future is already there. }

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RESEARCH ARTICLE

BUSINESS OF DEEP TRANSFORMATIONS

A Non-binary Approach

The world is facing ecological and social degradation. This provokes reflection on how societies can become genuinely sustainable. Transformation or radical change has become a widely debated topic. In the words of Maxton **(2018, p. 35)**, a «*sustainable economic system requires radical change in almost everything people consider normal*». Transformation also concerns business.

Perhaps the most radical discourse that contemplates transformations is offered by degrowth. Originally degrowth was conceptualised as a reduction in production and consumption. But a more recent definition entails «*deep transformations occurring on all four interrelated planes of social being [material transactions with nature, social structure, social relations, people's inner being], on different scales and in all sites, guided by gentleness and care, towards a society co-existing harmoniously within itself and with nature*» **(Buch-Hansen and Nesterova, 2023, p. 8)**. As such, degrowth has begun to address the question of business transformations. The ideas offered by degrowth in the business domain vary from imagining what degrowth business could look like to questioning the existence of business in a degrowth society **(Nesterova, 2020; Nesterova and Robra, 2022)**. Transforming business into degrowth business means rethinking all business practices that concern nature, society, and profits. For many degrowth advocates, leaving conventional business behind altogether as a form of organisation means placing hope in alternative forms of production and distribution such as community gardens and foraging.

While this radical rethinking of business practices has provoked interesting conversations and research, other valuable and sustainability-minded strands of thoughts have been flourishing in parallel to rather than in dialogue with degrowth. Some began to contemplate the role of sufficiency (what is enough) in business **(Beyeler and Jaeger-Erben, 2022; Niessen and Bocken, 2021)**, others, the role of circularity (how to close resource loops and keep materials in use as long as possible) **(Bauwens, 2021; Geissdoerfer et al., 2020)**. The dialogues between degrowth business and other approaches to genuine business sustainability have not been as prominent as they should be: all these approaches aim to understand how a sustainable society can be achieved, even though their philosophical and ideological underpinnings vary. We invite our readers to join us on the path of synthesising more radical business thought with more realistic ways of thinking by being open to knowledge from different traditions and imagining business transformations as an imperfect and even conflicted journey.

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The dialogues between degrowth business and other approaches to genuine business sustainability have not been as prominent as they should be.
///</quote>

JOURNEY-LIKE TRANSFORMATIONS IN BUSINESS

Contemplating a genuinely sustainable business may take the form of presenting a list of practices: it would produce only for human needs, use natural materials and renewable energy, and be characterised by flat hierarchies and worker-ownership, and so on. It is not a futile exercise to imagine what a perfectly sustainable business would look like. In our research on degrowth, business, sufficiency, and circularity, we notice that sustainability-orientated entrepreneurs are curious to see such lists. As teachers, we notice how presenting business in such terms is liberating for students passionate about societal transformation.

Yet, in reality, it is highly unlikely that businesses can adopt all those characteristics, at least not within the framework of a growth-orientated capitalist system from which businesses must currently ultimately start. And, while it may be helpful to have an ideal in mind, it appears fruitful to reflect on how this ideal or some constellation of its features can be achieved in practice. To give a comparison from daily life, it is impossible to be a perfectly sustainable consumer: sustainable practices co-exist at different times with less sustainable practices. We believe, many of our readers can empathise with this. To be a perfectly sustainable business is as challenging as being a perfectly sustainable consumer. This is particularly so considering that sustainability is not at the heart of the capitalist system or its logic, rules, or structures.

Instead of theorising a sustainable business, this contemplation leads us to see such a business as a process of navigating capitalist and diverse landscapes **(Nesterova, 2022)**. The landscapes are diverse since capitalism differs from country to country, and alternatives exist

///<quote>
Non-binary thinking is a more gentle and empathetic approach that may promote stepping on the path of transformations.
///</quote>

in parallel with capitalistic social entities and structures. This journey is characterised by trial and error, difficult choices, and nuance. To capture the nuance of the journey, we adopt non-binary thinking. Binary thinking is reflected in viewing a business in either/or terms, such as degrowth/not degrowth, high tech/low tech. Non-binary thinking is a more gentle and empathetic approach that may promote stepping on the path of transformations rather than not engaging with them due to a belief that perfection cannot be achieved anyway. Non-binary thinking invites us to see business as combining some degrowth business elements with more conventional elements imposed by capitalism, such as the need to make a profit. For instance, a constellation of elements can look as follows. A for-profit business can be small, eco-social, non-growing **(Liesen et al., 2015)**, and might instead look for alternative spaces outside capitalism, such as working with activists or like-minded organisations **(Beyeler and Jaeger-Erben, 2022)**. This approach also invites us to see growth in a more nuanced way: not all types of growth are bad **(Buch-Hansen and Nesterova, 2023)**. In terms of more conventional growth, e.g., numbers of employees or productive capacity, growth is not necessarily linear: at some points, businesspersons decide it is time for the business to grow while at other times not.

With regard to technology, within the post-growth discourse, there are positions that trace ecological and social degradation to technology **(Heikkurinen and Ruuska, 2021)** and propose low technology and highly localised futures **(Trainer, 2012)**. However, reality is much more complicated. Higher technologies may be helpful. For instance, digitalisation can help optimise the use of energy and facilitate the maintenance and redistribution of goods. This optimisation needs to be viewed in the context of its limits: considering questions of ownership and data protection, and keeping the goals of digitalisation focused on societal needs. Often, businesses combine high and low technologies, but the process of figuring out which level of digitalisation is appropriate is replete with uncertainty, doubt, and conflicting information.

ENGAGING IN DIALOGUE

The complexity of transformation we outlined above requires empathetic and genuine communication between different schools of thought within sustainability as well as between academics and practitioners. Binary thinking means that opportunities for cooperation are missed, or their potential is not fully explored. Since the goal is shared, this lack of engagement is counter-productive. This counter-productivity has been noticed by scholars, who invite us to explore more radical and normative futures **(e.g., Dzhenghiz et al., 2023)**. Moreover, academics presenting the ideal (and thus unachievable) wish list of practices to the general public and practitioners might put them off rather than inspire action.

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Dialogues should focus on multi-party conversations.
///</quote>

Focusing on the process demonstrates empathy and understanding towards the challenges businesses experience. Often, businesses are aware of the nuance and downsides of their practices. Too often, the temptation seems to be to view businesspeople as beings *«whose living humanity has been thoroughly excavated»* **(Perlman, 1983, p. 31)** while romanticising other forms of organisations such as cooperatives and community gardens. The reality is much more complex and varies from organisation to organisation, as does the constellation of practices, worries, and attempts to navigate complex and diverse landscapes. We call for exercising empathy and understanding as well as engaging in dialogues. While engaging signifies involvement, care, and compassionate presence, dialogues should focus on multi-party conversations where academia can present its ideas and ideals and businesspeople can share challenges and contradictions they experience on the journey towards genuine sustainability.

DID YOU KNOW …?

NEARLY HALF OF THE WORLD IS STILL OFFLINE

Source: *Internet Health Report 2020, Mozilla Foundation*

WAYS FORWARD

Non-binary thinking is more theoretically ephemeral since it requires us to be sensitive to conflictual practices unfolding in the same space and to constant *becoming* of business. It means transcending dualisms and seeing how different and conflicting practices co-exist and interact as well as trying to understand why things are as they are and what is unfolding in the minds of the humans who try to handle this co-existence of different practices.

As a start, dialogues between degrowth and circular economy scholars can become normalised rather than be held in parallel. Collaborative projects can involve real businesses, including businesses that share degrowth scholars' concern about ecological degradation but that also seek solutions currently available, such as circular processes and designs. Such dialogues and projects can also be used to share ideas and perspectives on an appropriate level of digitalisation that meets societal needs. Importantly, when considering transformations on the microeconomic level, the context needs to be remembered. The dialogues we propose unfold within the context of a capitalist system, and while inevitably the current system is where we must start transformations, transformations must improve the system.

Involvement of businesses and academics is not enough: transformation is a function of civil society, state, and business **(Buch-Hansen et al., forthcoming)**.

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RESEARCH ARTICLE

TOWARDS ARTFUL SUSTAINABLE INTEGRATION OF IT INFRASTRUCTURES

A Report from the Construction of a University Data Centre

In 2021, data centres consumed 17 billion kWh in Germany. This was 6.5% more electricity than in the previous year **(Hintemann et al., 2022)**. Despite significant efficiency gains in storage, servers, and processors, Hintemann et al. **(2022)** expect data centres' electricity consumption to increase to around 28 billion kWh by 2030. This enormous amount of electricity is primarily required for the uninterrupted operation of the servers and cooling.

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The more data is processed and stored, the more CO_2 is emitted.
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For data centres, climate change is a problem. Servers cannot operate at a temperature that is too high, and the warmer the atmosphere gets, the more cooling of servers and thus the more energy is needed. But data centres are a problem for the climate, too. The more data is processed and stored, the more CO_2 is emitted. The environmental sustainability of data centres is, thus, an important concern.

Discussions of data centre sustainability often address technical improvements and political regulations. Innovations make data centres more energy efficient, and political guidelines help – and force – industry to prioritise environmental sustainability. Such innovations are important, but they tend to overlook implementation. Not only must a new technology always be connected to the local infrastructures, which includes local governance systems and practices: No technical innovation runs on its own. Furthermore, the same applies to political regulations. These are necessarily vaguely formulated to allow adaptation to local conditions. This vagueness means that regulations leave space for many decisions to be made locally, often without any prior examples to build on. Lucy Suchman **(2011)** calls this process of adapting innovations the artful integration of technology in existing social and technical environments.

In this article, we use the case of a university data centre to reflect on what artful integration means for building sustainable IT infrastructures. We, furthermore, point to the need for institutional ownership and responsibility to achieve artful sustainable integration of IT infrastructures. The study is ongoing and is based on qualitative research interviews with (so far) 18 people from technical, administrative and scientific university staff and with three non-university consultants and contractors. We have also studied documents involved in planning the data centre: minutes from meetings, contracts, technical documents, need analyses, etc.

THE EXAMINED UNIVERSITY DATA CENTRE

The university data centre[1] we report on has a total area of approximately 900 square metres. There are 318 square metres of pure server space hosting more than 100 racks. The remaining area is reserved for network and energy infrastructure. Up to an outside temperature of plus 18 degrees Celsius, the heat emitted from of the servers (of a power value of max. 700 kW) can be cooled using outdoor air. The building was constructed in accordance with the European data centre norm DIN EN 50600 with a PUE[2] value of 1.4, and the TIER 3 class for protection, availability, and granularity.[3] The data centre has been certified by the German technical inspection association TÜV-IT. It is probably the first university data centre in the country to be built and certified according to the data centre norm. The data centre started operating in spring 2022.

The need for a new data centre arose in the early 2010s. The old ‹machine hall› from the 1960s, which had housed the university's central servers, had to be replaced due to campus refurbishment. Over the following years of planning, the staff had several conversations about how the data centre could become sustainable, for example, by ensuring renewable energy supply, reusing the surplus heat for housing heating, or operating the emergency power generator without diesel. In general, environmental sustainability has become increasingly important at the university: A sustainability forum has been established, a sustainability office was recently introduced, and in 2022 the rector appointed a sustainability officer whose job includes realising the university's sustainability goals by 2030.

With this broad concern about sustainability, how come the new data centre relies on natural gas supply, has no use of waste heat, and works with a diesel tank of 20,000 litres consuming hundreds of litres every month in test runs?

[1] *We would like to warmly thank staff of the university data centre who have contributed considerably as participants of the study and in commenting on this text. However, they prefer to remain anonymous. For this reason, the university also remains anonymous in this article.*

[2] *PUE: Power Usage Effectiveness: This unit of measurement expresses how much of the total amount of energy supplied to the data centre is used to run the servers, storage systems, and network technology. The average PUE value of data centres in Germany is 1.56* ***(Hintemann and Hinterholzer, 2021)****.*

[3] *According to the Tier 3 standard, the space of the data centre is protected through a shell principle design, supply paths are designed to be redundant, and energy consumption is measured directly at the individual servers.*

THE (NON-)SUSTAINABILITY OF EN 50600

It is crucial to acknowledge that a university is a public institution that must be able to justify the construction of new IT infrastructure to the federal state (Bundesland), university employees, and students, among others. In the following, we discuss what criteria were applied when making decisions about the data centre at the university and how they came about.

To determine the university's infrastructural needs, the parties involved conducted risk analyses, needs analyses, financial budgeting, and more. All this had to be agreed on internally by the university's rectorate, technical staff, scientific staff, chancellor, IT administration, network administration, staff council and, externally, with the Ministry for Culture and Research as well as the relevant construction company. Consequently, decisions required prior negotiations.

The data centre staff expressed it as a relief when the data centre norm EN 50600 was finalised in 2016. EN 50600 is a European-wide set of standards that, for the first time, combines norms for building construction, energy supply, environmental conditions, telecommunication cable infrastructure, and security systems for data centres. Although it is, in principle, non-binding, what is stated in EN 50600 has authority at the university: Once it was introduced, there was little need for further negotiations.

Because reference to EN 50600 came to be a key criterion for decision-making around the data centre at the university, it is relevant to understand what the standard says about sustainability. First, the norm states how power effectiveness – PUE – is to be determined. Early on, the university decided to aim for a relatively low PUE value that helped push a low-energy cooling system. Yet, this value does not motivate saving data storage or processing capacity, let alone rethinking hardware selection. Second, the PUE value of a data centre is independent of the source of power supply. A regenerative power supply does not improve the PUE value, nor does a fossil-based power supply make it worse. Third, when calculating the PUE value, a reduction in energy consumption due to the use of waste heat is not considered. The standard's neglect in considering these three points led to the university not reflecting on the related sustainability issues.

Nonetheless, the university now houses a powerful, centralised server building. Many servers that were hosted under desks and in office rooms across departments were merged, saving energy and office space. Also, the growing system of hundreds of virtual machines hosted by the data centre ensures more efficient use of server capacity. In this sense, the facility is an improvement. But it is only a first step.

GREEN IT INFRASTRUCTURES HAVE TO BE ESTABLISHED NOW

While standards are important, so are organisational routines. We turn briefly to lessons learned from the design process. The safety standard of the EN 50600 data centre norm and its targeted safety class stipulate that measures must be taken so that fire can be extinguished quickly. The university staff council had reservations towards related measures using fatal gas, as it posed risks to staff. Safety measures were thus redesigned.

Environmental sustainability has no institutionalised advocate similar to that available to staff through the staff council. The recently appointed sustainability officer has no comparable right of veto. Until a sustainability advocate with right of veto is institutionalised in an organisation, sustainability is and will remain a lower priority. The fight for and the institutionalising of environmental sustainability is unfolding now, and public institutions have the chance to advance this process.

///<quote>
Public institutions have the chance to advance the institutionalising of environmental sustainability.
///</quote>

Bits & Bäume **(2022)** have indicated that the political project of green IT deserves much more ambitious measures, from strengthening reuse and repairability while increasing service obligations to ensuring software security updates, to setting up buildings that rely less on resource-intensive concrete, to non-fossil forms of energy supply strong enough for data centres. These requirements are important. However, they ignore the organisational level and thus the practical measures for artful sustainable integration of the more ambitious requirements. Based on our ongoing study, we see leverage points for sustainability at the organisational level. If an organisation's sustainability officer were granted the same authority as the staff council, for example when implementing the data centre norm, more pressure for sustainable change could be exercised. As Pasek et al. **(2023)** emphasise, more than global solutions, we need binding local commitments towards implementing sustainable IT infrastructure.

ACKNOWLEDGEMENT

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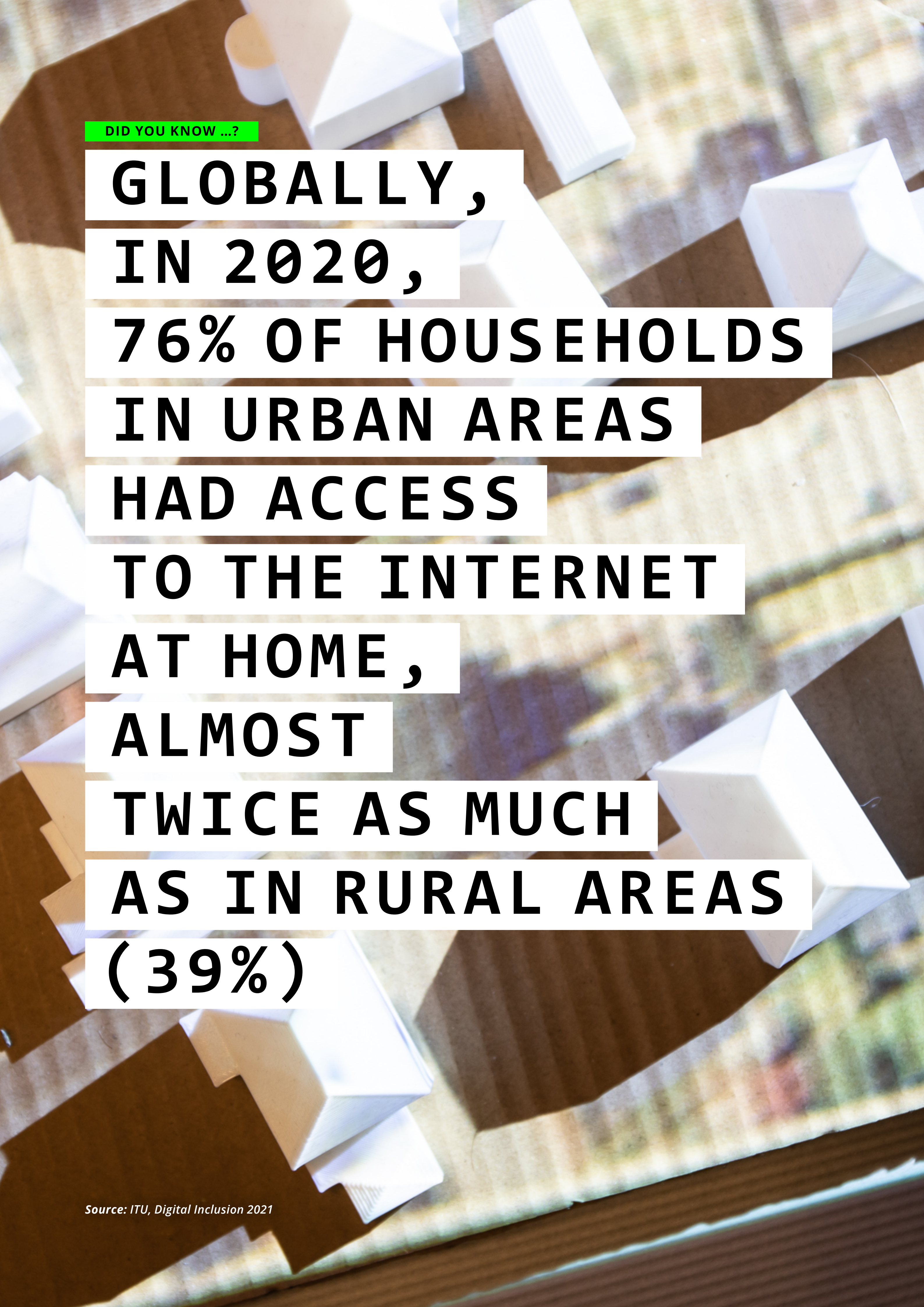

DID YOU KNOW …?

GLOBALLY, IN 2020, 76% OF HOUSEHOLDS IN URBAN AREAS HAD ACCESS TO THE INTERNET AT HOME, ALMOST TWICE AS MUCH AS IN RURAL AREAS (39%)

Source: *ITU, Digital Inclusion 2021*

4 Use Cases for More Sustainable Tech Design

BEYOND BUSINESS AS USUAL

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The perception that digitalisation's current design is not sustainable in a social, ecological, or economic sense is consensus within the Bits & Bäume movement. What drives us is the will to do better: A digitalisation that is aligned with social and ecological goals. We are aware that this change demands a systemic and political transformation. However, there are already many examples today where digital technology is really contributing to greater sustainability or technology design itself is guided by sustainability criteria. These lived alternatives are models for a practice that translates the desired values into action. They show that, despite adverse legal, bureaucratic or economic conditions, it is already possible to do business, to learn, or to care differently.

The articles in this chapter showcase such practices and aim to inspire imitation. The article by Eickstädt et al. uses the Computer Science for Future programme to show how (future) developers can be sensitised to issues relevant to sustainability as part of their education. Aretz and Jungblut argue that the energy transition can only succeed if everyone is involved – and what role digital technology plays in this process. Community Supported Agriculture, in turn, is a niche practice from the agricultural sector whose upscaling requires dedicated political support for such technologies and alternative ways of producing, distributing, and consuming food, as Prause and Egger explain. Moreover, participants from a Haecksen workshop at the Bits & Bäume conference, which is presented here, emphasise that digital technology in the sense of a socio-ecological transformation must be needs-oriented and intersectional.

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Anja Höfner

{ Authors *Elina Eickstädt, Martin Becke, Martin Kohler & Julia Padberg*

PRACTICAL PERSPECTIVE

COMPUTER SCIENTISTS FOR FUTURE

Computer Science for Future (CS4F) is an initiative of the Department of Computer Science at HAW Hamburg (University of Applied Science Hamburg). It is working towards establishing the UN sustainability development goals (SDG) as a major guiding principle for teaching and research. CS4F focuses strongly on teaching at university level to educate future generations of technical experts and decision-makers. It pursues different goals, which we divide into three areas – teaching, research, and transfer – as illustrated in the figure below. In this article, we introduce the CS4F initiative and reflect primarily on the role of students as amplifiers in transforming computer science.

COMPUTER SCIENCE AS A CROSS-SECTIONAL DISCIPLINE

Computer science (CS) has steadily gained in its impact on how society has developed over the past decade. In a progressively granularly networked and automated world, the infrastructure of coexistence is determined by decisions in CS that shape processes in companies, determine modes of interaction in society, and develop services related to how goods are handled. CS should therefore be systematically put at the service of the UN SDG.

Computational sustainability already touches on sustainability issues based on three computational themes: optimisation, dynamic models, and simulation **(Gomes, 2019)**.
It acknowledges the need for interdisciplinary work with specialists from other domains such as social, environmental, and natural science. Courses in CS and society are already offered at universities, and the interdisciplinary view is often trained in software engineering. However, the academic consensus that CS deals with socio-technical systems and not merely with mathematical-technical systems has not permeated the curriculum sufficiently. Empowering students to work with different disciplines based on common values and being aware of their role as makers of (societal) change is essential for developing solutions to future challenges and crises.

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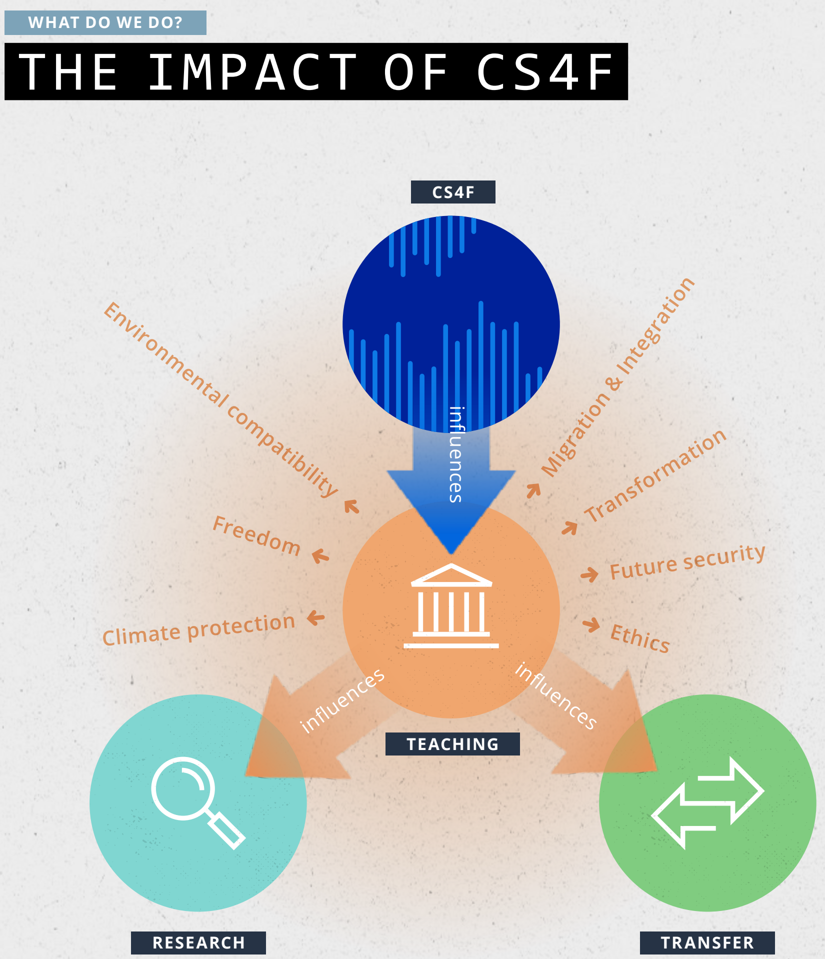
In this context, teaching is the essential lever that triggers activities in the other sub-areas of research and transfer. CS4F influences teaching **[see Figure 1]** in a wide range of sustainability topics, such as climate protection, ethics, or future security. Teaching then influences research and transfer in the given societal context (e.g., other universities, companies, or activists). Research questions can arise from teaching issues and can be solved within the framework of ‹research-based learning›. The transfer is then achieved by the teaching directly influencing the graduates, who then take the knowledge of the connections between informatics and sustainability into their future professions.

For example, there is a gap between the importance of data for social issues and the consideration of ethics and sustainability in their processing and use. These aspects tend to be neglected in CS curricula. With CS4F, the Department of Computer Science at HAW Hamburg is working towards closing such teaching gaps; a significant place in the curriculum is devoted to teaching ethics and sustainability aspects and the ability to adopt different perspectives. This shift will help to set off a process towards a more sustainable orientation, in line with the UN SDG. One of CS4F's main objectives is to strengthen motivation and problem awareness among students.

[**Figure 1** *Copyright Daha Yeo*



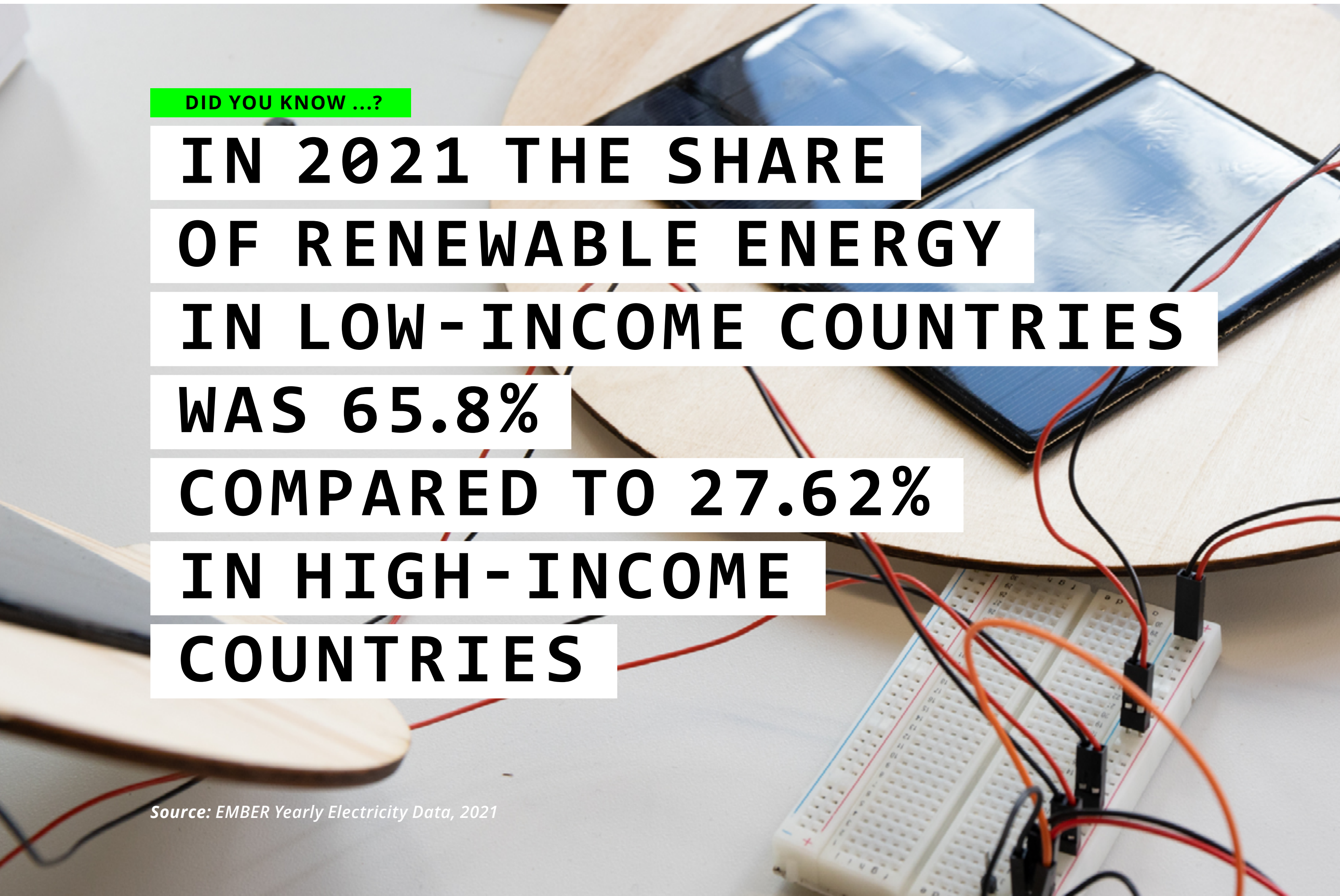
TEACHING AS A MULTIPLIER

Teaching is a strong multiplier as the students can put the sustainable approaches from their studies into practice once they enter the academic or professional field. CS4F uses two main methods for learning and innovation in education:

- *inquiry-based learning and*
- *transformative science*

> ///<quote>
> Inquiry-based learning puts teachers in the role of learning coaches and focuses on sustainable development and concrete problem-solving.
> ///</quote>

Inquiry-based learning puts teachers in the role of learning coaches **(Krause-Steger and Roski, 2019)** and focuses on sustainable development and concrete problem-solving **(Lingenau and Ahel, 2019)**. Digitalisation and education for sustainable development in higher education needs such teaching/learning formats to provide students with the competencies required to solve currently unknown problems of the future **(Lingenau and Ahel, 2019)**. Inquiry-based learning combines collaborative learning processes that include learning and knowledge achieved in non-hierarchical groups and the skills of handling complexity and uncertainty and of reflective questioning. The goal of transformative science is to describe, explain, and evaluate transformations towards a sustainable society, but also to advocate for them **(WBGU, 2011)**. Embedding such processes requires systemic thinking, concrete questions, and transdisciplinary ways of working. The real-world



DID YOU KNOW ...?

IN 2021 THE SHARE OF RENEWABLE ENERGY IN LOW-INCOME COUNTRIES WAS 65.8% COMPARED TO 27.62% IN HIGH-INCOME COUNTRIES

***Source:** EMBER Yearly Electricity Data, 2021* relevance and the inclusion of different, also non-academic experts' and others' voices favours research and learning formats such as workshops, real labs, or field experiments. For CS, this science means strengthening agile and incremental approaches and involving civil society and non-academic actors.

Existing structures must be strengthened and expanded. Examples such as the interdisciplinary laboratory ‹Creative Space For Technical Innovations› (CSTI) at HAW Hamburg have founded their work on research-based teaching principles and real-world experiments and are thus a key point of reference for the desired transformation.

EXPLORATION OF DIFFERENT APPROACHES THROUGH CS4F

The goal of CS4F is to integrate the UN SDG into every course of the curriculum. This lengthy process has been kicked off by creating new courses and teaching content for existing courses.

We have held 10 elective courses in the subject area of CS4F in the last two semesters and started to adapt the required courses. Notable cases are:

- ‹Fundamentals of Computer Engineering› (Year 1) was expanded to include interdisciplinary concepts. Concepts from sociology illustrate the contrast between solutionism and technology criticism. In addition, a basic overview of ethics was integrated. This overview included an introduction to various ethical theories, such as contractualism, autonomy orientation, and John Rawls' modern contract theory, and how these concepts relate to CS.
- ‹Fundamentals of Computer Science› (Year 1) has been extended to include sustainable software development: The creation of software that is sustainable and resource-efficient in the long term and considers not only technical aspects but also social, ecological, and economic factors. CO_2 emissions associated with using information and communication technology systems are a significant contributor to global greenhouse gas emissions. By implementing CO_2-conscious computing practices, businesses, governments, and individuals can help reduce their greenhouse gas emissions and contribute to a more sustainable future.
- ‹Applied Computer Science› (Year 2) teaches programming graph theory and graph algorithms. These algorithms are used to analyse and optimise complex systems in areas such as transportation, energy, and communication. The lab provides practice in implementing such algorithms, but students also learn to make their design decisions consciously and communicate them appropriately. They are expected to learn about the potential impact of their work on society and to use ethical guidelines from the ‹Gesellschaft für Informatik› (German Informatics Society) to address ethical decisions and be aware of the potential consequences.
- ‹Wisst Ihr, was Ihr tut?› (‹Do you know, what you are doing?›) is an elective seminar open to students from all areas of CS studying at HAW Hamburg. The course offers guided reflections on the far-reaching effects of CS in all areas of life, starting with communication behaviour and ending with organisational upheavals and the role of CS as a trigger or amplifier of change. The course is held by an interdisciplinary team from sociology, urban research, psychology, and CS/robotics. Participants are expected to engage actively in this dispute, to take a position, and to have a reflected understanding of themselves in their role as computer scientists at the end.

The CS4F framework is conceptualised as an open platform for students and teachers to create and experiment with new courses, projects, and learning formats that integrate sustainability issues, transdisciplinary and cross-disciplinary thinking, and concrete projects tackling sustainability issues in or from CS.

To accompany the project in its various phases, a podcast was initiated that is run by students, professors, and employees of the university. In each episode, the team talks to activists, experts, and scientists about climate change mitigation and sustainability in the context of CS, as well as discussions about ethical issues surrounding the impact of technology on society. The goal is not to make the podcast primarily for insiders but to introduce any listener to the topics. It also focuses less on persuasion and more on supplying broad information about how CS works and what impact CS can have on society.

These courses, the podcast, and other activities are the first results at our university. The created activities within this framework are promising and could develop into a solid path outlining how to integrate sustainability issues in educating future computer scientists and thus affecting the way these students act as professionals in their respective fields.

A long version of this article is available under: Eickstädt, E., Becke, M., Kohler, M., & Padberg, J. (2023). Computer Science for Future — Sustainability and Climate Protection in the Computer Science Courses of the HAW Hamburg (arXiv:2301.06885). arXiv. https://doi.org/10.48550/arXiv.2301.06885 }

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RESEARCH ARTICLE

HOW DIGITALISATION CAN HELP NEIGHBOURHOODS SHARE ELECTRICITY

Community energy supply and sharing concepts are beginning to show promise when it comes to decentralising energy sources. Having more actors in the market is key to moving forward the transition away from fossil fuels, and digitalisation plays an important role here. Nevertheless, digital technologies themselves are also energy-hungry. However, for smart meter rollouts, design could make an impact in keeping additional energy and resource consumption as low as possible.

Over a third of Germany's total carbon emissions come from electricity generation and district heating in public power plants and from producing coal and mineral oil products. German and European climate goals can therefore only be achieved with a rapid energy transition towards 100% renewable energies.

Wind, solar, biomass, and hydro are already important energy sources; their contribution to electricity production rose from just 6.5% in 2000 to 41.1% in 2021 **(Umweltbundesamt, 2022)**. But expanding renewable energy is difficult without increasing the decentralisation of energy sources and allowing more actors to participate in the market. In particular, concepts related to community energy supply and energy sharing show promise in this area. Related projects involve citizens developing wind or solar power plants in their neighbourhoods and then receiving the electricity pro-

///<quote>
The process could not only accelerate expansion but also increase acceptance for any changes.
///</quote>

duced at a reduced cost. In this way, the energy transition is not only left to the will of politicians and the energy industry, but private commitment and capital are integrated into the transformation process. The process could not only accelerate expansion but also increase acceptance for any changes; why should I take a ‹NIMBY› (not in my backyard) approach when I can directly benefit financially from a wind turbine or a solar plant? **(Salecki and Hirschl, 2021)**.

Simulations and modelling of shared energy supply models have shown that these approaches — also known as prosumer models — not only offer considerable economic advantages but also have great potential to advance the energy transition in the EU **(Doračić et al., 2020)**. According to an analysis by the IÖW **(Wiesenthal et al., 2022)**, energy sharing in Germany could contribute to the 42% (75 GW) increase in renewable capacities laid out in the German government's 2030 expansion targets.

///<quote>
Digitalisation - an enabler of a decentralised, renewable energy system by creating the necessary infrastructure
///</quote>

Digitalisation plays a key role in decentralising energy production and supply and making them more flexible. Above all, it serves as an enabler of a decentralised, renewable energy system by creating the necessary infrastructure **(RESET Greenbook, 2022)**. New, intelligent measurement and communication technologies make it possible to record and evaluate information on electricity production, transport, storage, and consumption in real time and to control electricity flows on this basis. In addition, consumption can be made more flexible **(Elberg et al., 2018)**, for example, by switching on the heat pump or refuelling an electric car exactly when wind or solar energy production is running at full speed. But all these applications are based on consumers being equipped with smart meters.

SMART METERS IN ENERGY COMMUNITIES

Smart meters not only collect consumption data at regular intervals and pass this information on to consumers, but they can also transmit it automatically and manage access rights. By connecting energy suppliers, consumer devices, and the electricity grid, they can form an important interface for controlling decentralised electricity generators such as photovoltaic or wind energy plants as well as for organising energy communities or joint self-consumption. In addition, smart meters can be used to introduce flexible electricity tariffs that take into account price fluctuations, grid loads, and electricity demand.

With the ‹Newtonprojekt› passive house development in Berlin's Adlershof district, a pioneering tenant electricity project has already been implemented. The project includes solar systems on the roofs of the houses and facades, a solar thermal system managing hot water supply, battery storage for electricity surpluses, and a fed-in connection to a district heating network if too much heat is produced. In addition, residents have access to 17 charging points for electric cars and e-bikes, which charge electric vehicles with locally generated electricity.

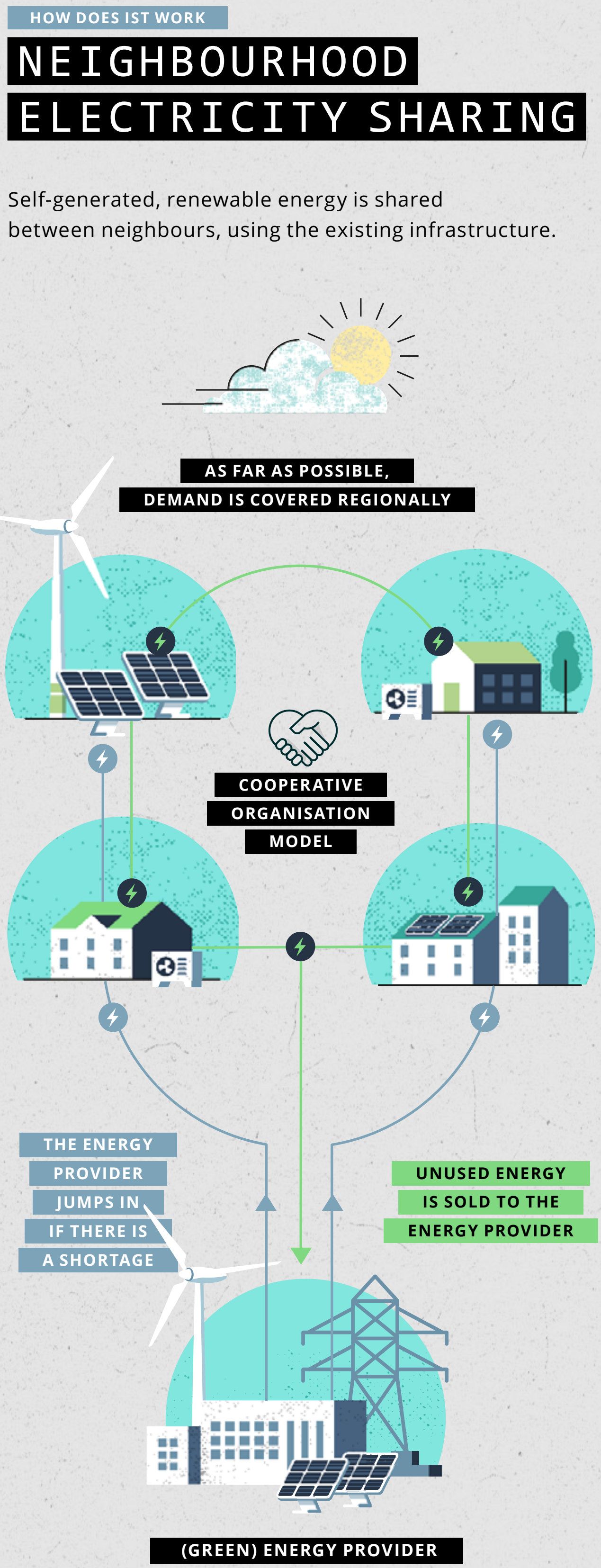
To ensure that electricity generation and use are ideally coordinated and to achieve the highest possible electricity self-sufficiency, the project's green energy provider has installed a local electricity grid with smart meters and intelligent tariffs. With a two-tariff model, residents are motivated to use as much of the electricity generated on site as possible. For the electricity from their own roof, they pay a reduced tenant electricity tariff. *«By recording electricity generation and consumption with smart meters — for each generation and consumption point — the residents end up with an individual electricity price that is made up of the share of local electricity they use and the share of grid electricity. This means that the highest possible direct consumption is rewarded directly via the electricity price»*, explains Florian Henle, Managing Director of Polarstern **(Polarstern, n.d.)**.

SMART GRIDS? LOST IN REGULATORY FRAMEWORK

In Germany, however, the essential prerequisites for smart, decentralised grids and the integration and flexibilising of all actors have not yet been created. The existing structures make it difficult to establish energy communities: The EU anchored energy sharing in the Renewable Energies Directive in 2019, but the regulatory framework is long overdue in Germany **(BUND, 2021)**. Furthermore, we are only at the beginning of digitalisation at the level of households or consumption communities.

Even though the German Act on the Digitisation of the Energy Transition pursues the goal of creating a digital infrastructure for metering point operation in the electricity and gas sector, we are still a long way from achieving the

[**Figure 1** *Illustration adapted from Robert Albrecht/BDEW*



The downside: Smart Meters/Smart grids require (raw) materials and energy.

///<quote>
There is a need for committed people who set up more energy communities and also for more service providers that take over the billing of peer-to-peer transactions and the energy communities.
///</quote>

goal. However, with the Act to Relaunch the Digitisation of the Energy Transition by the Federal Ministry for Economic Affairs and Climate Protection, the rollout is now to be accelerated. But for prosumership in energy supply to increase, other actors and services must participate. There is a need for committed people who set up more energy communities and also for more service providers that take over the billing of peer-to-peer transactions and the energy communities. But not all energy communities have it as hard as those in Germany. Austria, for example, has already recognised that energy communities are an essential component of a sustainable energy economy. And in countries such as Italy or France, smart meters have already been installed almost everywhere.

WEIGHING UP THE NEGATIVE EFFECTS OF DIGITALISATION

However, it should not be forgotten that digital technologies themselves are also energy-hungry. Every process that is digitised first requires material — sensors, processors, data lines — and energy for programming and training and later in operation. Meanwhile, producing and disposing of the digital infrastructure hardware also contribute to digitalisation's significant footprint. For example, if we compare a modern metering device such as an integrated management system (IMS) (without a smart meter gateway) with a classic Ferraris meter (current meter model in households), producing an IMS causes 91 kg of CO_2 equivalents, while that of a Ferraris meter causes around 8 kg of CO_2 equivalents **(Gährs et al., 2021)**. In addition, the electricity consumed by operating an IMS increases as soon as a smart meter gateway is added. A smart meter with second-by-second recording including device recognition emits approximately 17 kg of CO_2 equivalents in one year, including all up-front costs **(Aretz et al., 2022)**. Furthermore, that study calculated that about 40 kWh/year would have to be saved to compensate for the additional greenhouse gas emissions arising from manufacturing and operating a smart meter.

This puts us — as is so often the case when it comes to sustainable decisions — in a quandary. On the one hand, transforming our energy system, indispensable for achieving the climate goals, can hardly succeed without digitalising the grids. A smart meter rollout is an essential prerequisite to making the energy supply more efficient and flexible and enabling all citizens to participate. On the other hand, smart meters and the like also have negative environmental effects.

But there is scope for design to keep the additional energy and resource consumption of a smart meter rollout as low as possible. In particular, a nationwide rollout could make the smart meter rollout efficient because gateways in apartment buildings can be shared by several meters. In addition, the frequency of data collection could be set so that only as little data as necessary is collected. For example, data could normally be read out on a weekly basis and only when necessary, as with a flexible tariff, on a 15-minute basis. Incidentally, this would also have a positive impact on data protection.

PAVING THE WAY FOR NEIGHBOURHOOD ENERGY SUPPLY

Therefore, the appropriate framework conditions must be created at the political level, including the removal of bureaucratic hurdles for establishing renewable energy communities, the flexibilising of energy tariffs to link consumption to the availability of renewable electricity, and the promotion of citizen participation and co-design to increase acceptance. For this purpose, citizens should be given the opportunity to invest in renewable energy systems, to purchase electricity directly, but also to share it with neighbours. Overall, this change would lead to more citizen participation.

///<quote>
Citizens should be given the opportunity to invest in renewable energy systems, to purchase electricity directly, but also to share it with neighbours.
///</quote>

At the same time, the technical infrastructure must be created so that a networked, intelligent, and efficient energy system can develop, including the nationwide roll-out of grid digitalisation and smart meters installation for all households. In addition, digitalisation itself must be sustainable and take into account climate and resource protection, data protection, and social justice. Achieving these aims requires an appropriate political framework and guard rails. }

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RESEARCH ARTICLE

DIGITALISATION FOR A SOCIO-ECOLOGICAL TRANSFORMATION IN AGRICULTURE

The future vision of food production is often portrayed as a tech utopia. The German Federal Ministry of Education and Research (BMBF), for example, published a future image of food production that includes self-driving tractors, drones, sensor equipped cows, and field robots alongside high-tech aquaponic urban agriculture **(BMBF, 2023)**. There is still quite a way to go until these technologies become all-encompassing or even widespread, but they have made huge headway in the agricultural sector in the Global North in the past five years.

New digital technologies are often presented by politicians and large agro-food companies as the silver bullet to solve all of agriculture's problems: The food system contributes between 20% and 37% of global greenhouse gas emissions **(Mbow et al., 2019)**. Most of these emissions are generated by agricultural production, particularly crop and livestock activities within the farm gate as well as land-use change and deforestation for agriculture. Large-scale industrialised agriculture is also a key driver of the global biodiversity crisis. At the same time, many, especially small-scale, farmers as well as farm workers around the world struggle to make ends meet as they are often the first to suffer from the negative impacts of a changing climate. Digital technologies, so a widespread promise, provide the solution to making agriculture more profitable, more

///<quote>
The food system contributes between 20% and 37% of global greenhouse gas emissions.
///</quote>

productive, more independent of a seasonal workforce, and of course more environmentally sustainable. As such, the promise continues, they will provide a veritable fourth revolution in agriculture.

///<quote>
Many of the digital technological innovations are far from revolutionising the dominant agro-industrial model of food production.
///</quote>

Yet, many of the digital technological innovations currently being rolled out by large agro-food companies such as Bayer, John Deere, or Syngenta are far from revolutionising the dominant agro-industrial model of food production. More to the point, they minimally optimise the current production model through precision agriculture that can slightly reduce the use of fertilisers and water or through robots that reduce the need for seasonal labour **(Prause et al., 2021)**. They do not, however, offer a radically different way of doing agriculture, one that might, indeed, offer ways forward for a pesticide free, more climate-resilient and socio- and ecologically sustainable way of producing food. Instead, data-based decision support tools such as farm management platforms increase the risk of locking farmers into the current system of using large-scale machinery, chemical inputs, and standardised seeds **(Bronson, 2022)**.

ALTERNATIVE TECHNOLOGICAL AND SOCIAL INNOVATIONS FOR FOOD PRODUCTION

However, once we look beyond the dominating digital technologies, we do see a technological niche system that has developed in recent years. Here, technological innovations are developed in close relation with social innovations in food production. These social innovations include community-supported agriculture (CSA), direct marketing of organic produce to local consumers, and different forms of agricultural production, such as permaculture. CSA in particular constitutes a transformative social innovation **(Pel et al., 2020)**. Its agricultural practices are based on organic or agro-ecological principles that are environmentally friendly and produce high-quality food. Just as important, however, is that it also establishes a new form of economy and thus replace the dominant institution of food as a mere commodity. Instead, food consumers share the costs of agricultural production as well as the resulting harvest. Farmers and consumers share the relatively high risk of agricultural production **(CSX Netzwerk, 2023)**.

///<quote>
It establishes a new form of economy and thus replace the dominant institution of food as a mere commodity.
///</quote>

The following image gives an overview of some alternative digital technologies for CSAs and other forms of agro-ecological food production that are currently available in Germany, Austria, and Switzerland. The illustration is certainly not comprehensive and similar technological innovations have also sprung up in other contexts, such as FarmOS in the US.

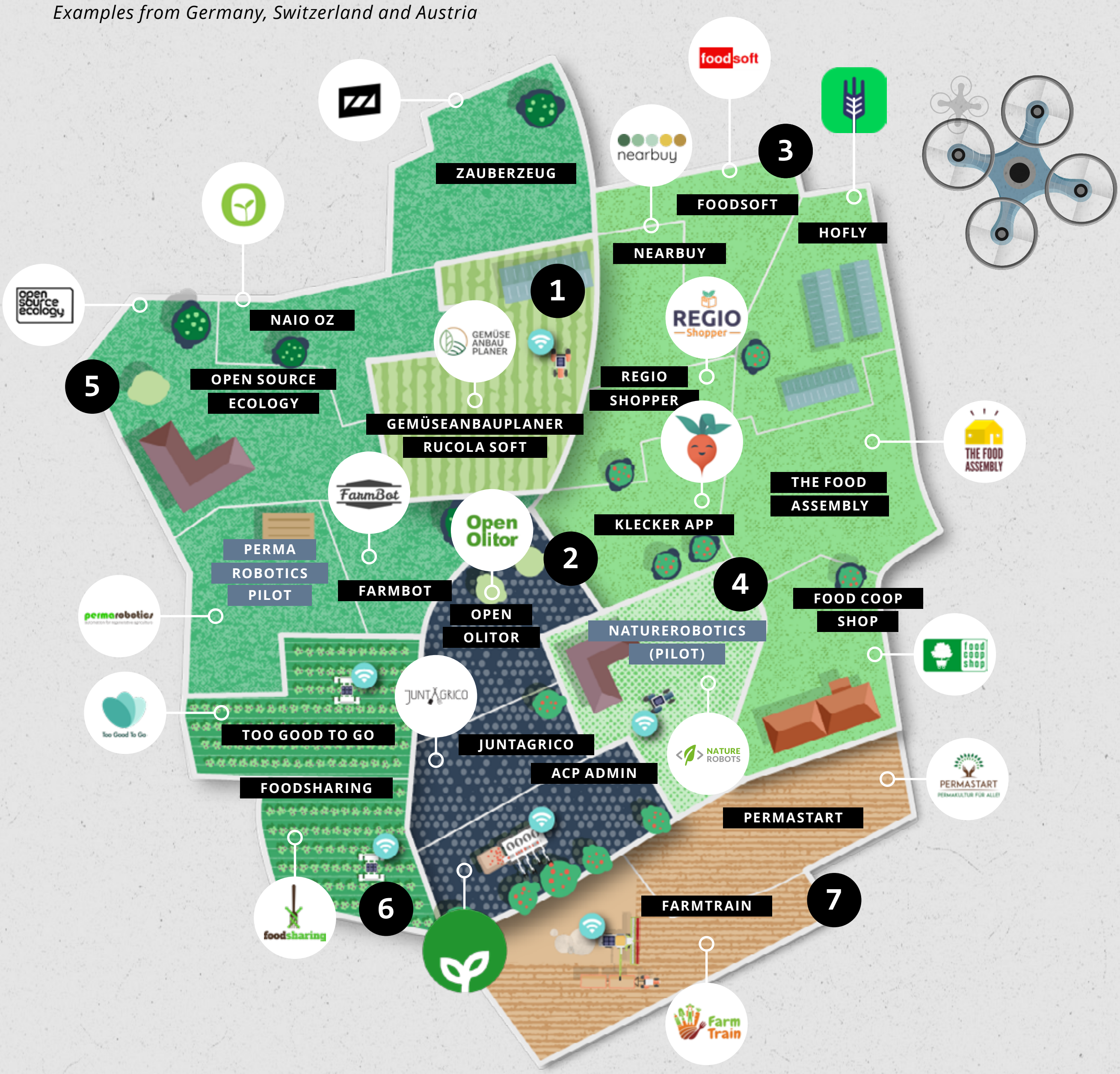
These alternative technologies can contribute to more strongly linking local food producers and urban consumers, be it through digitally supported CSAs or digitally enabled direct marketing. Robotics for small-scale agriculture can partially replace labour intensive and monotonous tasks, such as weeding on agro-ecological farms,

Image 1 *Own Illustration*

WHAT IS OUT THERE?

INNOVATIONS FOR FOOD SYSTEM TRANSFORMATIONS

Examples from Germany, Switzerland and Austria



1 PLANNING TOOL FOR SMALL-SCALE HORTICULTURALPRODUCTION

2 CSA ADMINISTRATION

3 DIRECT MARKETING

4 AI RECOMMENDATIONS FOR AGRO-ECOLOGY

5 FARM ROBOTICS

6 FOOD WASTE REDUCTION

7 LEARNING AND TEACHING

and free up new capacities for farmers and farm workers to experiment with new farming practices. Digital platforms for learning and AI-based recommendations for agro-ecology allow optimisation and dissemination of non-industrial farming practices and offer important resources for people who want to engage in agriculture but do not have any formal education in the sector. Digital tools for planning horticultural production, such as the Gemueseanbauplaner, can likewise make it easier for people to start producing food and also keep knowledge within the farm, if, for example, the gardener changes: The predecessor's planning and knowledge are to a certain degree saved within the programme.

DEVELOPING ALTERNATIVE DIGITAL TOOLS

Dominant digital technologies for agriculture are generally constructed in a top-down process with corporate profitability in mind. They are usually proprietary and do not pay much attention to data privacy. Many allow profits to be generated from the extracted data and thus reinforce some of the systemic challenges facing food producers **(Fraser, 2022)**. The alternative technological innovations are not only different in that they aim to support a different model of food production, distribution, and consumption. For many, but not all, different principles have been followed in their design.

The example from OpenOlitor, a digital platform for CSA administration, shows what an alternative approach to creating digital tools for agriculture can look like.

OpenOlitor

- is open-source, avoiding vendor lock-in and guaranteeing the four software freedoms **(Free Software Foundation, 2023)**;
- is built on an association as an organisational body incorporating all involved parties, centring on maintenance and further development of the platform and assuring cooperative financing;
- establishes hosting communities that share the task of operating IT infrastructure and function as a platform to organise mutual technical support and knowledge transfer;
- has a long-term focus on assuring availability and support;
- was built based on a bottom-up requirement analysis in close collaboration with farmers and consumers.

Through this collaboration with a number of CSA initiatives, the OpenOlitor team became aware of the many challenges CSAs face as small-scale innovative bottom-up projects. They generally unite very motivated individuals who often lack a formal education in agriculture and work for little or no remuneration. As such, many CSAs face both agricultural challenges in producing high-quality organic food and logistical and administrative difficulties. A tailored software-backed process such as OpenOlitor helps reduce the workload of the personnel and frees forces, allowing them to centre on the main activity: producing healthy and sustainable food.

However, people working in CSAs often face a huge everyday workload, making it hard for them to get involved with designing a technological tool, even if the tool would make dealing with administration and logistics easier in the long run. Some CSA projects also have a relatively critical stance towards technology, which needs to be addressed during the bottom-up design process. And once a software-backed solution such as OpenOlitor has been developed, CSAs still need to find time and space to set it up and to analyse and remodel their current work processes. Thus, having external support that is bringing in knowledge and practical help in setting up software-backed administrative routines can be important.

UPSCALING NEW TECH FOR FOOD SYSTEM TRANSFORMATIONS

So, what can these alternative digital technologies achieve when we look at a socio-ecological transformation of food production? Alternative digital technologies are still part of a small niche that caters to a small section of agricultural production. But niches can always be scaled up, as we have seen with the expansion of organic agriculture. This up-scaling would require dedicated political support for niche technologies *AND* for alternative ways of producing, distributing, and consuming food. A deep socio-ecological transformation of the food sector will never be achieved through a mere techno-fix. It cannot be stressed enough that hardware and software tools alone are never the answer to the problems the food system is facing. They can only serve as additional tools that, if used appropriately and in tandem with socio-ecological innovations, may support a broader food system transformation. Nevertheless, by bringing new tech, agro-ecological farming practices, and social innovation, such CSAs offers new and exciting ways forward for a food system based on different economic and agro-ecological principles.

///<quote>
A deep socio-ecological transformation of the food sector will never be achieved through a mere techno-fix.
///</quote>

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DID YOU KNOW …?

MORE THAN 80% OF THE WORLD'S FARMS OWN LESS THAN TWO HECTARES OF LAND BUT TOGETHER THEY PRODUCE A THIRD OF THE FOOD

Source: *United Nations' Food and Agriculture Organization, 2021*

{ Author *melzai*

PRACTICAL PERSPECTIVE

WORKSHOP RESULTS

How to Pair Intersectional Feminism and Technology for a Sustainable Future

How can a sustainable world be achieved? Which unique projects can be contributed by groups that cover knowledge in digitalisation, sustainability, and intersectional feminism? The results of a workshop in which these questions were discussed are presented below.

Transforming our world into a sustainable state takes a broad set of skills. One of them can be found in the technical domain. The Haecksen consists of over 600 women, intersex, non-binary, agender people, and trans men, mostly from German-speaking areas. We include communicators, programmers, scientists, makers, artists, system administrators, among others. Our common goal is a more diverse tech scene and an equitable, and thus sustainable, society.

To pursue our goal, we hosted an envisioning two-hour workshop at the Bits & Bäume 2022 conference. Envisioning workshops are a known starting point in the technology sector to derive a new concept or tool to improve a targeted situation. They are often used when conceptionalising new software. Thus, we invited visitors to envision and explore with us projects that would combine technology, intersectional feminism, and sustainability to help us identify unique areas of contribution for groups like the Haecksen that cover a range of rare capabilities.

The workshop started through a brainstorming activity with all 20 participants to envision projects concerning intersectional feminism, technology, and sustainability. The participants then split into three self-organised groups and created proposals for each of the aforementioned Haecksen sub-communities.

WORKSHOP RESULTS

The workshop participants proposed different projects covering climate, democracy, biodiversity, power relations, project design, system change, and communication.

In smaller teams, the participants then decided to investigate in more depth three requests from the initial list: ‹Sustainable IT provisioning/Is sustainable digitalisation possible?›, ‹Feminist city planning based on mobility data›, and ‹How to share and use personal sustainability data in a barrier-free way›.

Their results provided further insights into the nature of the project idea in mapping them to the earlier introduced Haecksen teams. In all cases, researching and making the current status of knowledge available to the broader public was requested. A request was also made for data relevant for sustainability to be identified, organised, and structured. Technical support was requested to support administrating software for community networking, hosting homepages, and data. Our makers were asked to develop increasingly sustainable products. Haecksen artists and makers were asked to visualise problematic spaces in the city. The need to create something tangible was clearly stated. The participants also voiced general pain points: Awareness concepts tend to be difficult to achieve or communicate, making spaces less accessible to marginalised groups. The urgency of the current environmental and societal changes seems to result in neglecting social and intersectional aspects.

///<quote>
Awareness concepts tend to be difficult to achieve or communicate, making spaces less accessible to marginalised groups.
///</quote>

The participants also voiced discontent arising from the perceived difficulty to create socially adequate and inclusive communication infrastructures that fully serve all needs.

Two specific requests should be reconsidered. Participants proposed hackathons as well as blocking critical infrastructure. However, hackathons as intense coding events are often less inclusive. On average, they tend to promote bad software quality and unsustainable practices and normalise psychologically unsafe spaces. Blocking critical infrastructure would block electricity, water, or food supply. Increasing efforts to harden our critical infrastructure against such interference would be more appreciated.

In conclusion, we noticed that the proposals did not include a strong technical request besides pushing hardware and software further towards sustainable sourcing and behaviour. More education in all areas, upskilling, data retrieval, and its visualisation seem to be a general need. At the Haecksen, we strongly empower our members to find their voice and communicate their wishes, opinions, and needs to society in their own, unique way. For some it might be a talk, a podcast episode, a blog entry. For others it might be an artistic expression such as an installation at a specific place, a performance, or images. For yet another group, it might be the commitment to enable more expressive groups to efficiently pursue their projects in providing improved tooling. As such, we see the vision of the Haecksen greatly resonating with the needs of the workshop participants. We are looking forward to see the fruits of this workshop in the next years. Wherever they might appear.

English translations of all original contributions from the workshop participants are accessible under https://www.haecksen.org/events/pairing-intersectional-feminism-technology-and-sustainability-for-a-sustainable-future-results-from-the-bitsbaume-2022/ }

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5 Necessary Changes on the Political Level

POLITICS UNDER PRESSURE

Most markets are dominated not by sustainability-oriented companies but by unsustainable tax-evading global monopolist conglomerates with a huge negative sustainability impact, including material use, energy consumption, unfree licensing, vendor lock-ins and overall poor working conditions along the supply chain. Sustainability impacts are regularly externalised and, in many countries, fossil resource-based processes are even state subsidised. In effect, producing (electronic) waste is a minor expense as is emitting CO_2, while designing devices for reuse, repair and recycling, and paying staff properly currently creates economic disadvantages. Given such circumstances, it is of no surprise that unsustainability thrives. In addition, in all countries, the small wealthy part of the population has the largest sustainability footprint while the large poorer part has a small footprint and very little room for meaningful individual improvements.

However, as can be seen in the previous chapters, there are many brilliant ideas and concepts as well as successful projects, available technologies, and existing best practices for sustainable societies. Those ideas span all dimensions, from community tech approaches to sustainable economy designs. But to realise the full potential of those approaches, the social and economic framework conditions have to be changed so that they enable sustainability pathways and remove incentives for harmful practices.

Collectively adjusting societal incentives, economic rules and governmental priorities precisely defines the political domain addressed in this chapter: It starts out by illustrating the political demands of the broad Bits & Bäume movement. Lasota and Albers then critically discuss the current EU legislation regarding sustainability and freedom-related aspects of ICT devices. Pohl and Zimmermann turn to the digital infrastructures of data centres and data networks to suggest concrete policy recommendations. Finally, Ramesohl, Wirtz, Gunnemann and Weier explore the concept of digital-ecological statecraft as a regulatory policy orientation and collective facilitation to unleash the creative power of digitalisation.

Rainer Rehak

Johanna Graf & Marja Lena Hoffmann, Bits & Bäume (2022)

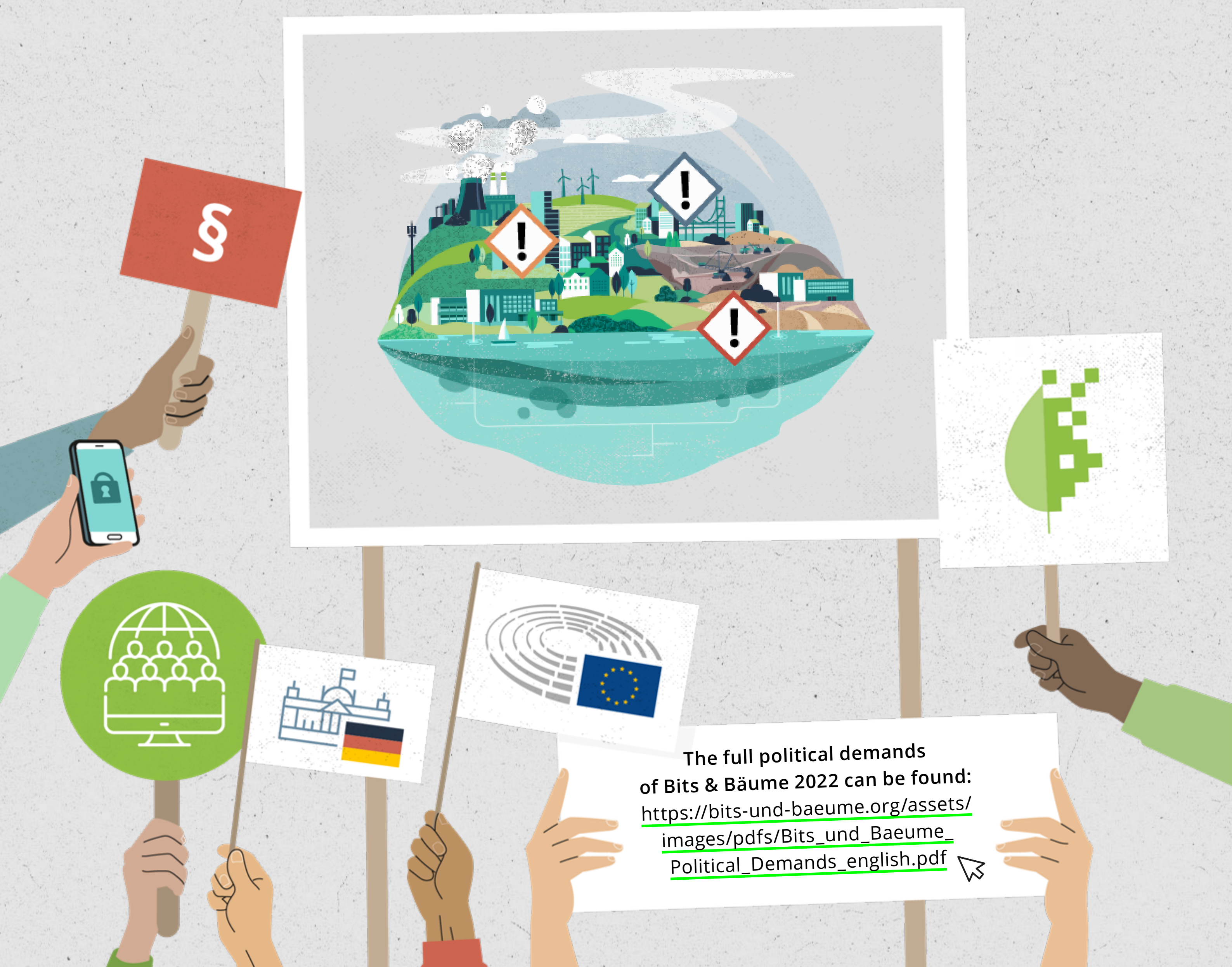
WHAT DO WE NEED?

BITS & BÄUME POLITICAL DEMANDS

MAKING DIGITALISATION SUSTAINABLE AND FIT FOR THE FUTURE

We demand: Digitalisation must increasingly be put into the service of society and of a sustainable socio ecological transformation. Digital technologies should contribute to the improvement of living conditions and of the environment through equal social participation and while respecting planetary boundaries, instead of exacerbating already existing crises through exploding energy and resource consumption and a lack of consideration of the Global South.

With this call, **thirteen organisations** from the fields of environmental protection, digital politics, development cooperation, and science are addressing the German government, the European Union and political actors worldwide.



1. DIGITALISATION WITHIN PLANETARY BOUNDARIES

We demand that technological developments are aligned with the standards of nature, climate and resource protection and the preservation of biodiversity. Digital infrastructures and electronic devices must be constructed and operated in a climate neutral manner, without climate compensation.

Continue Reading in Chapter 1 of the Demands

2. GLOBAL JUSTICE AND REGIONAL EMPOWERMENT

We advocate a digital transformation that supports a globally just and sustainable economic system. Trade agreements on digital goods and services should not restrict national regulations required to build an independent digital economy locally.

Continue Reading in Chapter 2 of the Demands

3. REDISTRIBUTION OF TECHNOLOGICAL POWER, DEMOCRACY AND PARTICIPATION

We demand the creation of governance frameworks that control digital monopolies and democratise the digital world.

Continue Reading in Chapter 3 of the Demands

4. JUSTICE IN DIGITALISATION, SUSTAINABLE TECHNOLOGY DESIGN AND SOCIAL ISSUES

We advocate a digital transformation that supports a globally just and sustainable economic system. Trade agreements on digital goods and services should not restrict national regulations required to build an independent digital economy locally.

Continue Reading in Chapter 4 of the Demands

5. PROTECTION OF DIGITAL INFRASTRUCTURE AND IT SECURITY

A sustainable democracy needs reliable, secure and trustworthy infrastructures. We, therefore, demand that digital infrastructures are adequately protected and maintained. To realise this, public security must be understood in such a way that IT security and data protection are oriented toward fundamental rights and viable and liveable societies.

Continue Reading in Chapter 5 of the Demands

{ Authors *Lucas Lasota & Erik Albers*

DEBATE ARTICLE

MAKING A MORE SUSTAINABLE TELECOM SECTOR WITH FREE SOFTWARE

FIRST STEP: LIBERATE ROUTERS AND SMARTPHONES

The dominant power of telecommunications operators and providers over internet access has sparked policy, regulatory, and legal reactions trying to impose accountability on large enterprises that control how end-users should use their devices to connect to the internet. Network operators can be vertically and horizontally integrated with other internet platforms, controlling diverse elements of the internet value chain **(Marsden, 2017)**. Aside from the clear impact on end-users' rights over access and control of the software, hardware, and services of their digital devices, such corporate power is also able to distort innovation **(Ezrachi and Stucke, 2022)** and competition in digital markets **(Savin, 2020)**, negatively impacting the environment **(BEREC, 2022)**. This article puts in context the latest set of norms in the EU dealing with the behaviour of network operators towards end-users' internet devices from the perspective of sustainability and the recent legislative initiatives on the ecodesign of products. This context is achieved through two use cases: the free choice of routers/ modems and the right to replace mobile phones' operating systems. Conclusions over both cases are reached in the light of end-user-oriented policies that positively impact the environment by mitigating e-waste and increasing the lifespan of devices.

DEVICE LOCK-IN AND REGULATORY HURDLES ARE NOT SUSTAINABLE

The digitalisation of infrastructures and services comes along with a growing number of devices connected to the internet. The telecommunications sector (ICT) is a driving force in this process. The expansion of new broadband networks such as optic fibre (FTTx) and 5G poses sustainability challenges for the entire industry. For example, personal routers/modems are important elements of the ICT infrastructure for home internet connection. Although it may seem common sense that end-users should be able to choose their routers — as they do with mobile phones —, this is not true for Europe. In many cases, network providers do not allow end-users to use their own private routers/modems **(Golem, 2022)**. This restriction is problematic for the environment because device interoperability can be limited, leading to unnecessary expense, fewer personalised features, and a lack of being able to make use of the right to repair.

Safeguarding the free choice of routers/modems in Europe has followed an uneven path. While the 2015 Open Internet Regulation[1] consolidated this right, further regulatory hurdles have impeded proper implementation. The latest reform of EU telecommunications law, introduced in 2018 by the European Electronic Communications Code,[2] allowed national regulators to limit such freedom on technical grounds. The rules have led to fragmentation of the regulatory patchwork among EU member states to the detriment of end-users **(Lasota, 2021)**. Interestingly, various reports from industry **(VTKE, 2019)**, civil society **(FSFE, 2019, 2022)**, and regulators **(BIPT, 2022)** have highlighted that, in countries where freedom of routers/modems has been guaranteed, no significant damage to public networks has been identified, fair competition evolved, and end-users' awareness of e-waste was raised.

Annually, almost 1.5 billion smartphones are produced worldwide **(Gartner, 2021)**. Among other factors, the lifetime of the smartphones hardware is often artificially shortened due to ‹software obsolescence›. ‹Software obsolescence› is defined as the end of life of a piece of software, mainly by the initial developer stopping support **(Albers, 2021)**. In the case of operating systems, such obsolescence often leads to the premature end-of-life of a device: Although the hardware might still work properly, the insecurity and instability of the software negatively affect the device's performance. From the sustainability perspective, this premature end-of-life is particularly concerning since the carbon emissions and energy investments necessary for producing a new smartphone outweigh several times the energy and emissions related to the smartphone's entire lifespan.[3]

FREE SOFTWARE SPARES HARDWARE, THUS THE ENVIRONMENT

One way to overcome hardware obsolescence is to allow users to exchange the initial operating system with one that is still benefiting from development and support. This exchange is becoming a current practice in the mobile phone and tablet sector. The environmental benefits are obvious: with almost 1.5 billion smartphones being produced every year, if users could use their devices one year longer, the production of hundreds of millions of smartphones would be saved annually **(EEB, 2019)**. The same goes for routers/modems.

[1] *Regulation (EU) 2015/2120 (Open Internet Regulation), Article 3(1).*

[2] *Directive (EU) 2018/1972 – European Electronic Communications Code (EECC). This law overhauls the regulatory framework for the telecommunications sector, implementing rules about net neutrality, increasing consumer protection, and improving data protection, as well as paving the way for the implementation of next-generation broadband networks, including optic fibre and mobile **(Geus, 2019)**.*

[3] *As Forti et al. **(2020)** explain, in 2019 the world generated a striking 53.6 Mt of e-waste, an average of 7.3 kg per capita. The global generation of e-waste grew by 9.2 Mt since 2014 and is projected to grow to 74.7 Mt by 2030 – almost doubling in only 16 years. The growing amount of e-waste is mainly fuelled by high consumption rates of digital equipment, short life cycles, and few repair options. In its yearly environmental responsibility report, Apple **(2019)** calculated that 79% of the overall carbon footprint of its devices applies to manufacturing and product transport while only 19% of the carbon footprint resulted from using the product use.*

Enabling end-users to install free operating systems in their devices *fosters reuse, repurposing, and interoperability. Free software licenses guarantee unrestricted access to software not only for all people but also unlimited in terms of space and time, fostering sustainability of solutions and hardware.* The right to install any third-party software on any device would enable users to choose software that helps them to keep their devices running even if the initial manufacturer has decided to stop support. It would, furthermore, enable diversified aftermarkets and enhanced competition regarding re-use of devices. These are all good reasons why legal, technical, commercial, or other obstacles to reusing these devices should be discouraged.

In addition, ‹device neutrality› can serve as a regulatory tool to improve end-users' control over devices. Device neutrality translates into a non-discriminatory IT environment, with any service and software application being treated equally within the running operating systems, their dominant platforms, and their respective hardware companies **(Krämer, 2019)**. Hardware providers can discriminate how users access services and apps in a fashion similar to how network operators can discriminate end-users' internet traffic. Therefore, device neutrality's main objective is to resolve the monopoly on devices by safeguarding end-users: supplying them with alternatives to accessing software, services, and content with their equipment **(Krämer and Feasey, 2021)**. Free software is a key in this process as it provides the alternatives for end-users to escape the restrictive lock-in imposed by device manufacturers, vendors, and internet platforms **(FSFE, 2022b)**.

UPCYCLING THE LEGISLATION

To avoid a greater impact on the environment, principles of digital sustainability can be incorporated into device-oriented policies that reflect the importance of open technologies. Specifically, for a critical, long-lasting, and sustainable change and extension of hardware lifetimes, legislation should strengthen end-user control over devices. The update of the 2009 ecodesign directive by the EU Commission (2022) has led to EU policy initiatives to make products more resource-efficient and applicable to circular economy methods. These initiatives include phones and tablets in the ecodesign criteria for the EU digital market and addressing the devices' *«shortcomings in durability, repairability, upgradability, e-waste, reuse and recycling»* **(European Commission, 2022)**.[4] Although the regulatory starting point of the ecodesign directive's update differs from the above-mentioned reform of the telecom law, sustainability aspects converge with how end-users exercise control over devices, providing ways to use devices for longer time periods. While the reform of the telecom sector relates mainly to routers/modems, the ecodesign directive's scope is broader. Nevertheless, both cases represent a window of opportunity for civil society to step into these processes and demand from policy makers device neutrality and the right for any user or third party to install any software on any digital equipment.[5]

[4] *The update of the European ecodesign directive includes a set of regulations and directives that together build the framework for the ecodesign criteria of sustainable products within the EU. With the possibility for more regulations or directives to come and aspects being covered through horizontal rule-making, currently, two regulations directly target mobile phones and tablets: «Designing mobile phones and tablets to be sustainable – ecodesign»* ***(European Commission, 2022a)*** *and «Energy labelling of mobile phones and tablets – informing consumers about environmental impact»* ***(European Commission, 2022b)****.*

[5] *As a policy and awareness initiative, the Free Software Foundation Europe has published an open letter asking European legislators to use the update of the ecodesign regulations to establish a universal right to install any software on any device. By December 2022, more than 150 civil society organisations across sectors and companies had signed it* ***(FSFE, 2022a)****.*

SAVING THE PLANET, ONE DEVICE AT THE TIME

Developing sustainable regulatory solutions for the telecom sector must include policies dealing with the reuse of devices by end-users. Hardware production outweighs several times the ecological footprint of reusing existing devices. Repairability, reusability, and extending hardware lifespan are a matter of accessibility and the possibility to run free software. There is room for improving the current regulatory framework in the EU. Keeping end-users safe from lock-ins can amplify competition and freedom of choice for more ecological options. For a European shift from linear production and e-waste production towards a circular electronic economy, freedom to install alternative operating systems and device neutrality must be established. }

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DEBATE ARTICLE

IT'S TIME FOR BOLD POLICY-MAKING!

Suggestions for a Climate-friendly Digitalisation

In 2030, the ICT sector's electricity consumption will account for around 10% of global electricity consumption **(Hintemann et al., 2022)**. This percentage would roughly correspond to a doubling of digitalisation's electricity consumption compared to 2020. Most of the sector's electricity consumption results from producing and using end devices, followed by the electricity demand from operating data centres and communication networks. However, data centres and communication networks are expected to drive rising electricity consumption by 2030.

In this opinion piece, we propose policy measures for ensuring that, in Germany and the EU, the production and operation of ICT infrastructure, i.e., data centres and communication networks, produce as little greenhouse gas (GHG) as possible. In the following, we provide policy recommendations for data centres, data networks, and data consumption, recommendations we consider convincing after our many years of scientific and political work in the field and countless discussions with other experts.

A GREENER WAY TO OPERATE DATA CENTRES

Despite the increasing efficiency of IT equipment and utility infrastructures, a strong increase in data traffic is leading to a rapid increase in the demand for capacity in data centres for processing, storing, and transmitting data. To keep this increase as low as possible, minimum standards on energy efficiency should be implemented, as well as ones on minimum inlet air temperatures for data centres that are cooled by compression chillers. Further, policy-makers should oblige data centre operators to employ a modular design so that hardware use can be optimised and partial loads can be run efficiently.

To reduce GHG intensity, data centres should be required to run on 100% renewably generated electricity, through direct power generation either on or next to the data centres or through power purchase agreements. In addition, based on the availability of renewably generated electricity in the power grid, the German government should incentivise intelligent load management in data centres. Similarly, the emergency power supply of data centres should be converted from diesel gensets to batteries.

At the same time, however, the current challenges in feeding waste heat into district heating networks or transporting it to heat users must be resolved. Data centre operators are already obliged to make technical use of waste heat. However, local heat network operators should also be obliged to accept waste heat at fair prices, or to examine other local heat sinks. A feed-in priority for waste heat should be discussed. Municipalities should be obliged to make using data centre waste heat an essential criterion for urban planning and to take it into account in building and heat management planning. The German government could support platforms so that data centre operators, heat network operators, and municipalities can find the best possible way to cooperate in using waste heat.

MAKING COMMUNICATION NETWORKS MORE EFFICIENT

The enormous growth in data volumes, in particular in mobile data volumes, is another driver of the ICT sector's electricity consumption. Compared to mobile applications such as 5G, fibre-optic connections are the more energy-efficient communication networks. As a transmission technology, fibre connections are therefore preferable, and nationwide coverage should be implemented.

///<quote>
Future decision-making should support open access models.
///</quote>

Clear political guidance is essential to avoid too many systems of landline or mobile network coverage in parallel. For instance, the introduction of 5G mobile networks has been politically supported by following the faster-is-better paradigm. Future decision-making should support open access models. This access requires national roaming with uniform and fair grid usage fees to prevent multiple coverage. The government should also prescribe joint use of base stations and other infrastructure by different network service providers.

Mobile phone masts should be powered by renewable energies as far as possible, taking into account emergency power supply. For the expansion of 5G, old 3G masts should be used. To make 5G as efficient as possible, the government should support further research on how efficiency could be improved by technologies such as beamforming (the targeting of radiation to individual users), sleep modes at low load, and higher spectral efficiency through better modulation techniques. The government should support implementation where appropriate.

LIMITING DATA TRAFFIC

Perhaps the most important but also the most challenging aspect is to prevent data centre and network efficiency improvements from being neutralised by growth effects due to ever more interconnected devices in the Internet of Things and the exponential growth of data **(Pohl et al., 2021)**. Therefore, policy-makers should aim to limit data consumption to a sufficient level. We provide three exemplary policy suggestions for data traffic reduction.

///<quote> Policy-makers should aim to limit data consumption to a sufficient level. ///</quote>

First, tracking human behaviour on the internet for marketing purposes comprises an essential part of the internet's growing electricity consumption **(Pärssinen et al., 2018)**. At the same time, such tracking is not aligned with sustainability goals. More to the point, it endangers data protection and privacy and even increases emission-intensive consumption **(Santarius et al., 2022)**. Hence, measures to reduce tracking, and thereby data traffic, should include mandatory opt-in strategies instead of opt-out (e.g., regarding privacy settings, tracking, online advertisement) and limiting data collection to only those data needed for the service being provided. Second, a large part of data traffic is caused by streaming. The EU should prescribe that autoplay functions and preload are switched off by default. Streaming services should also be required to reduce bitrates by default. Third, to create incentives for data sufficiency, flat rates with very high data volumes could be banned. To achieve climate-friendly digitalisation, the EU and the German government face major tasks. There is no more time to lose. The good news is: There are enough suggestions on the table for building a different, sustainable digitalisation. We have presented some of these in this opinion piece. }

///<quote> There are enough suggestions on the table for building a different, sustainable digitalisation. ///</quote>

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RESEARCH ARTICLE

NEW GOVERNMENT FOR NEW TASKS?

The Reorganisation of Government Action in the Digital World

A CALL FOR NEW GOVERNANCE – A SENSE OF URGENCY

The ecological challenges of this decade have been clearly identified. The pressure of problems is increasing drastically; progress in climate protection or the preservation of biodiversity is insufficient. Little time is left to act. In consequence, we can only achieve and permanently secure social and environmental prosperity through far-reaching changes in economy and society.

As a socio-technical innovation, digitalisation can realise its full ecological potential above all where it helps to profoundly change today's lifestyles, consumption patterns, and economic practices with a clear commitment to sustainability. As the most urgent design task of the 21st century, it is important to put digitalisation's enormous creative power at the service of the great transformation **(Ramesohl and Losse-Müller, 2021)**. The ‹great transformation› refers to the comprehensive restructuring of technology, the economy, and society in order to deal with the social and ecological challenges of the 21st century **(Polanyi, 1944; Schneidewind, 2018; WBGU, 2011)**. This is a task for state action in terms of both regulatory policy orientation and facilitating collective processes of change — new tasks call for new governance.

A digital-ecological statecraft is the indispensable prerequisite for effective state action to shape the social-ecological digital transformation. Using the example of the platform economy, we explore challenges, starting points, and (policy) measures.

LOOKING CLOSER: PLATFORM ECONOMY AND REGULATION

WHAT ARE PLATFORMS, ACTUALLY, AND WHY ARE THEY IMPORTANT?

Platforms are actors that provide internet-based, multi-sided forums and markets, thereby enabling the exchange of data, communication, and transfers of goods and services between various user groups. These digital platforms can now be found in all areas of our social and economic life, and they are playing an important role in the interaction between people, companies, and institutions. Platforms connect private individuals (peer-to-peer, P2P), business-to-customer (B2C), and business-to-business (B2B), e.g., in the organisation of industrial supply chains. Finally, public institutions are increasingly using platform approaches to carry out their tasks. The platform economy is an outstanding example of how digitalisation is changing the nature of societies, industries, and markets.

The ecological impact of platforms — their footprint — as intermediary actors can be seen in different direct and indirect effects and depends on their design and use. Their footprint might include the energy and resource input necessary for operating the infrastructure on which platforms depend and the consumption incentives they set, just as much as their effect on market structures **(Frick et al., 2019; Pouri, 2021)**.

OUR WORKING THESES

Since platforms facilitate environmentally relevant transactions and have a footprint themselves, they have the potential to shape proactively the socio-ecological transformation of our economies and lifestyles. This potential is currently untapped; on the contrary, the business models of platforms reinforce unsustainable production and consumption patterns. Considering their market power and relevance for today's consumption patterns, platforms need to redefine their role and proactively take wide-ranging responsibility for sustainable development.

Our vision: In 2030, platforms will be key drivers of the digital-ecological transformation of production and consumption. Their infrastructures, processes, supply portfolios, and governance mechanisms will be designed according to strict sustainability criteria (sustainability by design) and embedded in progressive enabling regulation.

But how can platforms themselves become agents of ecological change and contribute to sustainable development? What are the starting points and possible actions for politically framing and steering platforms?

WHERE WE ARE TODAY

These questions can be linked to the ongoing debates on regulating platforms at both the national and the European level. In recent years, several initiatives have started or are nearing completion.

It is becoming clear that the European Union and its member states are working intensively on the regulatory framework conditions to create a level playing field and push back dominant companies. Three major fields of (digital) policy action have emerged:

- Regulation of content, especially of (social) media
- Data regulation, with a focus on data protection and data access
- Competition regulation, with a focus on (potentially) dominant platform companies.

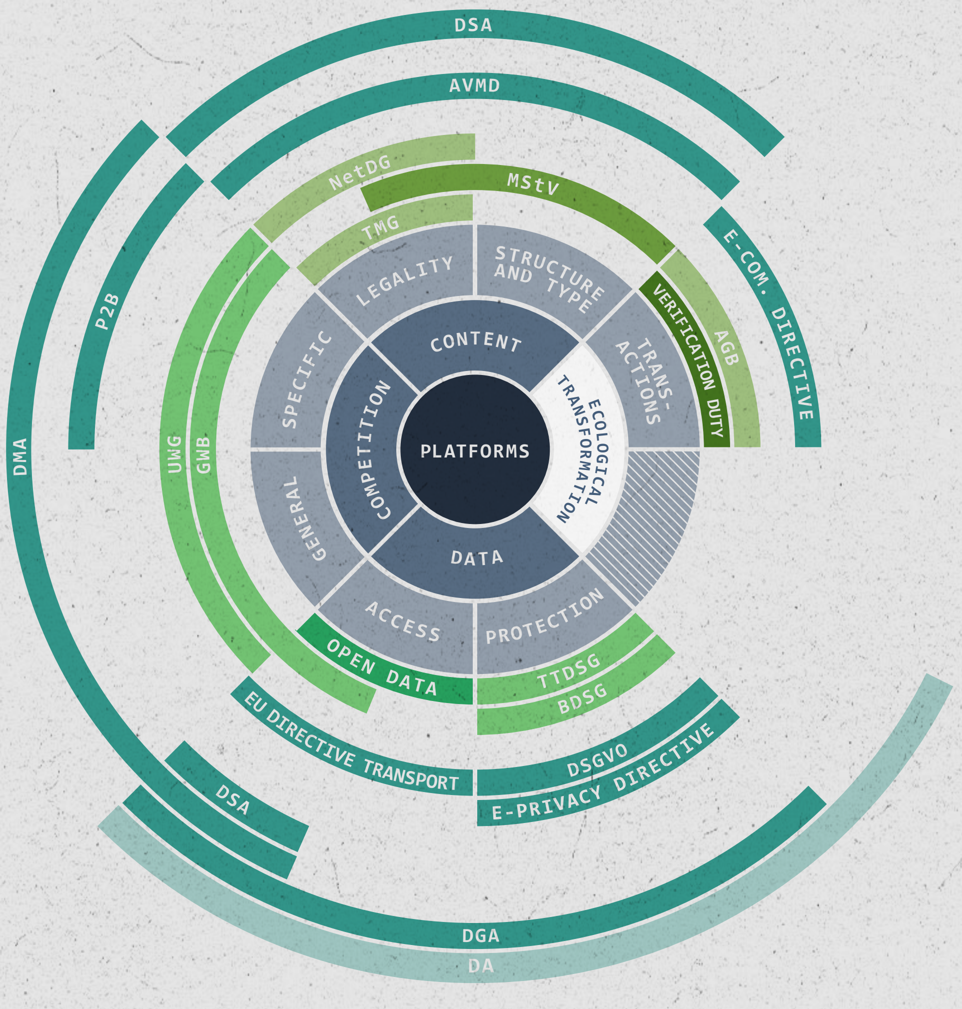
A LACK OF SUSTAINABILITY

At the same time, the guiding principle of sustainability has not found its way into these initiatives. The political target dimensions of climate protection and environmental sustainability do not yet play a relevant role in digital policy and platform regulation. There is still a way to go to manifest the vision of ‹platforms in the service of sustainability›. We therefore see the need for a governance framework that aligns sustainability and digitalisation in the shaping of platforms and their ecosystems.

[**Figure 1** *Own Figure*

WHAT'S THE STATUS QUO?

FOCAL POINTS OF PLATFORM REGULATION IN GERMANY AND EUROPE



PLATFORMS

- Underregulated
- Research needed *Type of regulation unclear*

GERMANY

- Federal Ministry for Economic Affairs and Climate Action (BMWK)
- Federal Ministry of Justice (BMJ)
- Federal Ministry of the Interior and Community (BMI)
- Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)
- Federal states

EUROPEAN UNION

- Implemented
- Pending

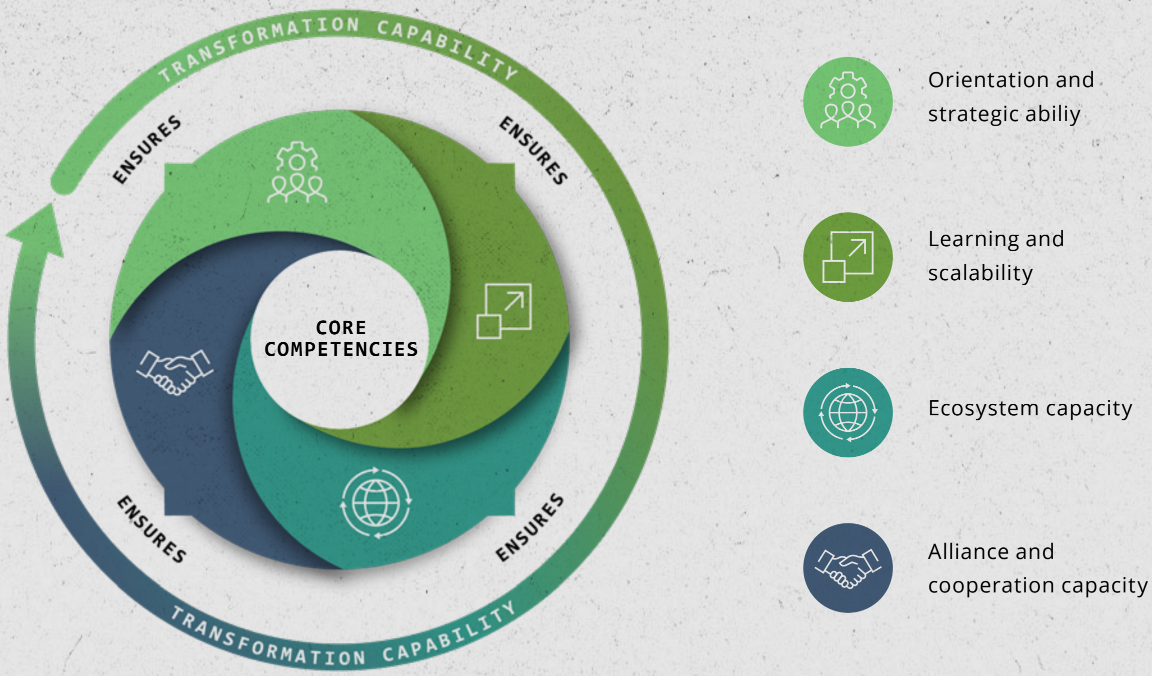
GLOSSARY

AGB: *General Terms and Conditions*
AVMD: *Audiovisual Media Services Directive*
BDSG: *Federal Data Protection Act*
DA: *Data Act*
DGA: *Data Governance Act*
DMA: *Digital Markets Act*
DSA: *Digital Services Act*
DSGVO: *General Data Protection Regulation*
GWB: *Competition Act*
MStV: *Interstate Treaty on Media*
NetDG: *Network Enforcement Act*
P2B: *EU Regulation on platform-to-business relations*
TMG: *German Telemedia Act*
TTDSG: *German Telecommunications-Telemedia Data Protection Act*
UWG: *Act against Unfair Competition*

Figure 2 *Own Figure*

WHAT DO WE NEED?

NEW GOVERNANCE COMPETENCIES



WHAT NEEDS TO BE DONE?

Platforms do not have sufficient momentum for an ecological shift towards sustainable consumption and the satisfaction of our needs without greenhouse gas emissions and with less use of resources. To become active players in a sustainable transformation, platforms must support sustainable consumption patterns and consistently align their service portfolio and business models with climate, resource, and environmental protection.

///<quote>
Platforms must support sustainable consumption patterns and consistently align their service portfolio and business models with climate, resource, and environmental protection.
///</quote>

We therefore see the need for a governance framework that actively shapes and politically steers the sustainable orientation of transaction platforms and their ecosystems. Governance can be defined as the steering, coordinating, and governing of socio-economic-political systems with the aim of managing the interdependencies between non-state and state actors **(Benz et al., 2007)**.

The competencies required for the design of a new governance approach for a sustainable platform economy can be applied to a wide range of challenges at the intersection of digitalisation and sustainability. It is essential to formulate the competencies in a universally valid and simple manner – after all, decision-makers at all levels must be able to understand and implement them quickly.

HOW IT WORKS – ELEMENTS OF A NEW DIGITAL-ECOLOGICAL STATECRAFT

The digital world is increasingly shaping how and what we consume. But it is also changing: With the vision of a continuous virtualised fusion of our internet use in the metaverse, expectations are growing for a completely new quality of the customer journey - although it is still completely open as to how these visions will manifest in the near future. The aim is to make complex digital ecosystems sustainable by linking infrastructures, hardware, software, data, and services along overarching social values and political guard rails.

Decentralised self-organisation of actors will not be sufficient to achieve the necessary system transformations in such a broad, comprehensive, and timely manner. In this context, it is important to understand the state again as what it is: the organisation of collective, common action. The socio-ecological transformation requires an active and capable state as coordinator of the transformation – we are not yet at this point in Germany.

We understand statecraft as the knowledge and ability to jointly shape the state and the community in the interest of all. In our view, a stronger role of the state as an active actor in a socio-ecological transformation is indispensable. The concept of a digital-ecological statecraft means that state and society, e.g., public and private actors, acquire the capacity to govern the transformation of complex digital systems. In our view, the following four competencies are particularly relevant for this.

I. Orientation and strategic ability, through common goals and narratives
II. Ecosystem capacity, through organisational set-up
III. Alliance and cooperation capacity
IV. Learning and scalability

The next few years can and must be used wisely to address platforms as central actors in sustainable economic activity and consumption and to build and expand the necessary competencies of a digital-ecological statecraft. }

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The Power of Civil Society in Driving Sustainable Change

A COLLECTIVE EFFORT

Yesterday Bitcoin, today ChatGPT, and tomorrow the Metaverse? The developments of digital applications and technologies are advancing rapidly and unceasingly. This dynamic opens up a wide range of opportunities but also poses the challenge of not being able to keep up with the wave of innovations, new business models, and hype-technologies. For civil society actors in particular, the complexity and dynamics of digitalisation are often accompanied by a feeling of powerlessness. The power asymmetries in the digital space further exacerbate this sentiment. Public-interest oriented actors such as NGOs are often confronted with the strong lobbying power of profit-oriented large tech corporations. However, here comes the good news: digital transformation is not a force of nature but is made and driven by people. Accordingly, it can also be shaped by people.

We need a vigilant and strong civil society to shape digitalisation for the common good. Civil society must act as an early warning system, watchdog, and debate driver. After all, we can only get ahead of the wave of these developments if the dynamics of digitalisation are subject to early scrutiny and creative solutions for dealing with the challenges. However, to support civil society in fulfilling its role, sufficient political and social framework conditions are needed. The contributions in this chapter address the challenges for civil society actors and develop concrete approaches for dealing with them. Frick, Mollen, and Rohde propose steps to counter power asymmetries and empower civil society actors to lay critical foundations for political debate.

Exploring the concept of surveillance capitalism, Hennecke and Jung argue that we need to consider the logics of the corporations that own our communication channels if we want to shape public discourse. In their opinion, a first step to defining a different (digital) future could be taken by forging broad alliances that include people being affected by surveillance capitalism, the tech community, and advocates for social-ecological transformation. Parske and Kastner's contribution introduces the potentials and challenges of crowdacting, a digitally supported concept that aims to mobilise people for collective action. Finally, Lamura and Lamura address the challenges that hypernudging poses for democracy. In their article, they propose top-down and bottom-up approaches to deal with these challenges.

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DEBATE ARTICLE

WHY DESIGNING A SUSTAINABLE DIGITAL FUTURE REQUIRES POLICY-MAKERS TO INCLUDE CIVIL SOCIETY

The Bits & Bäume movement calls for a digital transformation that supports and protects people, livelihoods, and the environment **(Bits & Bäume, 2022)**. The movement also emphasises that the underlying social and ecological issues are closely intertwined. Many demands from digital rights groups worldwide, for instance those connected with data protection, privacy issues, feminist, or de-colonial perspectives or questions of digital self-determination, are deeply entangled with concerns about the environmental impacts of digital technologies and infrastructures. To give just one example, personalisation and ‹dark patterns› of online marketing are based on large and compute-intensive data sets. Thereby, they potentially burden the environment and the climate, could endanger people's privacy, and might lead to discrimination. The Bits & Bäume 2022 conference impressively demonstrated a plethora of similar entanglements that exist between digitalisation and sustainability.

Civic movements challenge a one-dimensional view of digitalisation as an engine for the economy. They point towards risks while, simultaneously, offering perspectives on what role digitalisation could play for a social and ecological transformation. For example, transparent and sustainable supply chains, modular product design, repairability, and the use of public and free source codes exemplify how a more participatory technology development aligns with processes of socio-ecological transformation **(Pohl et al., 2021)**. These measures not only contribute to reducing environmental strains but can also foster social equality and the democratisation of digital infrastructures.

This critical perspective, pushed by civil society actors, then eventually builds the foundation for a democratic debate on what role digital technologies could play in processes of socio-technical change. In short, digital media technologies become politicised – a political issue that can be debated and commonly shaped by a multitude of actors.

GERMAN AND EUROPEAN POLICY PROCESSES LACK CIVIL SOCIETY

Essential for a ‹sustainable digitalisation› is that civil society can participate in digital policy processes on a national and a transnational level. It is therefore paramount to establish structures that include civil society in digital policy debates.

///<quote>
A way forward would be for digital rights actors and environmental and climate-protection actors to be invited and enabled to participate in political processes to the same extent as industry stakeholders are.
///</quote>

In the past, digital rights groups across Europe often suffered under a lack of institutionalised and inclusive legislative consultation processes. Furthermore, while big tech companies spend more money annually on lobbying in Brussels than the oil and pharmaceutical industries combined **(Corporate Europe Observatory, 2021)**, civic actors have often lacked sufficient financial resources. They are thus impeded in adequately responding to the enormous digital policy proposals currently happening on the European level. Instead, in the past, digital policy decisions have had to be revised after civil society actors had strategically litigated successes in court (e.g., state surveillance, Safe Harbor/Privacy Shield), engaged in massive protests and campaigns (e.g., chat control, facial recognition), or even mobilised wider publics (e.g., upload filter, ACTA) **(Spielkamp et al., 2021)**. This process is inefficient – for both policy-makers and civil society actors. A way forward would be for digital rights actors and environmental and climate-protection actors to be invited and enabled to participate in political processes to the same extent as industry stakeholders are.

On the German national level, the governing coalition of Social Democrats, Greens, and Liberal Democrats promised in its 2021 coalition treaty to include civil society in digital policy debates. But almost 18 months later, not much has changed. Despite the strong digital civil society scene in Germany, legislative consultations still lack participation. The most prominent example is the government's ‹Digital Strategy› launched in 2022, which was beforehand heralded as including many diverse voices, especially from civil society **(Rudl and Biselli, 2022)** – the strategy has now been designed without any civil society involvement.

STRUCTURAL CHANGES TO INCLUDE CIVIL SOCIETY

These examples reveal structural obstacles that prevent civil society voices from being adequately represented in digital policy processes. First, and above all, civil society actors must be empowered to participate effectively. The following structures and instruments may address existing barriers:

- **Equal representation:** To strengthen their participation on an institutional level, an equal representation of civil society, economic actors, and science representatives on governmental advisory bodies must be institutionalised.
- **Transparency:** More transparent policy processes and decision-making procedures need to be implemented.
- **Consultation and feedback periods:** Institutions must set adequate public consultation periods that give civil society actors enough time to produce statements on legislative processes.
- **Compensation:** There should be a provision for compensating civil society actors for the time they invest in hearings and consultation procedures.
- **Funding and coalition building:** Funding must be provided for civil society organisations to form coalitions with each other. The funding would allow them to benefit from synergies and work more efficiently. Additionally, it would support the inclusion of civil society actors not currently focusing on digital policies but increasingly seeing their mandate extend to the digital realm (for instance long-established welfare and environmental organisations).
- **Citizen councils:** To promote inclusiveness in the digital policy-making process, support should be provided for citizens' councils on digital issues. These councils could introduce to discussions new perspectives from the people affected.

These steps to strengthen civil society voices in digital policy processes will be especially important when tackling growing global and national inequality as well as when confronting climate change and environmental crises. Some consequences of unsustainable digitalisation are only starting to emerge, and they are doing so in unpredictable ways depending on the societal domains and groups of people affected. For digital policy to serve the common good instead of representing particular economic interests, it is essential that civil society is much more involved and that its perspectives are proactively considered. We will only be able to steer digitalisation into a sustainable future if this multiplicity of societal perspectives is considered in digital policy-making. }

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DEBATE ARTICLE

PREVENTING SURVEILLANCE CAPITALISM FROM HIJACKING SOCIO-ECOLOGICAL TRANSFORMATIONS

Communication is crucial for impacting public discourse or forming alliances, especially when who defines the crisis and respective solutions is contested. For instance, advocates of green-growth models and digital solutions often narrow down the socio-ecological crisis to the issue of climate change. In contrast, advocates of socio-ecological transformations (SET) aim to tackle challenges interconnected with global warming, such as the crisis of care, ecosystem collapse, and intersectional power imbalances. They aim for structural change beyond economic growth and claim that these crises cannot be addressed in isolation as they are interrelated. In the digital economy of the present day, most communication channels are monopolised by Big Tech firms. Hence, any strategy towards a SET must consider the logic and operations of firms like Alphabet, Meta, or Microsoft. In this article, we explain the logic of Surveillance Capitalism (SC) and outline first ideas on what we call the ‹SC dilemma of SET›.

SURVEILLANCE CAPITALISM

The new economic order emerged after the 2001 dot-com crash, when Google began targeting ads to individuals. SC is driven by the sale of prediction products. The prediction imperative unfolds as more accurate predictions of a person's click on ads increase ad-customers' willingness to pay **(Zuboff, 2019)**. Since the predictive ability of machine intelligence, the new means of production, is bound to the amount of data it is trained with, SC firms are economically pressured to obtain the most detailed and diverse data possible. Building on mass data analysis, the best predictions can be made by actively intervening behaviour. Under these imperatives, a ubiquitous extraction and execution architecture has been developed, consisting for instance of sensors, screens, and tools to discover patterns in data such as natural language processing, facial recognition, or sentiment analysis. In SC, user data turns into a critical production resource and profit becomes a function of a firm's surveillance and manipulative capabilities.

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SURVEILLANCE CAPITALIST DILEMMA OF THE SOCIO-ECOLOGICAL TRANSFORMATION

As much as SC services might mobilise people for SET, any information exchanged on accordant platforms is processed by machine intelligence to produce predictions and modify behaviour to maximise profit **(Forbrukerrådet, 2020)**. The socio-ecological crisis and communication intended for SET are utilised to accumulate surveillance capital.

Though mechanisms to influence public discourse with money are not unique to SC, the extraction/execution architecture captures knowledge about social processes, intensifies manipulative capacities and tilts power further towards capital. SC reduces the relative influence of movements supporting SET because those who own and funnel their capital into prediction products are mostly corporations in the Global North interested in reinforcing a patriarchal and racialised order that supports their dominant position in society. The failed constitutional referendum in Chile is a recent example of how this mechanism of SC has contributed to hijack a social movement that aims at SET. In 2020, Chileans voted overwhelmingly in favour of drafting a new constitution to curb the power of the undemocratically established neo-liberal regime. The 2022 constitutional draft included most demands of the October 2019 mass social uprising and was *«the most progressive constitution ever written in terms of socio-economic rights, gender equality, indigenous rights and the protection of nature»* **(Vergara, 2020)**. Nevertheless, it was rejected by the citizenship. Groups interested in conserving the status quo had used their resources to consolidate *«the narrative that the Convention was a political circus that had drafted a sloppy and unprofessional document»* **(Vergara, 2020)**. A survey investigating a sample of US$ 144,000 spent on political advertising

///<quote>
The failed constitutional referendum in Chile is a recent example of how SC has contributed to hijack a social movement that aims at SET.
///</quote>

DID YOU KNOW …?

IN 2020, 81 COUNTRIES WERE FOUND TO USE SOCIAL MEDIA TO SPREAD COMPUTATIONAL PROPAGANDA AND DISINFORMATION TO MANIPULATE PUBLIC OPINION

Source: *Oxford Internet Institute, 2021*

on Facebook and Instagram during the months before the plebiscite showed that 97.4% was spent on rejecting the draft constitution **(Vergara, 2020)**.

The ubiquitous extraction/execution architecture is also used by states for repression and influencing. Police and intelligence agencies may get access to data, analysis tools, or predictions from SC firms **(Westrich, 2022; Wetzling and Dietrich, 2022)**. Laws such as §49 of the German Law on Police Data Processing could legitimise the police to feed social media data into predictive policing tools such as Palantir's software Gotham **(GFF, 2020)**. Furthermore, governments may try to actively shape citizen behaviour. For example, in its ‹behavioural public policy›, the UK government intervenes in *«cultures of communities deemed by the state to be risky»* and promotes *«capitalist, entrepreneurial, and 'resilient' models of the good citizen»* **(Collier et al., 2022)**. Such practices subdue marginalised or criminalised strata such as migrants, workers, or environmental activists to increasing state influence and put democracy at risk in favour of an authoritarian security state backed by SC.

///<quote>
Actors of SET who want to get their voice heard are forced to subdue to an emotionally charged «superficial» mode of communication «consumed with short attention spans».
///</quote>

According to Zuboff, platforms´ design principles, *«engrossing, immersive, immediate»* trigger addictive *«loss of self-awareness, automatic behaviour, and a total rhythmic absorption carried along on a wave of compulsion»* **(2019)**. This state of mind keeps people for a vast amount of time in front of electronic devices and often occupies capacities for becoming active beyond liking, sharing, or commenting. Moreover, actors of SET who want to get their voice heard are forced to subdue to an emotionally charged *«superficial»* mode of communication *«consumed with short attention spans»* **(Fuchs, 2022)**. This absorbed state of mind and shallow mode of communication is at odds with the kind of self-reflection and communication required to dismantle the multi-layered contexts underpinning the socio-ecological crisis.

EXPANDED VIEW ON SURVEILLANCE CAPITALISM

Although Zuboff's concept reveals how SC may hijack SET, important aspects are misleading in her argumentation. While industrial capitalism has thrived on exploiting natural resources, Zuboff claims, SC would supersede this mode of production and flourishes on exploiting behavioural data extracted from human experience. Thereby, she creates a sentiment, which ignores the ecological implications of SC, idealises ‹good old› Fordist capitalism in terms of labour autonomy, and sidelines the manifold entanglements between surveillance and industrial capitalism. With our expanded view, we aim to paint a more holistic picture of the SC dilemma of SET.

A spatially and ecologically expanded view on digital economies is crucial for SET. Rather than being dismantled, Fordist production sites are often relocated to countries with lower wage levels and less environmental protection. The green image of SC stems from glorifying the merits of ‹intangible› prediction products in SC. However, SC contributes to exploiting ‹nature› on at least three fronts. First, the extraction/execution hardware is built on rare natural resources, such as coltan, tin, and lithium. Those resources are often mined under inhumane working conditions and with devastating environmental consequences **(Groneweg and Reckordt, 2018)**. Second, energy demand increases as surveillance capitalists are economically pressured to maximise users' time online and to process massive amounts of data to generate predictions. Third, those who are capable of and willing to invest in behavioural modification driven by SC are mostly providers of environmentally damaging industrial consumption products.

Furthermore, an expanded view on sources of surplus value is necessary. Fuchs **(2023)** argues, for example, that extracted surplus labour in SC includes precariously employed click workers, content moderators and content producers. Dominant market positions enable SC firms to extract monopoly rent and avoid taxes **(Staab, 2021)**. Moreover, the technology and logic developed under SC imperatives has been merged with production sites from earlier phases of capitalism, allowing for massive micro-surveillance of workers and an ‹algorithmic management› in warehouses, factories, transport, call centres or even the knowledge economy **(Christl, 2021)**. Including labour in our perspective on SC might have greater mobilising potential than Zuboff's narrow view on exploitation of user autonomy.

///<quote>
Extracted surplus labour in SC includes precariously employed click workers, content moderators and content producers.
///</quote>

PATHS WITHIN THE DILEMMA

The SC dilemma suggests that a SET will not materialise if SC prevails. Simultaneously, a simple boycott of SC services would make SET advocates disappear from the social sphere. Hence, it is crucial for SET advocates to form broad alliances for a sustainable (digital) future with both, the socio-ecological tech movement and people exploited by SC. Broadening the ‹Trägerkreis› (supporting circle) of the Bits & Bäume conference towards these strata, e.g., by inviting labour unions, may be a first step. Prohibiting SC operations such as microtargeting, psychometric analysis, geo-, mouse- and eye tracking as well as breaking up monopoly power may be strategies of such an alliance. Though ban and break-up may advance user autonomy and touch on elements of the dilemma, the path favours expanding market competition. Thus, if they stand alone, ban and break-up are unlikely to contribute meaningfully to overcoming the socio-ecological crisis. Hence, the alliance could, in addition, reclaim the nodes of communication currently occupied by SC. This reclaiming could be achieved through democratising platforms or transforming them into commons-based structures such as platform cooperatives **(Pentzien, 2021),** utilising approaches such as peer-to-peer networking **(P2P Foundation, 2017)**. However, paths beyond SC are at risk of getting appropriated **(Cohen, 2019)** and should, thus, be critically evaluated **(Weizenbaum, 1986)** and not be limited to digital solutions.

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RESEARCH ARTICLE

CROWDACTING AS A SPARK FOR CLIMATE PROTECTION?

A Digitally Supported Concept for Collective Action

How many people does it take to avert the climate crisis? What each of us can do is obvious – but sole individual action is insufficient. More effective solutions are the conversion of economic systems – or policy changes. Urgent change is demanded of the latter by, e.g., Bits & Bäume. By putting pressure on politics, collective action allows citizens to tackle climate change beyond individual actions.

This contribution discusses crowdacting, as a little-known concept to organise collective actions, and how digital tools may support it.

POTENTIALS AND CHALLENGES OF COLLECTIVE ACTION

Collective action is a challenge but one of the most effective fields of action **(Ostrom, 2010)**. Current psychological research encourages considering the environmental crisis as a collective crisis to be solved collectively **(Fritsche et al., 2018)**. Such action can range from supporting an organisation and engaging in civic engagement to radical environmental activism or civil disobedience **(Stern, 2000; Lee et al., 2014)**. When individuals see themselves as members of groups with pro-environmental goals, they also tend to view their behaviour as part of collective action **(Barth et al. 2021)**. Thus, collective action allows individuals to escape feelings of helplessness (e.g., facing the severity of cli-

///<quote>
If people perceive themselves as part of a group that is successfully fighting climate change, they will, in turn, be more motivated to engage in climate action.
///</quote>

mate change) and to develop a sense of collective efficacy **(Bamberg et al., 2015)**. If people perceive themselves as part of a group that is successfully fighting climate change, they will, in turn, be more motivated to engage in climate action **(Fritsche et al., 2018; Bamberg et al., 2015)**.

Although climate movements such as Fridays for Future, Extinction Rebellion or Scientist Rebellion have brought together thousands of people in a short time, the number of activists is small related to the serious impacts of climate change **(Furlong and Vignoles, 2021)**. This discrepancy can be explained by possible barriers that slow down activism, e.g.,

- the time needed for engagement,
- the financial costs of pre-paying expenses, renting, legal costs, etc., and
- the infrastructure needed to implement sustainable alternatives, e.g., public transport **(Quimby and Angelique, 2011)**.

Further barriers include a group size too small (curbing feelings of efficacy) and limited opportunities for meeting places, communication, or to inform those not yet active but interested **(Quimby and Angelique, 2011)**. These organisational factors matter, and they could be addressed well by human agency. One way to lower these barriers is through digital tool support for crowdacting.

CROWD-WHAT? – CROWDACTING IN A NUTSHELL

Almost like crowdfunding - but with the intent of acting instead of giving money -, crowdacting is a digitally supported concept. It drives collective action by helping to organise people: Calls to action, including numbers of participants, are listed online and people can commit and join in.

One of the first crowdacting-like platforms was PledgeBank (2005–2015). Since 2016, an explanation video advertising CollAction has increased both the reach and the definitional scope of the crowdacting concept. For example, one could state an interest in joining a public protest but only if 2000 others also take part, or decide to only fund a group when at least 10 other people commit to a shared goal. Thus, a public protest can be expected to have a minimum size and an according impact and groups can be started with less risk of overwhelming work on too few shoulders.

> ***‹X-tausend für Lützerath›*** *– The protests in and around the German village Lützerath next to one of Europe’s biggest coal mines used a similar approach. Starting in summer 2022, the protestors collected online declarations of intent from more than 14,000 people aiming to hinder the destruction of Lützerath and prevent coal mining under the village. Within one day, about 35,000 citizens joined the biggest on-site demonstration to show their solidarity with the activists occupying the village since 2020.*

ANALYSING THE CHARACTERISTICS OF CROWDACTING AND THRESHOLDS

At the intersection of computer science and environmental psychology, a study **(Parske, 2022)** with 593 participants explored the dynamics of crowdacting. It showed that this form of organising collective action could, indeed, greatly reduce some psychological barriers stopping people from getting engaged. Crowdacting can help in finding fellow activists and provides a starting point to inform and act. Furthermore, it can also reduce the inhibition to engage or change habits as well as lessen worries about potential work overloads or time scarcity. In addition, different levels of citizen engagement, but also the political will, were found to be greatly improved.

///<quote>
Crowdacting can help in finding fellow activists and provides a starting point to inform and act.
///</quote>

Parske **(2022)** analysed the effects of the necessary minimum number of participants (hereafter: threshold) as a condition for joining an action. Interested people prefer to join if a certain number of other interested people has been reached (conditional commitment threshold) rather than performing an action on their own or not at all. The greatest potential for activating inexperienced people was found for demonstrations, strikes, civil disobedience, and citizens' initiatives and petitions.

Especially for these forms of protest, multiple thresholds could lead to a cascading effect. The graphs in **[Figure 1]** represent the increase of participants between different thresholds per action form. The steeper a line between two points, the more meaningful the use of crowdacting with thresholds. For example, for demonstrations (blue graph line), there is a high increase from the second threshold (lower than 10) to the sixth threshold (100000 – 1 million). In comparison, active involvement in initiatives (green graph line) also starts with a steep curve but already breaks at the third threshold (10 – 100). The author concludes that crowdacting can be used to kick-start active involvement in small to medium-sized initiatives but can also initialise medium-sized to huge crowds for demonstrations.

PROBLEM SOLVER OR TROUBLE SHOOTER?

Even if crowdacting seems to have numerous advantages, it also has its down-sides (summary in **[Table 1]**). The chance of there being a lot of people in an action may be countered by a de-motivation if there are not enough people and no action takes place because the threshold is not achieved. Also, sharing the same goal with others could result in an ‹us versus the rest› feeling or even blind following. Additionally, someone simply stating that they want to participate does not mean that they have to appear, so there should be a lure or reward for actually taking part.

However, raising public awareness through large collective actions and therefore having a greater sense of self-efficacy may result in self-reinforcing cascades of actions, also called ‹social tipping points›.

A DIGITAL TOOL TO FUEL CROWDACTING

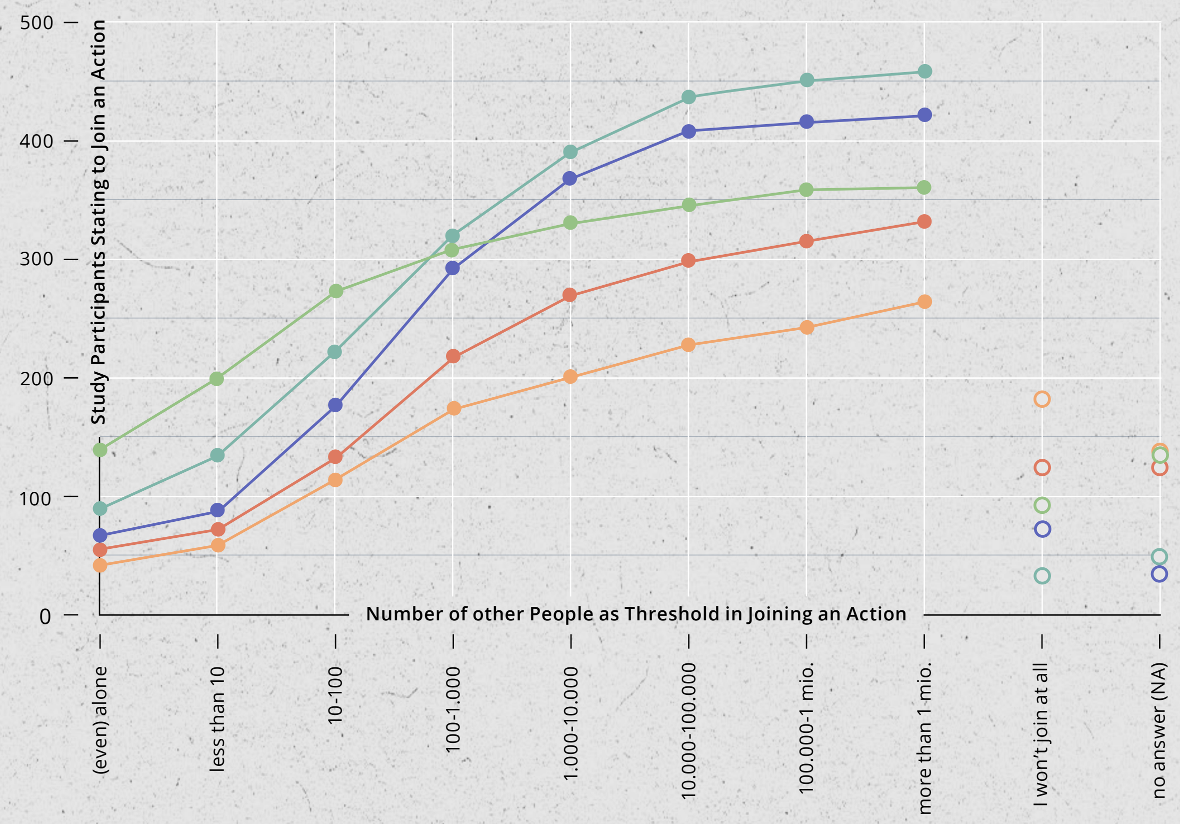
Parske **(2022)** found 8 out of 10 people do not know about crowdacting. However, half of the study participants were interested in registering at an online crowdacting platform, one-third remained unsure, and only 1 in 7 was opposed to it. So, there is potential for starting a platform.

As platform features, experts mentioned the social components of interaction between users as well as rewards for performing actions and participating in the

Figure 1 *Own Figure, Parske (2022)*

HOW MANY DOES IT NEED?

CROWDACTING THRESHOLDS



- Active involvement in civil society initiatives or organisations (NGOs)
- Demonstrations
- Strikes
- Actions of civil disobedience
- Citizens initiatives / citizens' petitions

Action forms and number of people joining at different thresholds – lower values are added up (n=593).

Table 1

ADVANTAGES AND DISADVANTAGES OF CROWDACTING

+ Assurance of not acting alone	− Demotivation if below threshold
+ Increased visibility and sense of efficacy	− Credibility of sign-ups not assured
+ Connecting with others	− Abuse (e.g., non-democratic calls)
+ Suitable for many forms of action	− Followerism, peer pressure
+ Possibility for social tipping points	− Risk of radicalising ‹us vs. them› feeling, possible camp formation

development of the platform. Also, there should be an anchor in the real world so as not to exclude non-digitalised people. Measurement of the impact of actions, the trustworthiness of calls to action (e.g., by providing an FAQ list or a fact checker) and, of course, displaying the participant counts were named as key requirements. Overall, participants prefer to choose their thresholds and types of engagement from different options or even add a personal one, rather than deciding on a single given option. This preference should be respected on a platform.

But just as with Social Media, negative effects may need to be considered. For example, how to make sure that the tool is not abused by undemocratic means or flooded by bots. The questions of ownership and financing the infrastructure must also be followed up.

AND NOW WHAT?

As crowdacting seems to offer unused potential for social change, further research on thresholds and practical - mainly technical - development is needed. Next steps besides networking could be designing prototypes and conducting field studies. Currently, several tools are under development, e.g., GetCourageNow (EN), CollAction (EN, NL), and Spartacus.app (EN), but none of them focus on using multiple thresholds – this gap still needs to be filled.

Eventually, the concept of crowdacting may help to overcome the climate crisis through countering the non-linearity of negative ecological tipping points with the non-linearity of positive social tipping points.

All in all, digitally supported crowdacting offers a promising approach to help engaged people build and visualise the political pressure needed for large-scale change, such as a sustainable digital transformation. Such change is urgently needed to keep our blue planet habitable for future generations. }

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DEBATE ARTICLE

HYPERNUDGING?

Please No, Touch Me Gently

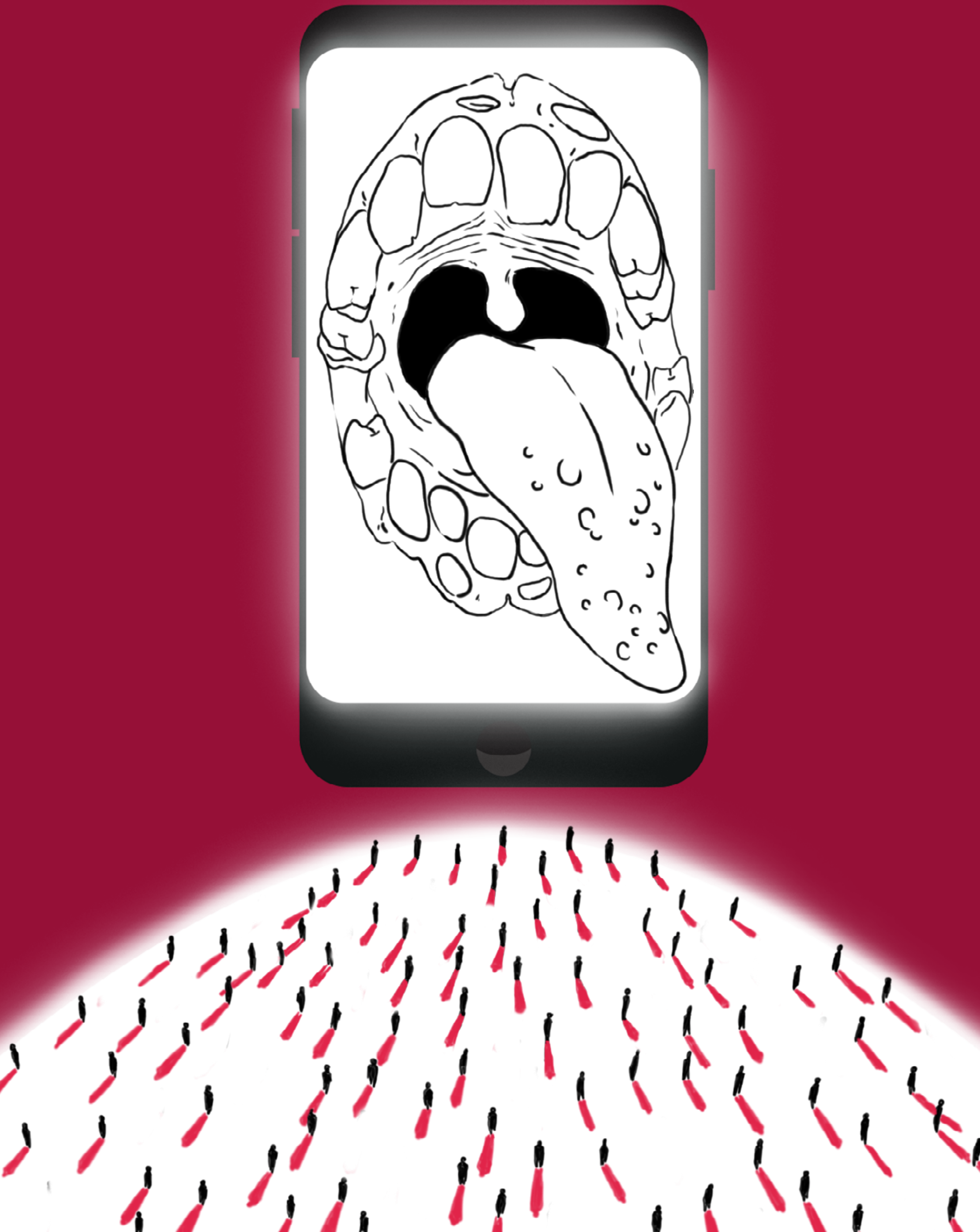
The health of democracies worldwide has been deteriorating over the past decade **(Csaky, 2021)**. A reason for this democratic backsliding can be identified in the pernicious architecture of technologies – above all of social media **(Haggard and Kaufman, 2021; Shahbaz et al., 2022)**. The advent of virtual opinion forming has quickened the possibility of encountering desires but transformed the inclusive meaning of encounters of the public space, impairing our ability to construct shared agendas to help solving problems as collectives.

PERSONALISATION AND INTERCONNECTIVITY

The new media employ an engagement-based algorithmic design, ‹Hypernudging›, which frames the virtual information space of each user in a personalised (through microtargeting), constantly updated, and networked way (through Big Data), determining and guiding the online informational choice context **(Yeung, 2017)**. The recursive and pervasive data-driven feedback loop, which dynamically tailors information to engage users, redirects people's attention and discourse exchange – fragmenting narratives and leading to hyper-individualised societies **(Reviglio and Agosti, 2020)**.

///<quote>
The recursive and pervasive data-driven feedback loop, redirects people's attention and discourse exchange – fragmenting narratives and leading to hyper-individualised societies.
///</quote>

To grasp the significance of the current structural change of the public sphere, the philosopher Jürgen Habermas argues that the inclusive sense of that sphere is fading. The personalised character of the virtual interconnectivity creates a new communication sphere, where an exclusive private (digitised) exchange sphere is expanding into public domains, hindering the inclusion of diverse argumentations and perspectives **(Habermas, 2022)**. The loss of this exchange results in a deterioration of deliberative processes, which are vital to sustaining democracy and just climate and digital transitions.



LOOSE GATEKEEPERS AND MANIPULATIVE STRATEGIES

In the past, a key role in establishing transparency and a common ground of shared meaning has been that of informational gatekeepers. Yet, traditional gatekeepers such as press agencies – which were accountable for performing 'truth tests' through fact checking - have been abruptly outpaced, replaced, and modified by social media **(EBU, 2022; Reviglio and Agosti, 2020)**. Nowadays, the libertarian doctrine prevalent in Western tech's Weltanschauung has often overstretched the right to free opinion to include the right to false facts **(Politico, 2018)**. All this is aggravated by hypernudging's inflammatory power when used to manipulate people's opinions, as in the blatantly illegal case of Cambridge Analytica facilitating Trump's elections and Brexit **(Cadwalladr, 2017)** or in the normalised political social media marketing.

///<quote>
The libertarian doctrine prevalent in Western tech's Weltanschauung has often overstretched the right to free opinion to include the right to false facts.
///</quote>

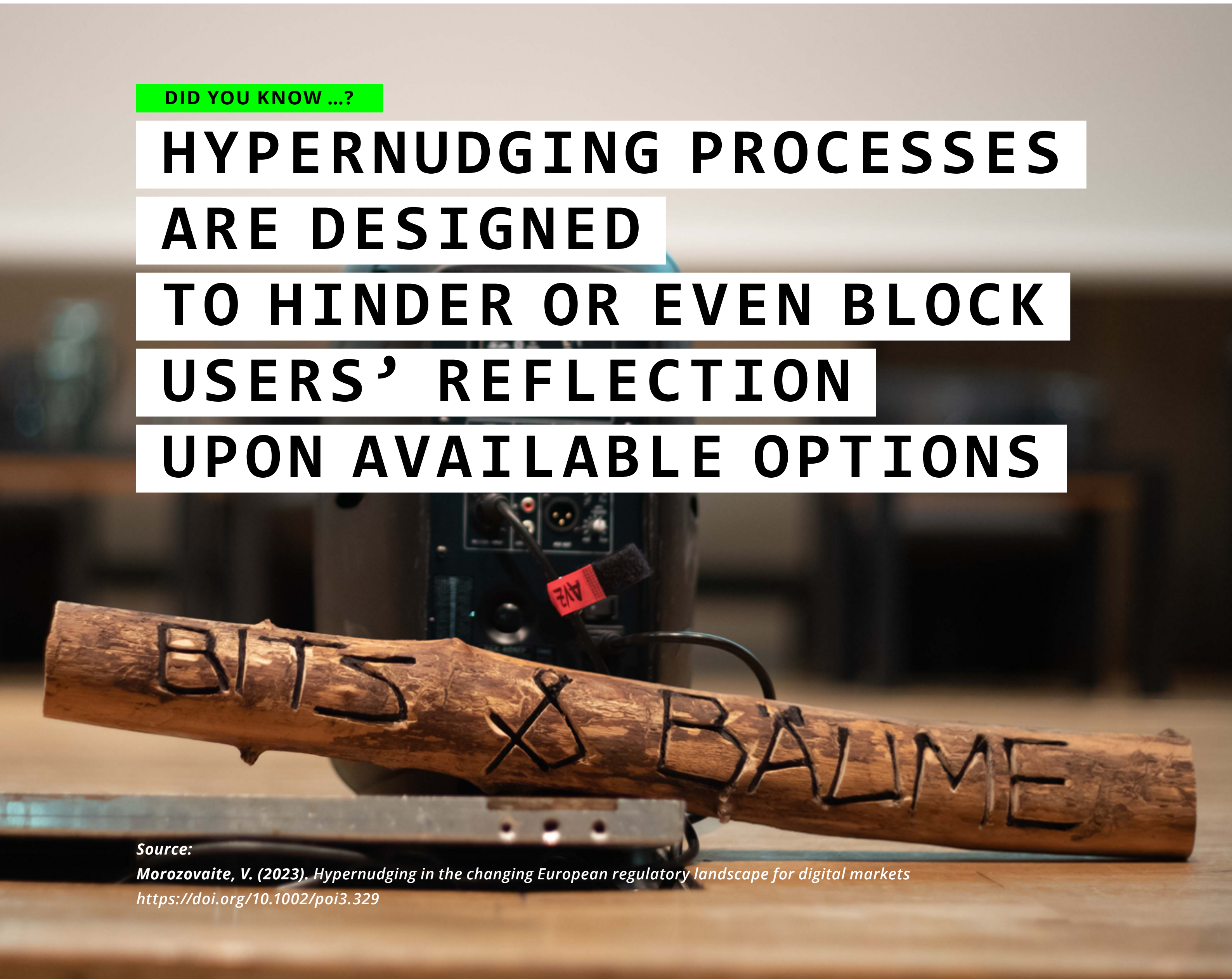
Focussing on the latter, political parties have taken advantage of social media's architecture and its loose regulative environment by engaging in three political marketing strategies, turbocharged by microtargeting and Big Data: (i) mobilising around identity threats, (ii) seeding divisions in opponents' coalitions, and (iii) leveraging influence techniques to exploit psychological vulnerability and manipulability **(Nadler et al., 2018)**. The first two approaches are based on political psychological profiles of voters' self-identification in partisan groups (around a sense of group loyalty and social identity), with the intent to mobilise or divide them by instilling targeted threats and fears. The third strategy indeed engages in behavioural modification, by rolling out social pressure mechanisms such as shame through hypernudging: *«With mass consumer surveillance, political advertisers can maximize the potential influence of their nudges by sifting through data to identify who is most likely to be influenced, what kind of nudges or triggers they may be most affected by, or even factors like at what moment or in what moods a target may be most receptive»* **(Nadler et al., 2018, p. 38)**. The authors denounced these actions as a weaponisation of advertisement strategies, while Karen Yeung **(2017)** condemned hypernudging as an intrinsically, structural undemocratic mode of regulation by design. Similar fragmenting and polarising undertakings turn parties away from democratically competing over the best arguments to unscrupulously competing over the best manipulation of emotions.

RESPONSES TO THE CHALLENGES POSED BY HYPERNUDGING

To counter the instability provoked by hypernudging, democratic efforts require innovative and comprehensive solutions, ones empowering citizens, media outlets, and politicians to uphold democratic values amidst the current digital fogginess. The following top-down and bottom-up suggestions should hence be thought of as a converging strategy towards a more cohesive and resilient democratic society.

TOP-DOWN GOVERNANCE STRATEGIES

- A first reform could seek to tune hypernudging according to democratic principles **(Yeung, 2017; Reviglio and Agosti, 2020)**. Instead of its current exploitative form, an emancipatory, reflective design of digital socialising spheres should be human-centred: rooted on a basic ground of collective understanding, in a historical-critical approach towards democratic constitutions, sustainable development goals, and human rights conventions. Receptive to criticisms, an evolutional dignity compass **(WBGU, 2019)** for virtual opinion sharing could help sustain collective democratic norms.
- A second intervention could strengthen the filtering and monitoring of digital platforms discussions and contents, while leaving possibilities open for falsification and transformation. The EU's recent Digital Service Act heads in this direction, yet substantially leaves the responsibility for moderating content on the platforms' shoulders, albeit that, to protect fundamental human rights and democratic practices, this task could benefit from additional involvement by political institutions and civil society organisations **(Turilazzi et al., 2020; Keller, 2022)**.
- As suggested within the B&B movement, the third and fourth top-down actions could, respectively, develop independent platforms by state actors (e.g., EU or Member States) or civil society, and break monopoly power through cartel law.



DID YOU KNOW ...?

HYPERNUDGING PROCESSES ARE DESIGNED TO HINDER OR EVEN BLOCK USERS' REFLECTION UPON AVAILABLE OPTIONS

Source:
Morozovaite, V. (2023). Hypernudging in the changing European regulatory landscape for digital markets
https://doi.org/10.1002/poi3.329

BOTTOM-UP ACTIVISM SUGGESTIONS

- Public awareness of virtual persuasive techniques could be revitalised by fostering digital literacy, thus enabling citizens to counter dis- and misinformation, to navigate the impending challenges aligned with collectively useful and meaningful visions, and to trust political leaders and each other **(Floridi, 2020; Reddy et al., 2020)**.
- Parallel to reforming online forums, citizen-wide meetings could be beneficial to the debate on how to encounter each other in the public sphere, expanding or re-organising horizontal structures to overcome fragmentation and platforms' multiplicity. By holding common reflections, regional communities could be invited to reflect about what is desirable for an inclusive public space, which Simone Weil **(1943)** defined as a basic need for the soul, enhancing social cohesion, including the margins.
- These initiatives could take multiple forms, such as Boal's **(2000)** theatre activism or fishbowl panel discussions

Ultimately, to counter the threats hypernudging currently poses to democracy, it is paramount to rejuvenate social participation, creatively empowering citizens to motivate collective action and cooperation with mutually trustworthy politicians. }

ABOUT THE AUTHORS

/// **Emilio Lamura** intrigued by multicultural experiences, activism, and philosophical discussions. He bridges Master studies of International Relations and Philosophy of the Digital with a keen interest in climate politics.

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TAKE ACTION!

HOW CAN I GET INVOLVED?

The Bits & Bäume movement thrives on the diverse backgrounds of its members, who bring valuable perspectives, opinions, and ideas. This collaborative approach is crucial for a profound socio-ecological transformation of the digital sphere, and it should continue to expand.

While this publication offers valuable insights into ongoing transformation efforts and areas that require action, it merely scratches the surface of the vast array of topics related to digitalisation and sustainability. There is an abundance of subjects to explore beyond the confines of this journal.

To drive progressive solutions and foster a broader consensus on the importance of this topic, we urgently need more individuals to join in. We need additional participants to cover the wide spectrum of issues and spread awareness.

After reading this publication, we warmly invite you to become part of the Bits & Bäume community in any way that suits you. There are numerous opportunities to get involved, such as joining regional groups, partnering with organisations connected to Bits & Bäume, contributing to the organisation of future conferences, or even initiating your own Bits & Bäume group regardless of your location.

Below, you will find inspiration to guide you. We would be delighted to have you join us on this journey, as every voice matters, and every idea, no matter how fleeting, contributes significantly to making the socio-ecological transformation a reality. Here are your opportunities to become part of it:

PETITIONS / CAMPAIGNS

EVENTS

COMMUNITY ACTIVITIES

ORGANISATIONS

PROJECTS

TRY OUT DIRECTLY

FURTHER INFORMATION

SECURE TOOLS OVERVIEW

ELECTRONICS WATCH

HANDPRINT TEST | JUGEND HACKT

DECODE | ITFORCHANGE | FIFF-CONFERENCES

HIVEEYES | BITS & BÄUME CONFERENCE(S)

OPEN SOURCE ECOLOGY | B&B ONLINE-FORUM

B&B PUBLICATION FROM 2019 | B&B REGIONAL BRANCHES

MUNDRAUB | EDRI CAMPAIGNS

FRAUENCOMPUTERZENTRUM BERLIN | HANDS-ON ACTIVITIES BY DIGITALCOURAGE

FAIRLÖTET E.V. | RESET | GESELLSCHAFT FÜR FREIHEITSRECHTE

WORKING GROUP DIGITALISATION OF YOUNG FRIENDS OF THE EARTH

ONLINE COMMUNITY-MEETINGS

B&B MAILING LIST | WECHANGE

HAECKSEN (CCC) | FAIRMOVE.IT

PUBLIC MONEY PUBLIC CODE

HEART OF CODE | DEGROWTH SUMMER SCHOOL

CRYPTOPARTY | CHAOS COMMUNICATION CONGRESS & CAMP

DEMANDS FOR A DIGITAL-SOVEREIGN SOCIETY

MESSENGER MATRIX

F3 KOLLEKTIV

FREIFUNK

Follow
the Links
in the Boxes
and
Take Action!

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In addition, we would like to thank everyone who made the Bits & Bäume Conference 2022 and this publication possible: from the funding application writers, administrators and supporters to the organisers (representatives of the host organisations and the conference office) and the speakers. Our special thanks go to the countless volunteers, including the performing, sound, and light artists, technicians, decorators, and many others, whose contributions have played a vital role in bringing the event to life.

THE BITS & BÄUME CONFERENCE 2022 WAS ORGANISED BY

BUND – Friends of the Earth Germany
DNR Deutscher Naturschutzring
Einstein Center Digital Future
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FIfF – Forum InformatikerInnen für Frieden und gesellschaftliche Verantwortung
iöw – Institut für ökologische Wirtschaftsforschung
konzeptwerk neue ökonomie
Technische Universität Berlin
weizenbaum institut
Germanwatch
Open Knowledge Foundation Deutschland

SHAPING DIGITAL TRANSFORMATION FOR A SUSTAINABLE SOCIETY

The second ‹Bits & Bäume› conference took place in Berlin in 2022. Once again, it provided a space for critical tech and sustainability communities to share ideas and collaborate towards the common goal of shaping digitalisation to foster sustainability. This companion book compiles the insights, work, research and opinions of more than 65 authors with a ‹Bits & Bäume› background, including practitioners, researchers and activists.

The articles included in this journal demonstrate the progress made in merging ‹Bits› and ‹Bäume› (Trees) topics since our first publication in 2019 by addressing different sub-areas of the intersections between digitalisation and sustainability. Encompassing a wide range of topics, the articles delve into pressing challenges such as the resource consumption, power implications and democratic governance of digital infrastructures, AI, blockchains, mobile apps, and other software applications, as well as the need to address the unsustainable practices and paradigms of e.g., the platform economy. Offering not only transparency but also solutions, the journal presents practical approaches and concepts related to the necessary transformation, such as the Computer Science for Future programme. It also contains articles commenting on current political developments, such as the EU legislation on sustainability and freedom-related aspects of ICT devices. Further articles highlight the power of and need for an active civil society, aiming to inspire activism.

This journal caters for everyone: Are you just getting into the topics around Bits & Bäume? Have you been involved in this field for many years, or are you an expert in one of the areas touched on here? In this journal you will find both introductory topics, such as illustrations on the challenges of today’s digitalised society, and also advanced topics, such as conceptual and regulatory discussions. Whatever your background, we think you’ll enjoy the read, learn something new on the way, and get inspired. Ultimately, we are all united by the overarching goal of shaping digitalisation as part of a necessary socio-ecological change; one which contributes to a sustainable and just society.