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Understanding the potential of Web3

From speculation to solving the greatest global challenges

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ABOUT THIS REPORT

This report was written between July and November 2022. It examines whether emerging Web3 technologies are useful for making progress on the greatest global challenges. It sets out the technical attributes of Web3 technologies, outlines some potential speculative applications, and is book-ended by practical recommendations for anticipatory governance, developed in alignment with the Digital Public Goods framework.

Inputs included: a grey literature review, desk research, and a series of collaborative workshops with FCDO civil servants and project partners. It is, of necessity, a summary of a wide-ranging programme of activity.

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Careful Industries is a research organisation based in the UK. Through research and prototyping, we help our clients understand the social impacts of technologies and create new futures. Our sister organisation, Promising Trouble, is a not-for-profit exploring the potential of community technologies.

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Foreword

Whether you love it, hate it, or are simply confused by it, Web3 is a hot topic in technology circles right now. This paper is an attempt to cut through that noise and consider how these new technologies might be used to achieve the greatest global challenges.

Over the last twenty years, the Web has succumbed to centralisation. Platforms and walled gardens have been built where networks once flourished, and a small number of companies have become dominant infrastructure players, some achieving power and influence equivalent to that of nation states.

Globally, many governments are mitigating this by taking regulatory and legal steps — but that is far from the only response. In assembling this report, we have witnessed a powerful shift towards decentralisation taking place in many parts of the world, both online and off. For some, this is a response to the real and perceived failure of existing technical, political, and social infrastructures; for others, a response to climate injustice, deepening poverty, and financial exclusion. Peeling back the layers of hype around Web3, we see the rapid adoption of these technologies as a part of this response — powered by an urge to decentralise and reorganise established norms and organisations in more equitable ways.

In gathering our research, we have broken Web3 down into two categories: governance and technology.

Writing in the second half of 2022, we have seen in real-time that the Web3 technology stack is in flux. Section 2 includes a set of working definitions for Web3 technologies, but it seems unlikely that the current artefacts are close to their final form. We recommend that any application of these technologies to the global challenges should be done with care, and propose a set of practical anticipatory governance measures to help manage and shape this.

Web3 early adopters are also experimenting with decentralised governance. In this paper, we understand the use of blockchain to form collective structures as part of a bigger social shift to new forms of institution making. Testing and reconfiguring the borders of and limits of how we gather is a fundamental form of social innovation, and we suggest this is an early indicator of much bigger social and political shifts to come — ones that are likely to be critical to the achievement of the global challenges.

Overall, we have four recommendations. Together these form the basis of an anticipatory governance model. As well as practical, short-term measures to maximise positive outcomes and limit harm, our research indicates a need for a co-ordinated effort to understand the impacts of decentralised technologies in the round, powered by early stage data gathering and iterative standards setting:

1. **Develop Web3 sandboxes** modelled on the CARE Principles for Indigenous Data Governance. This will enable innovative “testing and learning” to happen in a safe environment.

2. **Build risk and feasibility models:** analyse the outputs from sandboxed experiments to better understand the potential impacts and infrastructural requirements of Web3 deployments

3. **Establish standards**. Start by convening members of the Digital Public Goods Charter to determine whether the existing indicators and requirements are sufficient to cover Web3 deployment and use cases.

4. **Understand global impact.** Start by forming a Decentralised Governance Observatory under the aegis of an existing multilateral organisation and pool political, economic, social, and technical observations and weak signals to develop a collective view of the global impact.

While it might seem too early for bodies engaged with international development and diplomacy to intervene in Web3 technologies, the imperative to do so is significant. The recent history of digital technologies shows that the demands of the market are one of the strongest animating forces for technical innovation — but allowing investors and entrepreneurs to be the only ones that shape technologies does not represent the whole of humanities' needs. Investor return is not the only kind of value needed for achievement of the global challenges, and balancing forces must be present early on in the development and growth of new technologies.

As you read this paper, it is also worth remembering that Web3 is one type of decentralised technology. As we make the final edits, serial entrepreneur Elon Musk is finalising the privatisation of Twitter, leading many thousands of users to land on the decentralised social network Mastodon. Founded in 2016, Mastodon is not a Web3 technology, but a member of the Fediverse, "an ensemble of federated (i.e. interconnected) servers that are used for web publishing".[1] Subject to much less hype and investor speculation, Mastodon is one of the many decentralised technologies that are gaining traction, beyond the mantle of Web3.

Overall, we find that the blockchain is a single expression of a growing social movement to decentralise. While understanding it and galvanising its uses for public good is necessary, it should be understood as part of a bigger political, economic, and social revolution that we suspect will come to fruition as the twenty-first century develops.

As such, our overall recommendation is that any strategy to tackle the global challenges must look beyond blockchain and seek to understand decentralised governance in its broadest social context. While it seems probable that Web3 technologies will facilitate and popularise decentralisation, the real changes (and achievements) will be created by people. To this end, we propose putting the CARE Principles for Indigenous Data Governance at the heart of any future strategy for achieving the global challenges. This will help ensure that power sharing and decentralised governance are the true products of further innovation.

4 November 2022

[1] See https://fediverse.info/

1. Introduction

This report explores whether Web3 can help make progress on the global challenges in ways that provide economic and society-wide benefits for everyone, everywhere.

Emerging technologies are often subject to hype and heightened narrative, but few recent innovations have divided opinion so fiercely as Web3. Among technologists, investors, analysts, and entrepreneurs there are rigid divides between enthusiastic advocates and impassioned critics who are unable to agree whether Web3 is the beginning of a new decentralised era or the latest digital version of the Emperor's new clothes. Some of these tensions are between the new and old waves of technologists — a generational disconnect between those who are frustrated by the status quo, and those who have benefited from it — but others are more fundamental, anchored in differing personal, technomoral approaches to the world.

Perhaps ironically, this dispute — which represents a sort of midlife crisis for digital technologies — is one of the reasons Web3 is such a hot topic among innovators. Another is that Web3 bundles together a set of reasonably disparate conceptual and technical attributes, many of which have difficult to remember names and acronyms. For non-technologists, it can be difficult to understand what NFTs have in common with smart contracts, while for those immersed in decentralised governance it seems extraordinary that anyone would want to live their lives, or govern their countries, any other way.

Given the heightened tenor of the debate, this analysis takes the Digital Public Goods Charter as the benchmark for our assessment. Looking past the hype and disagreement, we have sought to understand what Web3 can offer those working to solve the global challenges in the context of multiple unfolding crises and uncertainty.

Inputs into our research and analysis have included: a realtime grey literature review; outputs from project partner Pluriversa's digital anthropology work in El Salvador; and assets created during a challenge weekend run by Phas3. Alongside colleagues from the Frontier Tech Hub, all project partners have also contributed to a process of speculative scenario development; this has helped us to understand what Web3 deployment at scale could look like over the next fifteen years.

In this report, we divide Web3 into two discrete categories: governance and technology. Governance alludes to the social and cultural elements of Web3, including decentralised and collaborative decision making, transparency, and collaboration. Technology refers to the technologies and related artefacts that run "on chain", including cryptocurrencies, NFTs, and smart contracts.

This introduction summarises our findings and recommendations.

1.1 Web3 is…

A work in progress

TIME HORIZON: SHORT TERM

This first wave of Web3 technologies is unlikely to be the final form of the decentralised Web.

Our research and analysis leads us to conclude that the Web3 tech stack is not yet ready to be deployed at scale in complex, critical situations. As demand develops, it seems probable that the technologies will either mature or be replaced by more suitable (and sustainable) alternatives. Likewise, investor focus might shift as new economic models are realised, and Web3 ephemera, such as NFTs, may well be replaced.

In the short term, we find it **unlikely that the current technical artefacts of Web3 will have a practical role in solving the greatest global challenges in ways that respect people's humanity and dignity and adhere to the Digital Public Goods standard.**

Untested but intriguing

TIME HORIZON: SHORT TERM

New technologies do, however, have a role in refreshing approaches to existing problems.

In examining recent case studies, we have seen that emerging technical solutions often become attractive to those tasked with solving long-term, complex problems. The adoption of a new or emerging technology can be appealing not just because it offers new ways of solving existing problems, but because it re-energises existing delivery teams and stakeholders and can make it easier to engage new partners and resources.

This "innovation uplift" also brings some drawbacks: it can mean that untested or unfinished technologies are deployed inappropriately, at the expense of beneficiaries. At the time of writing, Web3 technologies are at the peak of what Gartner's Hype Cycle calls "inflated expectation"; this means they are at heightened risk of being rolled out in inappropriate and risky contexts.

As such, although Web3 technologies are not yet robust enough to be deployed in the field, **the energy and potential created by the desire to explore these emerging technologies is significant, and is an asset in and of itself.**

A social alternative to over-centralisation

TIME HORIZON: MEDIUM TERM

Increased engagement with Web3 technologies is not only motivated by technical curiosity. It also reflects a broader cultural mood among people seeking alternative forms of ownership, collaboration, and decision-making. This interest in distributed and decentralised forms of governance and organisation — beyond traditional institutions and centralised technologies — is also a bellwether for a more generalised restlessness and dissatisfaction with political, economic and social norms.

In the speculations section of this report, we investigate how Web3 technologies could be rolled out to address some of the critical and complex problems of the near-future. These include the possible “on-chain” management and distribution of scarce resources; the notion of governance that is not bounded by geographical borders; facilitating large-scale climate action; and the possible expansion of token economics. These scenarios all require rapid infrastructural adaptation and collaborative, transparent decision making; but they also need technology that is stable and maintainable, environmentally sustainable, reliable, and fit-for-purpose across a number of legislative and regulatory environments.

Whether the technical artefacts of Web3 can reliably deliver in these contexts is an issue to be solved through the combined R&D effort of many sectors. More pertinent to the achievement of global challenges are the changing human needs and behaviours that these scenarios highlight, and the potential for new forms of organisation that will be cultivated by various short-term uses of Web3 technologies in other contexts.

Overall, we conclude that the drive for new forms of social organisation will be the long-term animating factor for Web3. This has the potential to lead to significant social and political change, which may in turn affect multilateralism, and lead to new forms of transnational collaboration.

1.2 Some general risks and issues

Besides well-known concerns about environmental sustainability, our analysis flagged the following:

Governance and technology can be easily unbundled

There is potential for the attributes of Web3 to be adopted separately: for the technologies to be deployed without good governance, and for decentralised governance to manifest without the Web3 tech stack.

Social reorganisation can easily take place without technical support, but technical deployment without transparency increases the risk of negative social impact. This kind of adaptation can be seen in the use of private blockchains which are opaque by default and centralise power for the blockchain owner.

Ensuring technologies are stable and supported

Web3 solutions require compute power and hardware, and the people who use them need training. To meet the standards set out in the Digital Public Goods Charter, every responsible deployment of Web3 must ensure that there is sufficient capacity to build, test, implement, and maintain in every country where the technologies are used. These infrastructural issues may well make the roll-out of Web3 solutions unfeasible in some settings; moreover, the cost, effort, and time investment of this essential preparatory and maintenance activity should be costed into every Web3 proposal.

Balancing decentralisation with multilateralism

As we explore in the speculative section of this report, there is the potential for Web3 technologies to facilitate alternative infrastructure across regulatory and legal borders, and initiate new groupings of interests and stakeholders, outside of and beyond traditional multilateral groupings. This brings with it a range of new challenges, including ensuring suitable legal, regulatory, and policy frameworks are in place to support equitable outcomes; it also requires understanding and mitigating the ramifications for existing democratic institutions and multi-stakeholder groups.

Hyperbole in context

Blockchain is currently as fashionable in international development settings as it is in Silicon Valley.[2] This is in part because there has been rising demand for agencies to be more transparent; partly because these technologies are perceived to provide better value for money; and partly because — as previously mentioned — innovation is always exciting. On paper, new technologies that deliver greater accountability and decentralised governance sound like a perfect match, but this does not take into account the largely untested nature of the tools or the heightened precarity and vulnerability of the situations and the people experiencing them.

In the words of the recent UNDP Asia and Pacific report into Digital Public Goods:

> *new technology architectures are believed to be easier to develop in developing countries because of the absence of legacy systems... [but] The new institutional systems that are being built are not drawing on the wisdom and experience of earlier systems. Instead, they are starting on shaky or weak grounds, which makes it even more important not to create harmful technological and policy lock-ins.*[3]

Some potential use cases for Web3 are both complex *and* complicated: they are the kind of projects that might, through necessity, be spun up quickly, have a lifespan of many years, and leave transformative legacies. Innovation is essential for delivery, but it must also be responsible, sustainable, and rights-respecting. Balancing these competing requirements is vital, and it is essential to remember that shared power and decentralised governance can be achieved through methods other than deploying untested technologies.

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[2] Mirca Madianou, 'The Biometric Assemblage: Surveillance, Experimentation, Profit, and the Measuring of Refugee Bodies', *Television & New Media* 20, no. 6 (September 2019): 14, https://doi.org/10.1177/1527476419857682.

[3] Urvashi Aneja, "Can Digital Public Goods Deliver More Equitable Futures? Reimagining Development In Asia And The Pacific: Foresight Brief", UNDP Regional Bureau for Asia and the Pacific (August 2022), https://www.undp.org/asia-pacific/publications/can-digital-public-goods-deliver-more-equitable-futures-reimagining-development-asia-and-pacific-foresight-brief

1.3 Recommendations

Given the above, we see the benefit of developing an anticipatory-governance approach to further R&D. Our four recommendations combine short-term practical steps that centre power sharing and collaborative decision-making with longer-term research and standards setting.

1. **Develop Web3 sandboxes** modelled on the CARE Principles for Indigenous Data Governance. This will enable innovative "testing and learning" to happen in a safe environment.

2. **Build risk and feasibility models:** analyse the outputs from sandboxed experiments to better understand the potential impacts and infrastructural requirements of Web3 deployments

3. **Establish standards**. Start by convening members of the Digital Public Goods Charter to determine whether the existing indicators and requirements are sufficient to cover Web3 deployment and use cases.

4. **Understand global impact.** Start by forming a Decentralised Governance Observatory under the aegis of an existing multilateral organisation and pool political, economic, social, and technical observations and weak signals to develop a collective view of the global impact.

This approach marries innovation with good governance, and offers the opportunity to simultaneously see Web3 from both a local, project perspective and a more global, systemic one. It is also low risk: the sandbox environment would give space for innovation in a controlled environment, ideally in collaboration with domain experts and communities with lived experience, and provide extensible knowledge that could have broad application to the roll out of other emerging technologies.

The **Digital Public Goods framework**[4] contributes five outcomes for safe, inclusive, and open digital public infrastructure:

1. "Products: There is a diverse set of discoverable, sustainably financed, effectively maintained digital public goods using interoperable standards, supported by qualified vendors and contributions from implementers, that effectively meet the needs of countries to build and maintain their digital public infrastructure;

2. Capacity: Governments and local private sector actors are empowered and able to locally select, plan, regulate, manage, and evolve their digital public infrastructure in line with national strategies;

3. Implementation: Countries have sufficient funding, technical capacity, strategies, and processes in place to build and scale end-to-end digital public infrastructure that addresses pressing national needs and empowers people, organisations, businesses, and civil society;

4. Safeguards and Inclusion: Countries and civil society implement and enforce policy, regulations, and governance frameworks, as well as technical and process-oriented measures to mitigate risks and maximise benefits of digital public infrastructure for all people;

5. Extended Ecosystem: Effective institutions, such as associations, think tanks, schools, universities, and accelerators, are funded and have capacity and authority to coordinate, safeguard, and advance digital public infrastructure and relevant digital public goods."[5]

These are the nine indicators and requirements that determine if nominated software, data, AI models, standards, and/or content can be considered a Digital Public Good:

- Relevance to Sustainable Development Goals
- Use of Approved Open Licences
- Clear Ownership
- Platform Independence
- Documentation
- Mechanism for Extracting Data
- Adherence to Privacy and Applicable Laws
- Adherence to Standards & Best Practices
- Do No Harm by Design
- Data Privacy & Security
- Inappropriate & Illegal Content
- Protection from Harassment[6]

[4] 'Digital Public Goods Standard » Digital Public Goods Alliance', accessed 10 October 2022, https://digitalpublicgoods.net/standard/.
[5] Digital Public Goods Charter, 'The Charter for Digital Public Goods', 29 September 2022, https://dpgcharter.s3.amazonaws.com/The_Charter_for_Digital_Public_Goods_docx_5d21aab306.pdf?updated_at=2022-09-30T15:06:31.944Z.
[6] 'Digital Public Goods Standard » Digital Public Goods Alliance'.

2. What is Web3?

The underlying Web3 technology:

- **Blockchain — the distributed ledger system of record keeping**

Functions on the blockchain:

- **Cryptocurrency**
- **Tokens (non-fungible and otherwise)**
- **Smart Contracts**

- **Decentralised Autonomous Organisations (DAOs) use all or some of the functions above to create an entity structure with no central authority**

The attributes of Web3 are:

- **Transparency**
- **Consensus**
- **Irrevocability**
- **Decentralisation**
- **A system for monetisation and equitable payment of participants**

Blockchain

While blockchain has become synonymous with Bitcoin, Bitcoin is not the only blockchain. At the foundation layer of Web3, there are numerous blockchains designed to have purposes well beyond the minting of digital currencies.

A blockchain is a **distributed ledger system**, which acts as a **decentralised database**. Each blockchain is an example of a structured peer-to-peer network, which was originally developed to act as a ledger system for online currency. Bitcoin is just one example of many different forms of cryptocurrency, and now tokens, that are supported by a variety of blockchains.

The blockchain is **accessible** to all users (with appropriate hardware and Internet connection) and all miners have ownership.

It is also **secure**. Security is created through transparency; the blockchain attempts to prevent tampering, given that all users have a current map of the whole blockchain.

Technologies built on blockchain also claim to be **immutable**; the blockchain cannot easily be altered.

The system relies on a **distributed network of nodes**; each node is a server that is running the blockchain software. Anybody can download the software and become part of the network, depending on how much computing power that individual has. Each transaction is

verified by a node in the network and is recorded in a new 'block' forming the next part of the distributed public ledger called the blockchain. Individuals in the network who set up a node are referred to as miners.

The blockchain system was originally designed to replace the need for a central repository or third-party arbitrators for transactions. Each node in the network puts in algorithmic work to process and authenticate transactions on the network, which are recorded on the blockchain. This algorithmic work not only validates transactions on the network, but also produces cryptocurrency for the miner as a reward for the computing power that has been invested into the network.

Blockchains generally used two ways to record transactions onto the ledger: proof of work or proof of stake. The original method was proof of work. When a block of transactions are ready to be recorded to the ledger, all of the mining nodes in the network compete with each other to solve a cryptographic maths problem which is based on the data inside the block. The complexity of the desired result of the problem gets deliberately more complex based on the total processing power available to the network. Once the validation is completed, the rest of the network can easily check the work, since the contents of the block can be fed into the proposed solution. If the equation works and the consensus of validators signs off the block, the block is added to the bottom of the ledger and the miner who solved the problem first is rewarded with newly generated bitcoin. The complexity of the answer that the computers are trying to solve scales up based on the network's processing power, specifically to incur heavy diminishing returns, a protection against an attack on the network where someone builds a bigger computer to gain more control. More recently blockchains have been using a less energy intensive method, called proof of stake. Ethereum has recently moved to proof of stake.

Other attributes of the blockchain system

- Blocks can never be removed, only added to.
- Each block has a unique number — as each additional block is added, the sequence of these numbers is forever cemented one in front of the next.
- As new blocks are made with new information stored in them, the entire chain of blocks is visible to all users of the network.
- The blockchain continues to grow to meet traffic requirements and new destinations.
- The blockchain has transparent rules for usage, such as standards, protocols and clear fee structures, which can be altered but only through a system of voting.
- Miners on the blockchain are owners, unlike previous technology where stagecoach companies were an intermediary that had to be negotiated with and paid.

Definitions and differences
Cryptocurrencies and Crypto Tokens What information is stored inside the blocks of the blockchain? Not all blockchains are created the same — some are designed specifically for carrying currencies, others are more universal in their design and can carry currencies as well as digital tokens. *The difference between coins and tokens* If a coin such as a penny or a bitcoin represents the ability to own something via purchase, a token is evidence of ownership. A physical world example of a token is a title for a car, or a deed to a property — it is not the actual car or the house, but proof that the car or house belongs to you, which can be transferred to another person if sold. In the Web3 world, tokens are the same — a representation of the ownership of an asset.
Fungibility An important concept to understand relative to Web3 and tokens is that of fungibility and non-fungibility. Fungibility is the ability of a good or asset to be interchanged with other individual goods or assets of the same type. Fungible goods are items that are interchangeable because they are identical to each other for practical purposes. If exchanging two items would be meaningless, they are fungible. In the physical world, a good example is paper bank notes. If two individuals exchange a dollar bill, the note is to all intents and purposes the same — a dollar bill, carrying exactly the same value. In the Web3 world, this would apply to cryptocurrencies such as Bitcoin — a bitcoin swapped for another bitcoin has exactly the same value, one bitcoin. Non-fungible goods have attributes that make them unique and therefore not interchangeable. Physical world examples could be diamonds, real estate, and collectibles such as signed memorabilia. Until very recently, digital content has been fungible — an MP3 recording or a JPEG image is not unique, being replicable and interchangeable indefinitely. For instance, if I do a web search for a famous painting, a Magritte maybe, I can copy and paste the image to a document of my own that is identical to the one I found. This image is fungible.
Smart Contracts ‘Smart contracts’ is a term used to describe computer code that automatically executes all or parts of an agreement and is stored on a blockchain-based platform. A smart contract, like any contract, establishes the terms of an agreement. But unlike a traditional contract, a smart contract’s terms are executed as code running on a blockchain like Ethereum, and are executed automatically. They can be used for a range of functions from finance such as loans, to insurance, logistics, or gaming.

DeFi — Decentralise Finance DeFi is an umbrella term for financial services on public blockchains, primarily Ethereum. DeFi supports functionality which banks would traditionally support — earning interest, borrowing, lending, buying insurance, trading derivatives, trading assets, and doesn't require paperwork or a third party. With DeFi, the markets are always open and there are no centralised authorities who can block payments or deny you access to anything.
ReFi — Regenerative Finance Regenerative Finance (ReFi) is a movement focusing on the power of blockchain and Web3 to address climate change, support conservation and biodiversity, and create a more equitable and sustainable financial system.
DeSci — Decentralised Science Decentralised Science (DeSci) is a movement dedicated to using blockchain and Web3 to advance scientific research and development, and to drive greater transparency and decentralisation in scientific R&D.

3. Speculating on the future of Web3

Web3 is emergent both as a technology and a cultural movement. It is technically complex, and requires an unlearning of the way we interact with traditional digital infrastructures. Part of the challenge of adopting Web3 is imagining its potential future applications. Working with our project partners, we devoted time in this project to speculating on possible use-cases, outcomes, and consequences.

Constructing visions for the future presents its own challenges: imagined futures are informed by present-day contexts. With this in mind, we identified a range of innovations that might emerge from Web3, and their resulting impacts on technology and society. We achieved this by holding a workshop with Pluriversa and Phas3 which brought learnings together to ideate on the potential impacts of Web3's widespread adoption. This workshop surfaced **four key themes**, which will be explored in this section.

Speculation is an extremely powerful tool, but the future of nascent technologies such as Web3 is shrouded in uncertainty. Therefore, we found it pertinent to construct narratives around our four identified themes, to help ground our visions for the future, and form the basis of our recommendations.

3.1 What can we learn from speculation?

Speculating on the future provides an opportunity to imagine a world that is radically transformed — one where policies and infrastructures do not resemble present systems. A large challenge in this kind of speculation is accounting for the entanglement of social, technical, political, and economic factors.

Imagined future scenarios don't necessarily lead to specific actions. Rather, they are an alternative method of identifying potential impacts and risks. The scenarios in this section have demonstrated Web3's sheer breadth of scope: it can be used by communities to carry out functions that may have otherwise been controlled by the state, but similarly can be used by governments to oppress citizens.

Proponents of on-chain solutions argue that Web3 technologies can simplify existing processes that are currently steeped in bureaucracy (such as keeping land registries, or remittances). In reality, implementing such changes requires widespread buy-in, trust, and political will from governments, and the entities who traditionally run or regulate these activities. Successful adoption and implementation is never a guarantee.

The global proliferation of Web3 technologies will also require all communities to have the infrastructures and resources which support this; currently infrastructure is not evenly distributed, and so participation in a DAO would be a big challenge for a remote community.

The widespread adoption of Web3 will not be possible without first making great strides in improving global internet infrastructure.

3.2 Speculating in themes: outcomes

The rise of authoritarian values and power

There are certain technical aspects of Web3 technologies that could enable new authoritarian powers to develop and thrive. As a way to mitigate this risk, the group discussed approaches that would ensure a strict separation of Web3 communities and the state. This separation is key to protect citizens who use the technology from potentially corrupt governments in the future.

Consider a refactoring of the benefits system onto a blockchain: all citizens who receive benefits are listed securely in a blockchain database, along with what benefits they receive. Blockchains are immutable, so the government agency managing benefits knows that no external actors can change any of the data. Benefits are distributed automatically according to the information on the blockchain, with little or no mistakes made in theory.

This 'benefits blockchain' also has scope for in-built fraud protection. On-chain data relating to which benefits an individual gets are protected behind an identification layer, so that only those who are meant to receive benefits can actually access the benefits system. Beneficiaries are assigned unique identifiers — something easy enough to design into a system built on top of a blockchain if you consider the function of non-fungible tokens — which they use when claiming their benefits.

A system like this may very well be designed and deployed in good faith, but is not future-proofed against the actions of any governments that will follow. A foundational feature of a blockchain is that any data stored on it cannot be deleted. If a new government with authoritarian values inherits the 'benefits blockchain' described above, there are no mechanisms in place to prevent them from using the data for other purposes. The unique identifiers assigned to each beneficiary could be used to 'prevent' more crimes than just benefit fraud, for instance.

This scenario plots a situation in which those in control of the technology experience transparency and flexibility, but those who actually use the technology for its purported intended purpose experience it as opaque and rigid.

While Web3 technologies create new opportunities for innovation in public service provision, limitations must be taken into account. Traditional infrastructures don't operate in the same way, so would need to be adapted and rethought if existing services are to be mapped onto Web3. Like with any radical systems' change, work has to be done to establish standards, so that the system works for everyone.

The rise of non-geographical governance

Web3 has the potential to enable new forms of governance that are not bound by borders or local jurisdictions. Decentralised decision-making systems could radically transform political participation on a local level, and collaboration on a global level.

There are communities emerging which are geographically scattered, but tied together with shared interests. Traditional mechanisms rely on centralised authorities making decisions based on the needs of their locales — but these decisions have implications outside of these locales (e.g. internet regulations). Web3 technologies can cultivate the growth of new global institutions which allow individuals to participate in making decisions that will have direct impacts on their lives.

One key enabler is the decentralised autonomous organisation (DAO). A DAO is set up by a community of people with a common goal. There is no central authority with 'final say' over decisions — members vote on what actions the DAO takes according to predetermined rules which exist immutably in computer code. This means that when the right conditions are met, the DAO will execute its function automatically, with no human interaction needed.

Governance systems such as DAOs can help communities make big decisions that transcend borders; DAO participants don't even have to know each other to work together. DAOs theoretically will never deviate from their purpose, because this is hard-coded into the programming, and can never be changed.

The use of DAOs and other Web3 technologies in global governance can catalyse new frameworks, such as an immutable code of ethics for policymakers, so that laws and decisions stay consistent with pre-agreed values.

However, DAOs come with important limitations that may hinder multilateral collaboration and pose significant risks. For instance, with widespread adoption of Web3, a DAO may be used to construct complex trade agreements, which remain in effect as long as certain criteria are met. Encoding law into DAOs — which are computer programmes written by humans — relies on the code being exactly right the first time, which is rarely the case. It would be impossible to take into account every possible external factor that might trigger the trade agreement to be revoked; any number of unforeseeable issues can lead to resource shortages and slow production.

DAOs are, therefore, vulnerable to automating mistakes on a global scale — a DAO will follow the rules of its code, which are technically correct, but may not always represent the 'right' choice in a world with ever-shifting needs and circumstances.

The unique capabilities of Web3 in non-geographical governance will very likely disrupt current modes of multilateral collaboration. Web3 has technical limitations — such as the fact that separate blockchains cannot talk to each other — which need to be taken into consideration. This highlights the importance of establishing standards in the way these technologies are utilised, and conducting rigorous planning of new infrastructures that can fit around the capabilities of Web3.

High carbon footprint and environmental degradation

Mining the blocks that form a blockchain is a computationally intense undertaking which consumes an extremely large amount of energy. The group therefore identified multiple scenarios that might emerge from a lack of care taken over the environment in widespread

adoption of Web3. Concerns ranged from water and food insecurity, to sustainability and environmental degradation.

In present day, global mining operations have already caused demonstrable harm to communities who do not reap any financial or functional benefits. The cost of making further mistakes is too high. Any new applications of Web3 technologies — whether designed specifically to address environmental concerns or not — must first be tested in a closed system that has no effect on the real world, so as to reduce any further potential harm.

Sandboxing potential use-cases to extrapolate the feasibility of a solution is vital when considering how much Web3 can unlock. For instance, we can see a future where Web3 is used to reduce environmental degradation, in a manner wholly separate from the state and private sector: what if there were large portions of land that governed themselves via smart contracts?

This mechanism could be used to protect forested areas: with Web3, a forest can be represented in two ways: first, as itself; a group of trees in the real world. Second, as a smart contract, an entity that can automate certain tasks, and interact with other entities in the same way an individual or business might. The purpose of this smart contract would be both to maintain the forest, and to ultimately expand it. The smart contract is therefore equipped to sell logging rights in order to raise capital to buy saplings — as long as the rate of logging is not higher than the rate of new tree growth, the forest thrives.

This scenario is theoretically possible but not necessarily feasible. If a forest's function is simply to expand, there is a risk that other ecosystems may suffer, and that communities will be displaced. This is why sandboxing solutions is integral to the process of adopting Web3: environmental experts need time to test out ideas and form governing standards on how Web3 technologies can feasibly be used in a way that does not continue to harm the environment.

The tokenisation of everything

Finally, a large concern coming from the group was the potential for Web3 to "tokenise everything": i.e. to reduce everything — from playing online games to securing a mortgage — into a speculative asset. With Web3, the ownership of just about anything can be represented in tokens.

For example, a group of people form a DAO and choose to buy a house together. The house is represented by 100 tokens, and each individual in the group buys a share of these. Having these tokens present in their wallets (which are public) mean two things: they each have **part ownership of the house**, and they have **voting rights over house-based decisions**, such as what colour to paint the walls. More tokens gives an individual more voting power.

However, tokenisation is not at all limited to physical objects or properties. Tokens can be used to grant or limit access to places or services; they can be used as direct-voting systems; another potential use-case is for creators to get paid directly by their fans, without the need for a large, centralised, online platform to host all their work.

To imagine how this would work in practice, take a hypothetical creator called Sam: Sam is tired of using Patreon to maintain a tiered payment structure for all their hard work, only to have Patreon take a cut of everything they make. They are also extremely unhappy with having to rely on ad revenue from their Youtube channel — they'd rather not run ads at all. So they decide to **tokenise themselves**.

Now fans can simply purchase $AM tokens to show their support. Money spent on the $AM token goes straight into Sam's wallet, with no need for intermediaries. With $AM, fans have some ownership over what Sam creates. They can make direct requests for the types of content they want to see, and Sam will have a contractual obligation to follow through. So, Sam is financially supported, and their fans have more meaningful control over the content they consume.

However, tokenised direct payment mechanisms such as this leave creators like Sam vulnerable to bad actors. If a $AM token is like a vote, then there's nothing stopping their fans from organising to buy up a large amount of tokens and request that Sam produces something different to usual — maybe something humiliating, or maybe something mediocre that doesn't resemble content creation at all, such as picking up someone's dry cleaning or waiting in line to pick up someone's coffee order and deliver it personally to their office. In essence, Sam's work could deviate away from content creation, and into something that more closely resembles gig-work.

Even with a tokenised future where most creators or independent contractors are relatively successful and financially secure, there is a risk that governments will compensate for this by reducing the availability of welfare benefits, thus further entrenching existing inequities. The barriers to engaging with tokens may remain high — it's unlikely that everyone will be able to participate on the same level, leaving many without access to the basic necessities needed to live.

These scenarios demonstrate an urgent need for running extensive sandboxed experiments for use-cases such as this. The widespread introduction of tokens will bring about unprecedented radical shifts in our economy, with outcomes and consequences that cannot be foreseen without safe, methodical testing in closed environments.

4. Recommendations

Our recommendations set out a “test and learn” approach, in which short-term practical steps that centre power sharing and collaborative decision-making are combined with longer-term research and standards setting.

This provides an opportunity to collect and act on empirical data, deepening understanding of the affordances of Web3 in a controlled environment, while also horizon scanning and exploring the long-term political, economic, and social implications of this shift towards decentralised governance.

1. **Develop Web3 sandboxes** modelled on the CARE Principles for Indigenous Data Governance. This will enable innovative “testing and learning” to happen in a safe environment.

2. **Build risk and feasibility models:** analyse the outputs from sandboxed experiments to better understand the potential impacts and infrastructural requirements of Web3 deployments

3. **Establish standards**. Start by convening members of the Digital Public Goods Charter to determine whether the existing indicators and requirements are sufficient to cover Web3 deployment and use cases.

4. **Understand global impact.** Start by forming a Decentralised Governance Observatory under the aegis of an existing multilateral organisation and pool political, economic, social, and technical observations and weak signals to develop a collective view of the global impact.

4.1 Sandboxing and feasibility

This section discusses the first two recommendations, as they are very closely linked.

Web3 is a nascent technology, and currently few real-world applications have been deployed. There is a clear lack of viable use-cases for the technology beyond trading speculative assets — one prominent reason for this is a great need for understanding the technical capabilities of Web3. Use-cases cannot be defined before we even know what’s possible to achieve with Web3 technologies.

In Section 3, the speculative future exploring ‘the tokenisation of everything’ illustrated the potential outcomes of deploying a new monetary system without first conducting safe, closed experiments. Reducing the ownership of assets into distributed tokens when the implications of tokenisation are still largely unknown risks further entrenching social inequities. Testing out a tokenised economy in a sandbox would help mitigate or avoid these risks.

Innovation is not a linear path from conception to delivery; rather it forms branches, many of which lead to dead-ends. The technical capabilities and limitations of Web3 are still emerging,

and these need to be carefully teased out in experimentation. In order to contextualise our recommendation for sandboxing, we will first outline what a sandbox is, and what it can be implemented to test. We will then outline the known features of Web3, and the potential barriers these present for widespread deployment, and explain how these could be areas to test through sandboxes.

What is a sandbox?

In a software testing environment, a sandbox allows for untested code or programmes to be executed in a closed environment. Sandbox environments let software developers simulate a virtual computer to run and test their software application, without worrying about these tests affecting adjacent programs or network components. Sandboxing therefore protects active servers and their data, and the systems they run by preventing any changes that could be damaging.

Testing is an integral part of software and website development; it usually occurs before the final release of a product and is a very important part of the process. It is possible to accelerate solutions by applying this method to products, applications, and the underlying infrastructure for Web3 in a collective way. The aim would be to accelerate towards success where benefits are observed and to rule out programmes or ways of working that present undue risks.

What challenges could we address through sandboxes?

Web3 technologies provide some clear advantages and disadvantages based on their attributes and the ways in which the existing infrastructure has been designed, deployed and implemented. Many of these challenges could be framed as barriers to progress. There is potential that some of these challenges could be quickly explored in sandbox environments. The aim of this testing would be to accelerate the identification of attributes or programmes that could have potential impact for global challenges and quickly rule out any that present high risk or low benefit.

This section explores some of the challenges with Web3 technology that could be tested or impacted through sandbox environments.

The cost of entry

Verifying transactions or writing data on blockchains require high levels of computational resources, with sophisticated processing rigs and intensive energy use. These are supported by hardware engineers and appropriate heating, ventilation, and air conditioning. This means that the cost of entry and ongoing maintenance are only available to those able to access equipment, which risks an asymmetrical distribution of access to Web3 technology and the power to use and shape it.

Creating bespoke sandboxes for innovators in a competition model or grant funding model could give innovators with good ideas the opportunity (through grant or prize funding) to test their Web3 idea in an economically viable way. There is evidence in the innovation literature

that shows schemes such as prize funding for innovation successfully identifies 'unusual suspects' — innovators that otherwise would not have created a novel idea or product.[7]

Environmental impact: Proof of work and proof of stake

The ethereum blockchain recently switched its verification mechanism from proof-of-work to proof-of-stake, reducing its energy consumption by an estimated 99.5%.[8] However, Digiconomist estimates that, in 2022, a single Bitcoin transaction generates:

- the same carbon footprint as 1.73m Visa transactions
- the same power consumption as the average US household uses in 48.1 days[9]

This raises concerns around the long-term sustainability of blockchain and the potential impacts to the climate, which risks counterbalancing gains made in shared governance.

Proof-of-work (PoW) consensus mechanisms are energy intensive because blocks are validated by solving complex cryptographic puzzles. This activity takes a lot of computing power, and so at a large scale consumes a lot of energy.

Proof-of-stake (PoS) consensus mechanisms use less energy, but are still complex mechanisms that require additional consideration beyond its environmental impact. With PoS, validators 'stake' coins they already have in order to validate blocks and gain rewards. There are open questions surrounding who gets to be a validator and how validators are selected.

Validators are rewarded on their ability to take and spend, and those with access to more capital thus have greater ability to participate in the reward system. In the past, Ether's PoS had a buy-in cost of 32 Ether, which has fluctuated up to USD 130,000.

The inevitable growth of the chain means that a validator will also have to constantly increase their capacity to store a chain and thus participate as a validator. This raises concerns regarding the potential to centralise power into the hands of only those who are capable of meeting the escalating power requirements, and who are more likely to have greater access to resources.

The problem with validation is therefore twofold; firstly, PoW has a high environmental impact, and both PoW and PoS act to centralise power. Therefore, creating a sandbox environment that is dedicated to testing solutions to improve the efficiency, process, and environmental impact of blockchain validation could incentivise novel innovations. There is a possibility that innovations could be incentivised that move beyond proof of stake.

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[7] 'The Great Innovation Challenge: How Challenge Prizes Can Kick-Start the British Economy', n.d., 36.

[8] Romain Dillet, "Ethereum switches to proof-of-stake consensus after completing The Merge", TechCrunch (15 September 2022), https://techcrunch.com/2022/09/15/ethereum-switches-to-proof-of-stake-consensus-after-completing-the-merge/

[9] "Bitcoin Energy Consumption Index", Digiconomist (accessed 19 September 2022), https://digiconomist.net/bitcoin-energy-consumption

Another significant limitation is network speed: with every transaction validated via PoS, there are multiple layers of the process left up to chance. Elected validators may be offline, and many simultaneous transactions might overwhelm the blockchain. All these factors contribute to slowing the network.

An overwhelmed blockchain can also cause de-syncs between validators, which could lead to "forks". A fork is where two or more validators reach a different consensus about the state of the network and each branch keeps on registering new transactions, believing it is the authoritative version. Forks can be executed intentionally, to effectively undo transactions. For example, if someone stole coins, the only way to get them back would be to convince the people who manage the chain itself to negotiate a rollback.

Disputes that lead to forking are incredibly difficult to resolve. If every branch on a fork is operating as if it is the ultimate authoritative branch, true consumer protection may not be possible. On blockchains, blocks mined in the future depend on the state of already existing blocks — it is not just a matter of a few disputed transactions that need to be resolved between the buyer, the seller, and the payment processor; these are agreements written on the fundamental state of the entire blockchain economy.

Validation is therefore a multilayered problem, leading to problematic implications like slow speed of transactions and forks in the chain; it presents a good opportunity for a sandbox. If PoW and PoS could be improved upon or replaced by a more innovative validation method, the benefits could be fourfold: a system that does not incentivise centralisation, a system that uses less energy, a system that is fast and therefore prevents forks.

Interoperability

Another emerging challenge that could be tackled through sandbox experimentation is the problem of lack of interoperability between blockchains. Since the creation of Bitcoin, there has been a growing number of blockchains. Some blockchains such as Ethereum host lots of projects; distributed autonomous organisations (DAOs), smart contracts, and tokens. This means that to start a Web3 project, innovators do not need to build their own blockchain, they can host their project on an existing blockchain, depending on its functionality.

The range and number of blockchains available and running creates advantages, like choice, but also creates challenges for interoperability: records on one blockchain are not visible on another — if two entities are using their own blockchains for similar purposes, there is little or no opportunity for interoperability. This poses a potential barrier to total transparency, as it is only possible to understand the data in one blockchain at a time, and not across multiple blockchains.

There are projects that are hosted on multiple blockchains in an attempt to work around this limitation, such as Chainlink. Chainlink provides accurate external data to blockchains for smart contracts. Though originating on Ethereum (ETH), Chainlink has been designed to work across any blockchain that has smart contract functionality. Therefore Chainlink does not operate its own blockchain, instead, it runs on many different blockchains simultaneously. This is an area of development that has not received much attention, and there is little incentive, so would benefit from funding through a sandbox.

Transaction fees

One of the biggest barriers to using cryptocurrencies for everyday transactions is high transaction fees. Cost of transaction fees and remittances therefore offer an interesting challenge to innovate around using sandboxes. In May 2020, transaction fees on ethereum were as high as USD 40. At the time of writing, they are at approximately USD 1.57. This volatile extra cost for each transaction makes cryptocurrencies an impractical choice for everyday currency.

Remittances

The World Bank expects that such annual inflows of money sent by individuals across borders will reach USD 630 billion by the end of 2022. On the one hand, this makes a case for a decentralised finance (DeFi) system. On the other hand, the lack of existing financial infrastructure in many parts of the world makes implementing experimental new technologies risky.

Cryptocurrencies do not require intermediaries (banks) to be transacted, which is why they appear an attractive choice for improving remittance systems. However, there are fees associated with converting crypto into fiat currency. Unless cryptocurrencies are adopted as legal tender all over the world, using crypto to send money to another country would require converting fiat currency into crypto, and then converting it back on the other end — making it a more expensive method than traditional peer-to-peer transfers.

Ryan Newton, founder of Paisa, has openly discussed her sceptical views about crypto helping her customers. Her Mexico-based startup serves remittance recipients, most of them women who are often unbanked or underbanked. She asserts that what they need is financial inclusion, not cryptocurrencies.[10]

Visualising Paisa's model is helpful to understand what its users do and do not need. The overwhelming majority of its target users receive their remittances in cash, at a physical point of contact — the kind of place where they might also be able to top up their phone and more. It is there that independent agents reach them to offer them Paisa's remittance-backed loans. The loans can be used for personal emergencies or for a small business and are managed via WhatsApp to avoid requiring a dedicated app.

This effective, low-tech, human approach to offering loans doesn't leave much space for a crypto solution. Paisa meets users where they are, both physically and metaphorically: "We are already working on understanding access barriers [...] for crypto, the customer just isn't there."[11]

To sandbox remittance solutions through a funded scheme would offer innovators the opportunity to test out new methods and ideas without taking undue financial risks. It could

[10] Anna Heim, 'For Remittances, Crypto Is Still a Problem Looking for a Solution', *TechCrunch* (blog), 30 May 2022, https://techcrunch.com/2022/05/30/for-remittances-crypto-is-still-a-problem-looking-for-a-solution/.
[11] Ibid.

allow innovators who might be 'unusual suspects' to create novel innovations to fill unmet needs.

Recommendations for safe experimentation

The opportunity to host and fund innovation experimentation for Web3 in sandboxes affords a safe way to overcome the potential challenges outlined above. The existing challenges with the underlying infrastructure of Web3 technologies should be explored and overcome in a responsible and controlled way, where possible. There is a clear tension between the desire for the formation of communities outside of state control (decentralisation), and for the possible need for state/global intervention (or cooperation) when it comes to regulation or mitigating risks.

The level of regulation and multilateral cooperation needed to successfully implement Web3 technologies depends entirely on the type of projects, and the scale of the proposed system. Therefore, we recommend a two-pronged approach:

The first is to create safe spaces for innovators to experiment with applications of Web3 technology within global diplomacy. These safe spaces would take the form of sandboxes, each dedicated to a potential domain of Web3 — such as tokenisation. As outlined above, a sandbox is a virtual, isolated testing environment in which programs can be run, without affecting the wider system external to the sandbox. Software developers use sandboxes to test new programming code. Cybersecurity professionals use sandboxes to test potentially malicious software. As this section has explored there are a number of clear challenges around which grant- or prize-funded innovators could use sandboxes to accelerate or rule out novel solutions.

With domain-specific sandboxing, innovators could experiment with different solutions based on the challenges that each domain presents. For example, the effect a tokenised economy would have on independent contractors. There is evidence that funding innovators through prize money in a stage gate design could lead to greater diversity of solutions from 'unusual suspects'.

The second prong of our recommendation is to use the data from these sandboxes to both:

1. review the potential scale of impact of the innovations coming out of the sandboxes;
2. review and update our understanding of potential harms and problems with Web3.

Decentralised governance for this programme should be built in from the start, and we recommend the implementation of the CARE Principles for Indigenous Data Governance,[12] which seeks to ensure technologies and data collection are deployed in collaborative, respectful ways, centering data sovereignty and power-sharing for Indigenous peoples. These principles — discussed further in Section 4.2, below — have been developed in a rigorously collaborative and respectful manner, and their application embeds a respectful, regenerative approach to digital governance.

[12] Stephanie Russo Carroll et al., 'Working with the CARE Principles: Operationalising Indigenous Data Governance', *Ada Lovelace Institute* (blog), 9 November 2020, https://www.adalovelaceinstitute.org/blog/care-principles-operationalising-indigenous-data-governance/.

The principles are summed up in the mnemonic "#BeFairCare", which unpacks as:

- Findable
- Accessible
- Interoperable
- Reusable
- Collective Benefit
- Authority to Control
- Responsibility
- Ethics[13]

Data from these trials could inform early policymaking, and highlight potential political, economic, social, and technical outcomes.

Sandboxing potential Web3 solutions means that safe mistakes can be made, the impact of innovation can be assessed, and risks can be revealed. Most importantly, it provides an opportunity to rapidly discount ideas that have a high potential for harm, or vulnerability to misuse.

4.2 Establish standards

Multilateral and transnational uses of Web3 technologies for global good will require some shared standards.

It may seem counterintuitive to set standards for self-regulating technologies, but it is important not to assume that "public good" will have the same affordances in all contexts. Moreover, if — as we anticipate — Web3 governance and technologies will facilitate the formation of new institutions beyond geographical barriers, clashes are bound to arise between different legal and regulatory regimes. Creating and monitoring standards will not obviate these legal conflicts, but it will offer useful early insight into the kinds of challenges that will arise.

In the context of solving the global challenges, it is also the case that technical norms do not always translate well between different contexts. For instance, a use case that might be unproblematic in a market-driven setting — such as the fully-consented collection of biometric data — might infringe human rights in a humanitarian one. Also, it is worth noting that not everyone who is affected by a blockchain technology will be a stakeholder; this means that, while stakeholders are likely to be equal and accountable, there is no clear redress mechanism for those who are not.

Decentralised is not the same as transparent

The World Food Programme's Building Blocks programme is one example of how decentralised technologies can entrench power and information asymmetries. The programme, which operates from a private blockchain, runs a remittance system that is

[13] See 'CARE Principles of Indigenous Data Governance', Global Indigenous Data Alliance, accessed 22 June 2022, https://www.gida-global.org/care.

optimised for security and efficient supply chain management. However, its use of blockchain does not automatically make it transparent.[14] As Margie Cheesman points out:

> *blockchain…reformulated the institutional arrangements workers dealt with and thus where and who they went to for payment problems and information.* ***But no one explained the blockchain to these women workers:*** *as a concept, GEN staff treated blockchain on a 'need to know basis', deeming the technical complexity inappropriate because of workers' mixed literacy and numeracy skills and technical capacities….****Refugee women workers made new data points whenever they completed a transaction, but the ledger was not made visible to them.*** *The only transaction records they were able to access were the paper receipts provided by supermarket cashiers.*[15] [our emphasis]

In this instance, layering more technology into the solution makes the service more abstract rather than less. As a result, it does not empower or equip the programme members with the information they need to live independently. In turn, this lack of transparency and portability increases the complexity of any transition or decommissioning phase, minimising the sustainability of the programme. Developing standards in an early, iterative manner would allow the lessons learnt from this and other early adopter programmes to be shared and more deeply understood; this would lessen the chance of the same problems being repeated and, perhaps inadvertently, enshrined in Web3 practice.

Collaboration across borders

The scenarios in Section 3 demonstrate how Web3 technologies and governance might give rise to highly specific new products, services, and organisations that are created in response to an issue that arises across several borders or in a number of geographical regions.

Our hypothesis is that, in the near future, communities responding to the climate emergency will be motivated to organise in new ways to find solutions to existential threats, and that agencies and other multilateral bodies will be called upon more frequently to deploy novel solutions in urgent settings. Creating frameworks that anticipate known problems with technology deployments in these settings will minimise any harm caused as an unintended consequence of a rapid-response deployment.

Legislative and regulatory differences across borders already cause both service readiness and human-rights problems for the roll-out of technology-driven services. This can be due to a number of factors, including different assumptions or practices in partner organisations, the absence of clear cross-border policies for the collection, storage, maintenance, and use of data, including failure to guarantee purpose limitation.[16]

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[14] Madianou, 'The Biometric Assemblage'.
[15] Margie Cheesman, 'Blockchain for Refugees', Medium, *Data & Society: Points* (blog), 9 June 2022, https://points.datasociety.net/blockchain-for-refugees-a46b41594eee.
[16] Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: New York University Press, 2018), 122, https://nyupress.org/9781479837243/algorithms-of-oppression/.

Adding Web3 into this mix creates more complexity, and Aiste Rugeviciute and Afshin Mehrpouya argue that the "lack of a common legislative framework is partly hampering [blockchain's] adoption for aid development".[17]

Equitable access to the benefits of technology within global diplomatic initiatives also requires scrutiny and accountability; rolling out new technologies without these protections will create new injustices, and lay the path for new problems further down the line, when data is reused for potentially inappropriate purposes.

Preparing for Web3 multilateralism

Digital multilateralism is complex and covers a wide range of sensitive considerations.

Currently, digital soft power is a subset of real-world soft power, but in the coming decades it seems possible that the relatively lightweight tools for collaboration offered by Web3 might give rise to new forms of multilateral organisation, both formal and informal. This might, variously, lead to the formation of shadow alliances that do not follow existing political or geographical patterns or encourage new kinds of governance to emerge, disconnected to geographical states but rooted in communities of people and things.

Engaging with standard setting at this early stage, before issues become fraught or urgent, will make it easier to respond to unexpected or urgent events as they arise — building both trust between disparate parties and a store of practical knowledge-sharing.

This is particularly important because decentralised governance is likely to give rise to new methods of diplomacy and relationship building. Current Western technology discourse tends to assume that different models of Internet governance are in direct competition with one another, preferring a "winner takes all" approach. However, it seems probable that decentralised governance might create mechanisms for forming more equal, collaborative partnerships that facilitate new ways of building alliances and sharing resources between states. This has the potential to redraw the power map, creating new trade routes and data flows, and new opportunities for political partnership. This is not simply an economic consideration, but a matter of cyber diplomacy, underwritten by national security considerations, global ambitions, and issues such as the right to self-defence, international humanitarian law, and the use of countermeasures.[18] A failure to engage with this might risk long-term isolation and the depletion of soft power.

Building on existing standards

As a starting point for standards development, we recommend convening members of the Digital Public Goods Charter to determine whether the existing indicators and requirements are sufficient to cover Web3 deployment and use cases.

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[17] Aiste Rugeviciute and Afshin Mehrpouya, 'Blockchain, a Panacea for Development Accountability? A Study of the Barriers and Enablers for Blockchain's Adoption by Development Aid Organizations', *Frontiers in Blockchain* 2 (22 October 2019): 5, https://doi.org/10.3389/fbloc.2019.00015.

[18] Mark Bryan F. Manantan, "Defining Cyber Diplomacy", Australian Institute Institute of International Affairs (10 November 2021), https://www.internationalaffairs.org.au/australianoutlook/defining-cyber-diplomacy/

The existing indicators are:

- Relevance to Sustainable Development Goals
- Use of Approved Open Licences
- Clear Ownership
- Platform Independence
- Documentation
- Mechanism for Extracting Data
- Adherence to Privacy and Applicable Laws
- Adherence to Standards & Best Practices
- Do No Harm by Design
- Data Privacy & Security
- Inappropriate & Illegal Content
- Protection from Harassment[19]

Data and insight from the sandbox programme and feasibility studies we recommend in 4.1 would be a useful input here, and could be used to develop an initial set of tests and scenarios to establish whether the above standards are sufficient. This review would, of course, need to be an ongoing process, updated as more data becomes available.

We recommend starting with the existing indicators, not only because the Digital Public Goods Charter has direct application to the achievement of the global goals, but because the collection of organisations that support the Charter represent an active and functioning point of multilateral collaboration. It is likely that other approaches to digital multilateralism will become necessary over time, but this seems like a practical and achievable place to start.

Paving the way for decentralised governance

Beyond these existing indicators, new forms of multilateral cooperation create space for new kinds of principles. Decentralised governance offers an opportunity to retire top-down methods of decision-making and combine multiple epistemic conventions, creating infrastructure that will create more just and sustainable outcomes for more people.

The CARE Principles for Indigenous Data Governance outlined in Section 4.1 are an example of an already operational approach that combines technical expertise with people-centred emergent governance.[20] [21] Stephanie Russo Carroll has outlined how operationalisation has been open and collaborative, relying on absorbing "bi-directional feedback" in a wide-range of contexts,[22] including urgent deployment of new standards during the Covid-19 pandemic.[23]

The scale and ambition of the CARE Principles for Indigenous Data Governance shows that rethinking *and* reworking data governance in an inclusive way that prioritises collective

[19] 'Digital Public Goods Standard » Digital Public Goods Alliance'.
[20] Mark D. Wilkinson et al., 'The FAIR Guiding Principles for Scientific Data Management and Stewardship', *Scientific Data* 3, no. 1 (15 March 2016): 160018, https://doi.org/10.1038/sdata.2016.18.
[21] Stephanie Russo Carroll et al., 'The CARE Principles for Indigenous Data Governance', *Data Science Journal* 19 (4 November 2020): 43, https://doi.org/10.5334/dsj-2020-043.
[22] Stephanie Russo Carroll et al., 'Working with the CARE Principles'.
[23] Research Data Alliance, 'Final Release: COVID-19 Guidelines', 2020, https://doi.org/10.15497/RDA00052.

benefit is not just possible but highly effective. The most important step to collective governance is the acknowledgement that no single approach to knowledge management needs to be pre-eminent, and that top-down governance is a choice, not the default. The knowledge, experience, and expertise of those who have stewarded the creation of this framework is decentralised by default, and while it may garner less press coverage than the DAOs being created by technologists and funded by venture capitalists, it is more deeply aligned with the long-term sociocultural shifts indicated by the scenarios we have developed.

This expertise is critical to the development of decentralised governance, and **we strongly recommend engaging with the Research Data Alliance International Indigenous Data Sovereignty Interest Group as thinking and standard-setting in this domain emerges.**

In citing the CARE Principles, we also acknowledge that Western academic reference systems do not do justice to such a plural or collaborative approach, and reproduce Stephanie Russo Carroll's acknowledgements of the network of contributors alongside the other references for this paper.[24]

4.3 Understand global impact

The political, economic, social, and technical ripples that may be caused by the widespread adoption of decentralised technologies and governance are significant. To understand these, **we recommend forming a Decentralised Governance Observatory under the aegis of an existing multilateral organisation**. This would enable collaborative, in-depth horizon scanning and shared observations of weak signals, informing a collective view of the possible impacts of Web3 on multilateralism and global democratic infrastructure.

Observatories of this kind are typically hubs that bring together global interdisciplinary data and expertise to reflect on and capture events as they unfold. Existing examples include UCLG's Global Observatory on Local Democracy and Decentralisation, WHO's Global Health Observatory, the Global Observatory for Genome Editing, the UKRI/ESRC Economics

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[24] *The original workshop 'Indigenous Data Sovereignty Principles for the Governance of Indigenous Data', was organised by Stephanie Russo Carroll and Maui Hudson, in collaboration with the Research Data Alliance International Indigenous Data Sovereignty Interest Group at the International Data Week held Thursday, 8 November 2018, in Gaborone, Botswana.*

The principles described in this manuscript represent voluntary contributions and participation of the authors; workshop participants Oscar L. Figueroa-Rodríguez, Ray Lovett Simeon Materechera, Mark Parsons, Kay Raseroka, Desi Rodriguez-Lonebear, Robyn K. Rowe, Rodrigo Sara, and Jennifer D. Walker; and from the wider US Indigenous Data Sovereignty Network, Te Mana Raraunga Maori Data Sovereignty Network, Maiam nayri Wingara Aboriginal, and Torres Strait Islander Data Sovereignty Collective communities.

We acknowledge the Indigenous Peoples of Botswana on whose land the principles emerged, as well as Indigenous Peoples worldwide.

We are grateful to the Research Data Alliance for workshop location and travel support for some attendees.

Observatory and the WHO/International Agency for Research on Cancer Global Cancer Observatory.

While many of the possible considerations flagged below may not come to pass, the potential of decentralised technologies to be deployed in ways that challenge institutional and geopolitical norms should not be overlooked. Web3 may not be the default set of technologies for delivering this decentralisation, but its roll out will certainly pattern new forms of collaboration and create challenges for established methods of international governance.

The dominant consideration here is that Web3 makes it possible to convene and organise people and information outside of traditional geographical, institutional, and governmental formats. Traditional multilateralism and democratic government are relatively firmly rooted in those formats, and may be vulnerable to practical and strategic disruption if new relationships and alliances are forged and executed “on chain”.

This vulnerability is heightened by the fact that new technologies do not roll-out at the same pace in every territory — and within countries, adoption in governmental organisations may be much slower than it is in business or civil society. The potential implications of this could be far reaching: optimistically, this could unlock potential for rapid, transparent problem solving and delivery across and between nation states, but this is unlikely to be the only consequence.

Web3 technologies might affect multilateralism in a number of ways, and more in-depth horizon scanning is required to map these eventualities to particular geopolitical contexts. The following is an indicator of some of the possible considerations:

- **Technical robustness**
  Using technological forms to mediate multilateralism requires failsafe levels of transparency and stability, underpinned by excellent governance and security. Agreeing standards and delivering assurance for this may, in itself, require multilateral negotiations.

- **The potential impacts of Web3 technologies on peace and democracy**
  Context is, of course, everything but adoption of Web3 technologies at state or quasi-state levels will challenge existing infrastructures for multilateral negotiation and create new challenges for global democracy. For instance, Web3-enabled agreements might be open to bad actors, be used to undermine democratic proceedings, instigate revolution, or become weaponised as part of cyber warfare. It is also possible that DAOs could be used to convene non-geographical states, with potentially low barriers to entry. Each of these eventualities relates to a nexus of social, legal, political, and financial implications that shift depending on geopolitical context and perspective.

- **Impact on soft power**
  Web3 adoption may have unexpected impacts on the soft power of nations that do, and do not, adopt it. For instance, the stated aim of making Bitcoin legal tender in El Salvador was to reduce overheads on the USD 6 billion in international remittances

sent home by El Salvadorians living in the US, and increase financial inclusion for the 70% of citizens who are unbanked and working outside the formal economy.[25] This has not yet come to pass: at the time of writing only 2% of remittances use Bitcoin, the government is sitting on USD 58 million of unrealised losses (not including the cost of implementation), and the IMF has postponed a USD 1.3 billion programme due to "risks from Bitcoin".[26] However, El Salvador has become more attractive as a centre for crypto businesses over the last year, and may yet become a fintech hub. The future impacts of this are as yet unclear, but it may, for instance, lead to future legal and regulatory changes in El Salvador or to a rapid increase in provision of compute power within the country.

- **Ensuring equity in multilateral or multi-national Web3 products and services**
  The commitment within the Digital Public Goods Charter "to build, test, implement, maintain, and govern digital public goods that best address their country's infrastructure needs" requires prioritising local knowledge. This kind of context sensitivity, and any necessary mitigations for equity, may become difficult to maintain in a technically-mediated environment in which all actors are considered to be equal, or in which insufficient contextual information is available. The risk is intensified in technically-mediated projects, where a "veneer of technical neutrality"[27] can mask and deepen discriminatory attitudes.

  Participants in Web3 projects from different nation states may also have "differential access to rights and privileges",[28] and it is unclear which mechanisms would establish which nation (if any) would or could assert sovereignty in a Smart Contract or international remittance system. Web3 projects could also be used to paper over ideological asymmetry, with potentially positive and negative outcomes, for global diplomacy.

Our assessment that new forms of social organisation are the dominant animating force for Web3 adoption means that the issues set out above need to be examined from a range of different geographical, political, and social contexts and scales to be understood in more depth.

This is potentially a huge challenge, but getting ahead of it by engaging in strategic and collaborative research would have the preferred benefit of also strengthening relationships and enabling the creation of rights-respecting pilot programmes that maximise and model the advantages of Web3 governance.

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[25] "At Miami Conference, El Salvador's President Announced He Wants Bitcoin To Be Legal Tender In His Country", CBS Miami (7 June 2021).
[26] Michael D. McDonald, "El Salvador Had a Bitcoin Revolution. Hardly Anybody Showed Up", Bloomberg Business (3 September 2022).
[27] Ruha Benjamin, 'Assessing Risk, Automating Racism', *Science* 366, no. 6464 (25 October 2019): 422, https://doi.org/10.1126/science.aaz3873.
[28] Stefania Milan and Emiliano Treré, 'Big Data from the South(s): Beyond Data Universalism', *Television & New Media* 20, no. 4 (1 May 2019): 323, https://doi.org/10.1177/1527476419837739.

5. Conclusion

Together, our recommendations form a lightweight system of anticipatory governance that combine short-term steps for responsible innovation with long-term intelligence gathering to inform future planning and strategic interventions. This is a pragmatic approach that does not overinvest in the technical possibilities of Web3 but instead prioritises the social and cultural shifts these technologies might facilitate.

It is likely that the energy and momentum around Web3 will continue as the global polycrisis unfolds. The hope and escape offered by new technologies is an important part of the innovation cycle, but it is vital to remember that not every hopeful prospect turns into a useful solution. At the time of writing, cryptocurrencies are being shaped by their first brushes with regulation, while other on-chain technologies are still in early stages of development, with some fundamental functionalities not yet identified.

Our aim in proposing a sandbox programme is to enable innovation while also limiting the impact of unintended consequences and producing useful learning and next-steps for an ongoing programme. This is a proven method of developing early and effective governance measures for new technologies that will generate some of the empirical evidence needed to deploy Web3 technologies in complex situations.

Understanding the political, economic, and social factors that make decentralised governance attractive to people from across the political spectrum is not, of course, a technology governance issue, but this cultural shift is the strongest signal that emerges from this work. The drift towards Web3 principles is social innovation in search of a more networked, equitable, and adaptive way of life. Web3 technologies may or may not ultimately provide the means for delivering this, but they are a means of experimentation. Anticipating some of the future legal and regulatory structures that might support this shift, and the challenges for multilateral cooperation, are vital inputs for sustaining and modernising democratic and economic systems.

The specific opportunity that Web3 creates with regard to solving global challenges is developing infrastructure for international cooperation. As we outline in sections 4.2 and 4.3, it is worth understanding the legal and governance challenges this will create, and to model terms for international cooperation based on established, rights-respecting standards. Developing scrutiny and redress models for this will be challenging, and will benefit from long-term preparatory work to establish trust, deepen existing relationships, and build new ones.

Finally, although Web3 technologies might be exciting and novel, their emergent nature makes them unsuitable to be paired with emergent problems. There are plenty of difficult challenges that need to be solved without creating new ones by deploying these technologies in potentially unsafe and unknowable ways.

Careful Industries

About Us

Careful Industries is a research organisation based in the UK. Through research and prototyping, we help our clients understand the social impacts of technologies and create new futures. Our sister organisation, Promising Trouble, is a not-for-profit exploring the potential of community technologies.

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