BLOCKSTAND

An Overview of Decentralised Autonomous Organisations (DAOs): Benefits and Challenges

Contents

Aims:

This report will highlight how existing Decentralised Autonomous Organisations (DAOs) face challenges with interoperability, regulatory uncertainty and non-standardized governance models. It will further examine interactions of DAOs among themselves, with existing off chain entities and traditional economies stakeholders. It will also examine DOAs are structured and the different variations and the impact DAOs have in terms of social responsibility and sustainable development.

Additionally, this report will highlight the attributes from the EU regulation that will allow the enhancement and certainty of this new type of for-profit commercial and not-for-profit virtual entities. This report also intends to assess DAOs from the perspective of providing support the Digital Decade in the modernisation of the infrastructures as proposed within the ICT and other EU Regulations and understand how they can contribute to the efforts of EBSI and EIRA.

Examining Decentralized Autonomous Organizations:

Building on distributed ledger technologies' (DLT) foundational premise of transparency and participation in the virtual world, the rise of Decentralized Autonomous Organizations (DAOs) has been unprecedented. The term was put forward in the Ethereum Whitepaper (2014), with a very vague, oblique definition. DAO as a concept first appeared within the writings of Barbrook & Cameron "Californian Ideology" (1996), of libertarian markets and individual freedom by providing the infrastructure for "infinitely scalable" societies.

DAOs are an essential use-case of distributed ledger technologies (DLT). In addition Web3 technologies such as artificial intelligence (AI), smart contracts, and the internet of things (IoT) represent an important category of applications within the DLT adoption and Web3 ecosystem. This has led to DAOs now affecting global regulatory policies and design as well as being considered within EU's Rolling ICT Plan principles of being "digital by design".

Relative to traditional organizational structures such as Limited Companies and LLCs, DAOs may offer a way to achieve greater transparency, trust, adaptability and speed. DAOs attempt to decentralize the operation of companies and other collective entities by making functional and financial information transparent and empowering token-holding members to propose, vote on and enact changes. DAOs do not currently have comprehensive governance framework with clear and direct lines of responsibility and accountability for their functions and activities. This contrasts with their traditional, off-chain counterparts whose governance framework and structures have been defined and cemented over the last centuries by industry and Government.

In the void of a standardised, accepted structure and governance model for a DAO, a unique opportunity presented itself to potential users/societal members to create and themselves define the DAOs structure via consensus mechanisms, made active via tokens and employment of smart contracts established on a continuously evolving set of rules for the organization through vote-based decision making. This has led to a wide range of differently configured and operating DAOs across the world that has presented challenges to the DAO members with:

- operating in the real world
- working with different DAOs
- scaling of the DAO itself

For the purpose of this exercise, and in the void of a standardized definition by Standard Development Organizations (SDOs), we shall define a Decentralised Autonomous Organisations (DAOs) as a virtual, on chain, digital, for-profit commercial entity or not-for-profit entity, representing a manifestation of multiple actors from different backgrounds, jurisdictions and disciplines with a broad spectrum of drivers and requirements, but a harmonised common interest and/or goal, that by a consensus mechanism, and allocating satisfaction with the manner in which they process their rights and wield those rights within the entity, perform and carry out the entities operations.

To add depth and completeness a definition by the US Department of the Treasury is also hereby offered. It described a DAO as a system of administration that operates according to a set of encoded and transparent rules or smart contracts (2022). It is an organisation that does not have a hierarchical decision-making process, for example through a board. Instead, decisions are made on the basis of members' votes and subsequently recorded in a programming code, known as a smart contract. The DAO operates on the basis of these smart contracts. The smart contract defines the rules of the organisation and holds the DAO's "treasury" (the funds held by the DAO to achieve its objectives). It can include, for example, rules on who may launch or vote on proposals and how the treasury is disbursed. Smart contracts can only be changed through a vote by the DAO's members. Any matter may be put to the members' vote, including hiring employees, product development, strategy, investments and fundraising. However, the range of decisions that can be put to the vote depends on the DAO's mission.

A DAO''s legal and/or organisational structure, size, rules and goals may vary very significantly between different DAOs. It is important to delve further in one aspect of a DAO and describe exactly what is held as funds in the DAO's "treasury". DAOs issue tokens as a tool of functionality having the member's rights attached to it, such as the mechanism by which votes are cast for governance and as an incentivization tool which may or may not have a "monetary" value. These tokens may also be categorised as digital or crypto-assets, as defined in the proposed MiCA Regulation, as digital representations of a value or right that may be transferred and stored electronically, using distributed ledger technology or similar technology. They may also receive, hold in custody, clear and settle and transfer these crypto-assets.

Studying the current myriad of DAOs is to gain an understanding of the need for minimal, open-source standards, especially for governance and possibly smart contracts employed by DAOs. The use of the combination of technologies by DAOs, their applications, their adoption in different sectors of the market fits into the Rolling Plan for ICT Standardisation. To assist in structuring this complicated landscape it would be useful to adopt a standardized definition by Standard Development Organizations (SDOs), Therefore it is necessary to consider the merits of SDOs taking up the call to define those standards. Furthermore, this project is necessary and timely due to the ambition of the EU for European Blockchain Service Infrastructure (EBSI)

going live across the 29 member states. DAOs could become part of the decentralized public service that EBSI can perform, in line with the EU Policy and Rolling Plan requirements.

Currently there is a proliferation of ventures of all sizes in the digital society. Open-source communities and a few private-closed communities represent a fact of innovation and evolution in benefit of the wholeness and oneness of the global community accessing technology on a more increasing frequency. This allows the frontiers of what is possible within our physical world to be challenged and stretched via online, real-time interactions between different actors across jurisdictions and communities.

These self-empowered structures that DAOs are navigating, clearly showcase the way this decentralised ecosystem is flourishing. They interact in real time in a seamless blending of the digital and physical world. Operating across finance, technology and social media, DAOs have expanded rapidly in recent years. In 2021 alone, the value of DAO treasuries surged by a factor of 40, from $380 million to $16 billion. Today, the analytics site DeepDAO estimates that DAO treasuries total $18.4 billion. What is the appeal of the DAO that is leading to this unprecedented growth?

What has been ascertained through research work, via first hand interviews such as with founders of Blue Future Organization, the founder of OBADA, Hedera Head of Development which includes DAOs oversight and management, and second-hand sources, is that those individuals who belong to a DAO, joined voluntarily a group that was borderless and agnostic to anyone joining. It does not matter where or who you are, your background, privileges, life choices nor physical characteristics, their right to join was determined by whether the gatekeepers believed the individual resonated in the stated “north star”, the shared goal and mission of the DAO, referred to as the common mission. It can be argued that a DAO is truly meritocratic. This attribute of DAOs is one of the factors quoted by several of the founding members of DAOs during the research, as a determining factor when choosing this specific structure for the organization.

Further it is to be noted, that the individual on joining the DAO was exercising their “free will” and affirming their right to assimilate, to be part of a community that gave them a certain amount of self-agency and sovereignty. When asked the respondents explained that this gave them an element of control, that is currently opaque in general economic societies. They believed that they were consciously choosing to be part of a tribe where they were able to affect change in some form, have a positive impact on society, their communities and/or the environment whilst simultaneously being able to participate in an incentivize mechanism, albeit that incentive may not actually be linked to a monetary value at all but rather an intrinsic benefit, which the participant ranked highly. For example, this could be the planet somehow benefitting from their inclusion in the DAO and the incentivizing mechanism propelling them to be an active participant in the process of voting. Being a participant of the DAO they were able to determine the outcome of their participation, receive immediate gratification and firsthand experience with lucid comprehension the direct consequence of their action.

Essential Functions of a DAO:

By breaking down the essential functionalities of a DAOs different elements we can understand the benefits they offer to the participants.

DAOs aim to create decentralized, transparent, and democratic organizations that can operate autonomously, without geographical boundaries, without intermediaries and no central authorities. By leveraging the emerging Web3 technologies communities, corporations, and/or any type of collective organization can determine and impose their will on the way the organization is run. This creates resource efficiencies and give users greater control over how their data is used, addressing privacy and security concerns. A commercial advantage for an organisation by automating functions is efficiency of processes and devolving decision-making, which can potentially free up management time and introduce cost savings.

In addition to broadening participation in governance, DAOs may also benefit from low barriers to entry and exit, speed, adaptability, transparency and more. With membership in many DAOs conditioned upon token ownership, individuals can join a DAO simply by purchasing a governance token or as is seen frequently in Impact DAOs, receiving a token in exchange for a specified engagement or services.

DAOs may also benefit from a high degree of customizability; however, this, too, is an area that is still developing. They may benefit from enhanced transparency and automation for those able to interrogate the technology. With important information accessible to all with sufficient expertise, DAOs can benefit from this high degree of access. On a related point, making use of smart contracts, or automatically executing promissory code, DAOs can also benefit from disintermediation and increased efficiency.

Although every DAO is built on the premise of distributed “ownership” and decision making, various voting mechanisms exist in practice adding various levels of further decentralisation. DAO framework facilitates collaboration and community engagement among all members. What remains to be seen is are DAOs suitable for use in all sectors and use cases and can they be used to unlock funding and global collaboration for various idealistic, cultural and economic activities? The funding of DAOs is often based on the sale of native tokens and NFTs in accordance with the Blockchain Council.

Unlike traditional corporate structures that have been defined over the course of many iterations of experimental design and best practice of employment within industry and economies over the previous centuries, how a DAO is structured is entirely up to the community that codes it. This flexibility allows for any number of organizational permutations and incentives to be coded, but because these systems are novel, the longer-term outcomes of these design choices are often yet to be determined. While somewhat limited, off-the-shelf governance frameworks are now available such as Hedera’s Hashiodao, as well as a developing ecosystem of business supporting DAO tooling, are growing to help communities develop a DAO that suits their needs.

As DOAs continue to grow in number, the question is answered to their suitable use in all sectors and a distinct number of structures around themes and sectors are emerging. Creation of a DAO is dependent on the community's shared goal, and factoring this in makes categorization of the type of DAOs possible. Main types of emerging DAOs are listed below:

- **Algorithm DAOs:** seek to utilize algorithms to solve specific challenges, such as trading. Examples include PowerPool and dHEDGE.
- **Media DAOs:** are designed to develop a more democratic structure to media. These DAOs count BanklessDAO and Decrypt among their ranks.
- **Protocol DAOs:** govern a platform, exchange, or application. Some well-known examples include Bitcoin, Ethereum, Uniswap, Compound, and Yearn.
- **Philanthropy DAOs:** aim to facilitate a philanthropic cause, organizations such as UkraineDAO vote and fund projects. GitcoinDAO, MolochDAO, EduDAO, KlimaDAO, LexPunk
- **Grant DAOs:** fund projects based on their established protocol and grant applications. MakerDAO, Big Green DAO are examples.
- **Special Purpose Acquisition DAO (SPAD)/Collector DAOs:** are created to make a collective investment into a valuable asset often a unique item or other companies. Well-known examples include ConstitutionDAO, SpiceDAO
- **Social DAOs**: seek to build collectives or groups to solve specific challenges or simply to create communities. Production DAOs that compensate people for the work they do (dOrg, HumanDAO, Yield Guild Games, Mirror, MODA, Audius, Nouns, Squiggle), Community that facilitate networking (Friends With Benefits, Bored Ape Yacht Club, LexDAO, Bankless) and Flasmobs whereby people come together at a place and/or time are all examples of Social DAOs.
- **Investment/Venture DAOs:** much like traditional investments, aim to work together to make smarter investments. Boost VC and the LAO fall into this category. Metacartel, Olympus Pro, Pleasr, Flamingo, Whale, CityDAO
- **DSaaS:** seeks to provide decentralized software as a service. Examples of this include Aragon and Colony.
- **Real-world asset DAOs:** manage physical or digital assets and make decisions related to the management of those assets (ownership, maintenance, and utilization). Real-world asset DAOs can be used for various purposes, from managing investment portfolios to jointly owning and managing real-world properties or valuable digital assets like NFT collections. Examples include Lofty
- **SubDAOs:** aim to address the operational challenges of delegating responsibilities while preserving decentralization. The main idea behind a SubDAO is to establish independent groups or divisions within a DAO, each with its own foundation and ownership structure, while still being connected to the parent DAO in terms of mission and goals.

- **Impact DAOs:** aims to effecting positive social change, help end wars, alleviate global poverty, build and strengthen local communities, streamline charitable giving, contribute to environmental sustainability and more. Impact DAOs are developing well-defined strategies to achieve their ends effecting positive social change. Gitcoin DAO, and the Blue Future Organization (BFO) are examples of this.

Additionally, for DAOs to operate effectively processes and roles assigned to those are emerging that often can be inferred from traditional organizational structures and are adapted for purpose to the DAO ecosystem requirements. Each individual works as part of the collective, totally decentralized being agile and the norm is to be available when needed to the DAO for consultation and voting on demand. Examples of DAO stakeholders are listed below.

- Members: Individuals and organizations who hold tokens or shares. This gives them voting power in decision-making, depending on the DAO's rules.
- Proposal makers: Members who suggest projects to the DAO through official channels seeking funding or support.
- Curators: These members are responsible for evaluating proposals and making recommendations before these proposals are put to the vote.
- Voters: Often the DAO's token holders (stakeholders), these members can vote on proposals made in the DAO's ecosystem.
- Stewards: Tasked with the role of implementing the decisions made by the DAO community, they work to ensure that the DAO operates effectively.
- Working Groups: Cross-functional teams that are involved in specific projects (engineers, marketing team members, project managers, etc)

The above functionalities, structures and roles clearly demonstrate that DAOs greatly improve organizational agility, enabling community participants to collaborate, develop products and exploit new markets and emerging trends much faster than conventional corporations. DAOs enable and allow this which is part of their appeal for humanitarian, environmental focussed community groups to choose such a novel and dynamic virtual entity to operate within. It could be argued that these characteristics are why DAOs are the chosen vehicle for global initiatives that tackle environmental and sustainability concerns affecting positive change and building communities.

Social, Philanthropy and Grant DAOs, collectively all aligning with the aims of an Impact DAOs, can all be compared to have taken the place of traditional NGOs and Foundations. As DAOs are open to anyone who can demonstrate alignment with the DAOs missions, the collaborative ecosystem can address climate and sustainability challenges, advancing equity and inclusion across the whole spectrum of the seventeen Social Development Goals (SDGs), as outlined when adopted by the United Nations in 2015, driven by community initiatives by pooling resources be it within the DAO treasury, across the DAO eco-system or off chain with Research Institutions, Governments, Private Enterprises, NGOs, Foundations and citizens within the broader community both locally and globally. For example, DAOs align with, to

name a few, SDG 11, Sustainable Cities and Communities, SDG 13, Climate Action and even SDG 17, Partnerships as DAOs promote and implement global partnerships between different actors for sustainable development that traditional structures struggled with as being an active member within the DAO at many different levels motivates the members and drives sustainable action in practice.

These Impact DAOs achieve this through tapping into the creator economy principles enabling them to build a community around their practices, products and services, with DAO members guiding the development cycle and gaining a sense of shared ownership, feeling they are making a difference through self-agency and feeling that feeding their intrinsic values for the planet throughout their DAO engagement. The principle of shared ownership and incentivization also ensures that all participants are financially incentivized and rewarded for good community action by their DAO's success.

A clear example of this would be "…when a creator uploads their footage to a video sharing app, they get zero return on the intellectual property they share," says Michael Lukacs, Principal, National Services Tax at Ernst & Young LLP. A DAO would benefit the individual depending on the Governance mechanisms set up for that DAO. If the DAO is following the principles of creator economy and the uploader was to be rewarded with a fee for the IP rights to be transferred to the DAO he would become part of the data economy. However, if the picture uploaded for example was of a company tipping waste into the Seas and the DAO had set a monetary reward for that the uploader, he would be able to earn a fee for the whistleblowing action and earn reputational tokens also further incentivizing the individual to remain anonymous and vigilant for the community.

Environmental sustainability is a global goal that we must all address as a global community and any action that unites global actors under one organisation with automation of governance and consensus operating models will have a positive societal impact. In traditional off chain organisations, it is mostly impossible to have seamless, real-time voting mechanisms achieving a consensus on the action plan across different jurisdictions seamlessly and simultaneously with tamper proof auditable trail.

DAOs are less people-focussed with regards to their administrative processes, less of a burden with traditional consumption of resources therefore free those resources whether it be human or technological for other uses and decrease our dependencies on them and has the potential of putting industrial development on fundamentally new grounds. It is to be noted that social responsibility cannot be automated completely, but the individual steps that are a part of the social responsibility can be automated and performed online therefore reducing the environmental impact of such nominative actions. Furthermore, DAOs enable a multijurisdictional circumstance simultaneously, which reduces the need for individual companies acting in each jurisdiction separately to tackle the environmental challenge. Decentralized governance can have a massive societal impact and lead to an equitable, sustainable world. It drives financial inclusion and puts automatic decision-making at the fore.

Inherently DAOs attributes and facets assist circular economies and donut economies to fulfil their mandate to support the renewal of local industry and assist us all with the digital transition,

by driving green innovation and increasing competitiveness, all of which are key elements of the European Green Deal. Circular DAO, OBADA, Protokol are all examples.

A recent initiative named Greenius by UrbanGo based in the Netherlands, are in the process of creating a DAO for supply chains to affect sustainability within the global value chain and bring together the multi-jurisdictional stakeholders in a novel way to not only promote sustainability in practice but also circularity. The DAO will have a variety of different offerings that will be promoting both a circular and donut economy. For example, one offering would be to match an end-of-life product with a recycler of that product or the components of that product and thus effect the circular economy.

Studying the above highlighted and documented attributes of a DAO we can conclude that DAOs do adhere to the OECD's definition of "digital by design". Digital by design is the principle by which digital technologies and data are leveraged to rethink and re-engineer public processes, simplify procedures and create new channels of communication and engagement with public stakeholders. This is key to the digital revolution of governments themselves as the need to reduce costs and optimize efficiencies is a paramount concern especially when European Governments are now focusing their policies on sustainable practices and are citizen centric. DAOs can be arguably a natural fit to continue the of efforts of the EU to support the Digital Decade that are providing modernisation of the Infrastructures via EBSI & the efforts of European Interoperability Reference Architecture (EIRA©). That said to truly understand if DAOs can be a vehicle of choice and be deployed by Governments we must evaluate the limitations of DAOs.

Limitation of DAO functionalities and Governance:

DAOs are a typical example of how innovation is running ahead of what already exists in the physical world, and the virtual world empowering citizens to be more involved in democratic life. There are DAOs which employ multiple technologies, co-existing within the online community, such as DLT with edge computing, cloud computing, kron computing, CitiVerse environments and they are a perfect example of how blockchain and other distributed ledger technologies are in fact being used to further human endeavours within the digital and physical world.

With this innovative leap forward comes some real-world limitations. Some of the most popular DAOs (Uniswap, Polkadot, Cosmos, and Binance Smart Chain) all have unique advantages and limitations. While this diversity is beneficial for innovation, it can also lead to fragmentation and inefficiency. By engaging a vast rostrum of members in governance decisions, DAOs can create inefficiencies, as compared to a traditional company that meets and decisions are made relatively instantly by the Board. Without clearly defined roles, many DAOs face coordination challenges compounded by technology limitation because just like the DLTs on which DAOs operate, they also confront limitations of scalability both technological and by effect membership, as experienced by Ukraine DAO when member onboarding became problematic, a common phenomenon with community DAOs.

Cybersecurity vulnerabilities as well as adversarial challenges such as protocol-level attacks, and inadequate tooling, can prevent some DAOs from efficiently performing necessary functions. Other limitations come in the form of a concentration of power whereby resource rich minority vote in their own interest and despite best efforts by the DAO voter apathy. Both distort the reliability and truly reflection of the intent of the DAO members.

It is notable that this risk is also present in traditional organizations. DAOs by their design may also unintentionally violate privacy of the voter through the transparent recording of their actions. A well-run DAO should serve as a transparent platform wherein individuals can still maintain control over their personal data and their identities (Soltani et al., 2021). For many the lack of clarity and rigor of standardized governance and practices employed by DAOs translate into their operations being opaque. This makes it difficult for participants to fully understand the risks especially as the most acutely limitation of DAOs is that they confront a lack of legal, standardization and regulatory clarity.

This combination of technologies, their applications, their adoption in different sectors of the market fits into the EU's Rolling Plan for ICT Standardisation. The deployment, evolution of DLT technologies and the innovation introduced by them as highlighted by this report thus far the report will now delve into lack of difficulties of interoperability, lack of standardisation, legal clarity and regulatory implications of the advancements an innovation.

There are currently no standards from SDOs which help to harmonise the tremendous eco-system of DAOs, or their impact in both a social and economic manner. The need for Standardization for DAOs and the technologies that they employ and are integral to their existence, is clear and why the International Standards Organization (ISO) through the Technical Committee (TC) 307 are now in fervently carrying out the work necessary to bring to market the much required and anticipated standards along with and INATBA and other SDOs.

The EU, and by extension SDOs, understand that the social experiment that DAOs belong to has reached critical mass and now to successfully navigate the next stage of the experiment standards are now essential to harmonise the adoption of these novel technologies into traditional sectors and economies. Standardization is the process of developing, promoting and possibly mandating standards and compatible technologies and processes within an industry. Technology standards focus on ensuring quality, consistency, compatibility, interoperability and safety.

Standards create concrete benchmarks based on a consensus reached by a variety of different experts from a variety of backgrounds and verticals creating a field of collective industry specific knowledge that through a process of accepted norms can be revisited and updated as industry develops and evolves.

ISO standards set out requirements or guidance to help organizations manage their policies and processes to achieve specific objectives. Any company, traditional or novel, complying with an accepted set of published standards can augment a company's status, solidify a customer confidence in the company's products and services, adding to the company's operational efficiency.

As this report details a major drawback and limitation of a DAO is the fact that as each one employs its own governance therefore becoming a separate and individual network, with its own set of rules and features. This fact, as discussed, allows for flexibility and members to create a fit-for-purpose structure and by default creates silos of communication for DAOs, creating a fragmented digital eco system. The key to achieving integration is a connected Web3 ecosystem and standards that facilitate interoperability, allowing communication between the DAOs, decentralised applications and the rest of the on-chain ecosystem. Efficient automated data sharing between applications, databases, and other computer systems is a crucial component throughout networked computerized systems.

Before moving on to examine interoperability at length, to conclude this section regarding the limitation of DAOs it must be note that there are limitations caused by biases that do limit accessibility to and membership of a DAO which affect true global representation and inclusion and therefore by default the meritocracy DAOs are so proud of. As with any new and shiny advance we must first accept and understand where potential biases can occur, highlight them, and then address those areas to minimize the bias, even when the bias is unintended and an inherent feature of life itself because we can all agree where there is human intervention there is always a possibility for biases to exist.

In this instance those biases include but are not limited to, language of the DAOs members and the language that it communicates in being a limiting factor, at least for now, and discoverability of the DAO not being common outside the ecosystem. Accessibility to technology is a limiting factor as a DAOs lives only online and participation can only thus be possible if you have access to technology that hosts and allows access to the DAO. Rules of acceptance for individuals into the DAO are programmed into the code of governance and ultimately the bias is created at the human element that creates and manages the code. Those humans will inevitably be responsible for setting those rules and therefore a certain amount of bias will be present when those individuals decide the parameters of this governance must be factored in and enforced.

It is imperative to add a voice of caution. Although DAOs face many challenges in comparison with traditional centralized organizations, which have benefited from a long history of trial and error, DAOs are in experimental stage, especially experimenting in governance, and we must be careful not to stifle the process of innovation by applying standardization and regulation too quickly and be overly prescriptive, as the research and development is still ongoing. During this stage freedom to pursue different courses of action must be facilitated and allowed so that every permutation possible is conducted and the results studied and ingested by the actors within the of the social experiment, regulators, Governments and other stakeholders. This social experiment, although not neat and tidy, nor conducted by the manner. What is certain is that this experiment is naturally occurring, and the uptake continues to grow as in accordance with the World Bank's study in 2022, DAOs are now the fastest growing chosen commerce structure globally.

Interoperability in the DAO Ecosystem:

Why is there concern about interoperability of DAOs? The answer to that can be understood in the context of an exchange with the Kronians, who work within the Kron Computing tech team and the Head of Development at Hedera.

It was shared that Hedera created the basic models for Governance of DAOs that will exist on the Hedera Protocol. They wanted to unlock their protocol to a wider community than just the members of the DAO. By standardizing the governance, creators of the DOAs were able to quickly go to market by creating the DAO and getting on with the business of the DAO as by optimising their limited energy and resources instead of figuring out the basics of the Governance model.

In its very basic form, interoperability for DAOs are necessary to mitigate risks and inefficiencies such as compatibility, security, and governance. Compatibility is the degree to which different blockchains can work together without compromising their functionality or performance; security is the level of protection and assurance that different DLTs can provide; and governance is the process and mechanism by which different DLTs and DAOs can make decisions and resolve disputes.

Further examination of the necessity of interoperability indicates:

1.) Interoperability can increase the diversity and quality of the resources and services that DAOs can access and offer across different blockchains. A DAO that operates on a fast and cheap chain may face difficulties when interacting with a slow and expensive chain, or vice versa.
2.) Interoperability can enhance the security and resilience of DAOs by enabling them to distribute their assets and operations across multiple chains, reducing the risk of single-point failures or attacks.
3.) Interoperability can foster innovation and collaboration among DAOs by allowing them to share data, value, and logic with each other, creating synergies and network effects.

A plausible description of interoperability is put forth by HeavyAI and within the description supports SDOs efforts states two or more systems to be interoperable, they must be able to exchange, interpret, and present shared data in a way that is understood by the other. This is accomplished with the establishment of syntactic interoperability, which involves adopting a common data format and common data structure protocols, followed by semantic interoperability, which involves the addition of metadata that links each data element to a controlled, shared vocabulary. Within this shared vocabulary are associated links to an ontology, which is a data model that represents a set of concepts within a domain and the relationships among those concepts. The adoption of these common standards enables the transmission of meaningful information that is independent of any information system. The benefits of interoperability include increased productivity, reduced costs, and reduced errors. Applying this to DAOs we observe the following DAOs have a variety of approaches and

solutions available to achieve interoperability between blockchains. Bridges such as Polygon, for instance, are smart contracts or protocols that connect two or more blockchains, allowing the transfer of tokens or data.

These bridges can be centralized, decentralized, or hybrid, depending on the level of trust and security they offer. Cross-chain communication such as offered by Polkadot and Cosmos is another option, allowing smart contracts on different blockchains to invoke each other's functions and exchange information. This could enable more complex and dynamic interactions between DAOs, such as cross-chain governance or conditional transactions. Lastly, meta-protocols such as Universal Protocol and Interledger are frameworks or standards that define how different blockchains can interoperate with each other. These meta-protocols provide a common language and interface for blockchains to exchange data, value, and logic as well as coordinate their rules and policies.

Taking the above description as a basis of interoperability requirements we can take into account that to solve the issue of interoperability the EU have commissioned and built both EBSI as the blockchain and the European Interoperability Reference Architecture (EIRA©). EIRA© is an architecture content metamodel defining the most salient architectural building blocks (ABBs) needed to build interoperable e-government systems. The EIRA© provides a *common terminology* that can be used by people working for public administrations in various architecture and system development tasks and aims to become immersed in end-to-end design of EU integrated digital public services of the future.

The opportunities presented by cross-chain DAOs are profound and demonstrate why they are needed as the bridge that connects these blockchain islands, allowing them to harmoniously facilitate asset portability, enable scalability and promote risk mitigation. The EU commissioning EBSI and EIRA exemplify DAOs use of tokens, digital assets and the ability to provide services can only be realized globally when DAO members are able to transfer them not only within the DAO ecosystem but to a much broader global value chain. There are distributed computation and decentralized technologies like kron computing which extends the efficiency and optimize the computing resources in hybrid peer to peer infrastructure and use omni communication channels to give human interaction capabilities in real time and are blockchain holistic therefore making interoperability not only possible but take the debate of possibilities beyond the data protection and governance debates to the wider decentralized community and even making it possible for the intersections to create possibilities of interoperability when connected to legacy infrastructure systems. This was a key element in the for kron computing data flow processes to become part of the data flow standard within ISO, where named and included with the ISO TR 6277 (https://www.iso.org/standard/82158.html) and within ETSI Time Project (https://pdlwiki.etsi.org/index.php?title=PoC_03:_Timeless_in_Metaverse_Environment_based_on_Edge_networks_(TIME))

The challenges of making DAOs interoperable are varied. A DAO that relies on a bridge or cross-chain communication protocol may be exposed to the risk of losing funds or data if the

bridge or protocol is corrupted or attacked thus interoperability introduces new security concerns, as vulnerabilities in one blockchain could potentially affect connected chains. Robust security measures are essential to protect cross-chain DAOs

Building and maintaining cross-chain DAOs is a complex endeavour. Developers need to ensure compatibility with multiple blockchains, which can be time-consuming and resource intensive. DAOs that interact other DAOs or DLTs may face conflicts over rules, policies, or outcomes of their interaction, and may need a way to coordinate and align their interests and values. Decentralized governance across multiple blockchains requires coordination and decision-making processes that transcend individual networks. Effective governance models will be critical for the success of cross-chain DAOs which can revolutionize industries like finance, supply chain, and gaming, opening new possibilities for innovation and collaboration.

Legal and Tax Constraints of DAOs:

Another major flaw of the current paradigm is that DAOs due to their design are not an accepted company formation within the legal constitution of a country, except for a rare anomaly such as Wyoming, USA. DAOs present a huge challenge for legal systems, which struggle to apply existing concepts of corporate law, financial and non-financial reporting, corporate governance, and taxation to decentralised entities.

Traditional organizations are based on a legally enshrined and accepted set of rules and conduct, have a central authority that are accountable legally for actions of the company and the actors within the central authority are human individuals which belong to a particular jurisdiction who are held can be held answerable and liable on behalf of the company if the need arises in conjunction with the law of the land. In contrast, the legal framework that applies to a particular DAO will depend on precisely how the DAO has been constructed and from a legal perspective, therefore, it is not possible to treat all DAOs as traditional organizations are.

As DAOs are decentralized by design and based on a set of agreed rules coded into smart contracts, therefore most aspects of the organization's activities and governance can be programmed to run automatically using smart contracts, which can execute themselves in certain pre-determined circumstances with little human intervention. By entrusting processes to self-executing programs, rather than exercising active oversight, the founders or management of an organisation relinquish control of the process to the general body of participants which brings with it a complexity of accountability from a legal perspective.

In theory the members of a DAO can be all held accountable for the actions and businesses of the DAO and therefore open themselves up to unlimited liability financially, legal liability and unfathomable tax risk as there are currently about 13,000 DAOs in existence, with a combined total treasury (invested funds and liquid assets) of nearly US$23b, as of May 2023.

The precise legal status of this type of business organization is generally unclear (Pranata and Tehrani, 2022), and may vary by jurisdiction. A ruling by the SEC in 2017 was adverse and found that the DAO may constitute an illegal offer of unregistered securities. Nevertheless, in 2021 Wyoming became the first US state to recognize DAOs as a legal entity, and CryptoFed DAO became the first business entity recognized as such. Although often of uncertain legal standing (Pranata and Tehrani, 2022; Tse 2020), a DAO may functionally be a corporation without legal status as a corporation: which is commonly and legally referred to as a general partnership. This partnership model may allow for acceptance from a regulatory standpoint; but still, any known participants or those at the interface between a DAO and traditional (regulated) financial systems, may be subject to prosecutorial measures by regulators if they violate various laws.

As such, DAOs tread a much more sensitive path than even cryptocurrencies in jurisdictions that might otherwise be favourably disposed towards DLT-based innovations, such as the United States. Securities, commodities, and taxation laws are carefully applied to major cryptocurrencies (SEC, CFTC and IRS being the enforcement authorities), but with DAOs, it is the complexity of organizational design oversight that has led them to receive at best a lukewarm response. It can be surmised that differentiation between the wider purpose of DAOs and other blockchain technologies has been inferred by regulators (digisprudence as per Diver, 2021), and this would make sense given that more recent concepts such as dApps and DeFi (Ushita and Angel, 2021; Wronka, 2021) bring much larger risks than mainstay cryptocurrencies (Bitcoin and Ether) would. Yet the more troubling basis are looking at governance in DAOs is in conundrums that have yet to be resolved.

Without this legal clarity and the ever-increasing range of DAO use cases, each with their own underlying assets and legal and tax considerations, means there is no single templated approach to risk mitigation. governance token holders can find even the most straightforward interactions with the physical, non-blockchain world impossible. For example, many commercially focused DAOs may to be subject to sales or business income tax.

Furthermore, without an established legal status for DAOs, however, holders are unable to register as a business or open a bank account, which can make filing a tax return by a DAO impossible. DAOs become most problematic at this intersection between the physical and virtual worlds. Government administrations are not capable of accepting payment in digital assets, for example, let alone allow a DAO protocol to collect tax receipts from digital-asset activity and forward those receipts to a tax administration.

The Web3 space has outpaced regulation, and founders are having to think outside of the norm to fit DAOs into a company registration framework that is centuries old. The need to build a regulatory framework and accepted minimum governance standards around the Web3 ecosystem is urgent and requires private-public partnerships among technologists, regulators, and entrepreneurs. If there ever was a call to action to save digital entrepreneurship this would be it.

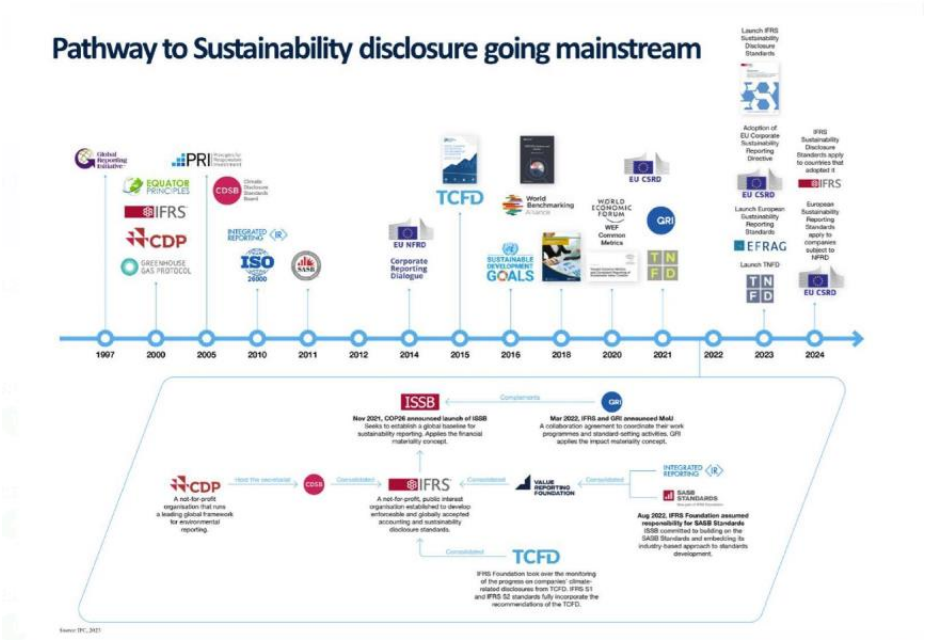
Conclusion:

DAOs, as presented within this report, are a here to stay as the future is digital. Although they face many challenges as they are a relatively new social experiment, DAOs are in effect democracy personified and have the potential to bring democracy to everything. They deliver a more inclusive and scalable means of organizing, governing and empowering transnational communities with a shared, common mission. Based on the latest technologies, they offer transparency and true decentralization, being relatively quick to set up regardless of the diverse geography that the founders may be in, as opposed to the tediously bureaucratic, static, legacy governance structures of traditional entities. Deploying smart contracts DAOs organize themselves effectively, streamlining voting via governance tokens and allocate a shared treasury. As a result, DAOs are the fastest growing global company structure and therefore the requirement for Governments and SDOs to meet their needs for clear and standardized terminology, governance frameworks, legal frameworks and processes is urgent. It is my recommendation that SDOs not only work towards the standard creations for DAOs but also harmonize their efforts across of the various Government initiatives, and SDOs so that the uptake of those standards is accelerated, and they will further facilitate interoperability across the DAO ecosystem.

Focusing the necessity of Standards inwards on DAOs, I took part in a Working Group 5 coll event relating to Governance in ISO TC 307 Plenary in Valladolid, Spain in June, 2024 which covers DLT, Blockchain and NFTs. In accordance with the needs highlighted during the research of this report a proposal of a new potential project for Governance of DAOs was presented by INATBA liaison officer during the Plenary. The importance of the project and its necessity was presented, and with my active support during the WG5 session, discourse was open and consolidated. The seeds were sown for a future Technical Specification of Governance for DAOs, and this can now evolve in due course alongside Governance for DLTs.

Impact DAOs numbers rising reflect that DAOs are emerging as a powerful, influential community force and are thus being favoured by organizations that are looking to affect ESG & sustainability. With traditional structures it is not so easy to call individuals for global action in real time, DAOs however overcome this limitation due to the characteristic of being agnostic to jurisdiction and anyone joining, is open to all who align with the stated mission. It is a vehicle that bypasses the traditional inefficiencies and barriers, especially capital market ones, to reach the corners of the world that struggle to access funding and deploy alternative energy sources. It is precisely these areas and the poor, vulnerable people that are affected disproportionately by negative geo-political events and climate change, called out in the UN Sustainable Development Goals report of 2023. The report also points out the impact of the climate crisis, the Ukraine War and ongoing effects of the COVID-19 pandemic has hindered progress towards the SDG 2030 and goes so far to say the SDGs are in peril, stating that technology and data are an integral part of the solution to enable a better future as envisaged by the seventeen SDGs, which are a blueprint for a more resilient, peaceful and inclusive future, which is the same rhetoric that galvanizes DAO communities.

This blueprint was the bedrock of the SDG Framework which outlined the implementation of systems, frameworks, and support from global, national, and local entities. and has uncannily been incorporated within the Governance of DAOs from the outset. Whether an onchain DAO or a traditional legacy company, the realization that companies must be sustainable has been the mantra since the 2015 Brundtland Commission that defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs.". This has led to a call out for planet, people and profit to take an equal footing in the design and implementation of business practices and requirements in non-financial information reporting. Sustainability in practice is now a necessity and has become embedded within the design of the current European regulatory framework, namely the Corporate Sustainability Directive Reporting (CSDR) and the Corporate Sustainability Due Diligence Directive (CSDDD), concerning environmental, social and governance (ESG) criteria.



The image above shows the various incoming Sustainability disclosures that have been implemented that are now affecting the Governance of ESG and DAOs are responding to.
Source: LinkedIn

This requirement for companies to be more transparent about their role in society and the effects their activities have on it has pushed the agenda for a more accountable corporate governance and once again DAOs have a natural affinity to this as they can respond to this requirement for a new governance structure. The key questions is "What is the optimal corporate governance design to achieve sustainability in terms of governance?"

If we look at foundational documents of the CSDR and CSDDD we will find that the elements that are named as essential parameters within the governance are stakeholder engagement and incentive mechanisms both of which are naturally part of DAOs. DAOs

through their governance tokens are not only able to incentivize community action but also much more inclusive and representative governance paradigm.

BFO, OBADA and Greenius are all examples of such DAOs whose core mission is sustainable action in practice, looking to leverage their global reach to drive sustainability and ensure their collective actions lead to even greater and more impactful positive effects on society and the environment at scale. The technologies that DAOs employ bring new capabilities to the missions they drive. Due to the DAOs being transparent by design, risks can be identified and those can be monitored, and their Governance structures being automated, each vote placed using the Governance token recorded, and the possibility of implementing a myriad of solutions for information exchange within the framework of Zero Knowledge Proof schemes explored. This can bring a certainty that DAO claims and results are credible, based on truthful, accurate and impartial information and not misleading, as they are evidence based and both the evidence and methodology can be verified independently as the supporting information is available when required if proper interoperability policies are in place for off-chain and on-chain circumstances.

As the DAO ecosystem continues to evolve and address the myriads of challenges, it would be beneficial to continue this study of the role DAOs will play to enhance and effect the “G” within ESG. Traditional company structures may also benefit from the evolution of DAO governance and be able to take away a number of iterations for their own use. For example, a traditional listed company with a large number of employees may put in place an incentive mechanism that can work as an ad-hoc DAO if the common interest are aligned with the business interests of the company. Another example is the board of directors create an alternative committee as an ad-hoc DAO that intricates all the advantages of a traditional company and tackles the disadvantages of that legacy structure (such as avoid biased decision and centralized information). This ad-hoc DAO life can be terminated and that demonstrates multiple choice of various typologies of DAOs and the dynamic evolution of this ecosystem.