Blockchain for Organising Effective Grass-Roots Actions on a Global Commons: Saving The Planet

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Abstract

An overwhelming majority of experts has been flagging for decades that "Saving the Planet" requires immediate, persistent and drastic action to curb a variety of catastrophic risks over the 21st century. However, despite compelling evidence and a range of suggested solutions, transnational coordination of effective measures to protect our biosphere continues to fall short. To remedy, we propose a novel platform for addressing the central issue of affording trust, transparency and truth while minimising administrative overheads. This will empower an even loosely organised, global grass-roots community to coordinate a large-scale project on a shared goal ("Commons") spanning the digital and real world.

The Web3 concept is based on the swiftly emerging "Blockchain" and related cryptographic, distributed and permissionless technologies. "Wisdom of the crowds" mechanisms involving competitive parallelisation and prediction markets are enabled by formalised reputation and staking to incentivise high-quality work, fair validation and best management practice.

While these mechanisms have been (mostly separately) applied to science, business, governance, web, sensor, information and communication technologies (ICT), our integrative approach around Blockchain-enabled 'operating principles and protocols' sets the basis for designing novel forms of potentially crowdfunded Decentralised Autonomous Organisations (DAOs).

Introduction

There is a markedly growing awareness and willingness in the general public to take action on complex global challenges. Climate change, biodiversity and environmental protection for the striking objective "Saving the Planet" represent the prime, real-world example elaborated in this paper. For many years, various communities have impressively succeeded in putting these vital topics on the political agenda [1-8]; yet, it turns out that governments are, somewhat inevitably, hesitant to implement effective measures that are urgently called for by knowledge leaders as their adverse short-term impact on economies and familiar life styles of their electorate would presumably deny them a next term in office [9].

By virtue of promoting their careers, most senior politicians are well versed in handling issues through legislation, negotiations, rhetoric or simply sitting them out, which applies well to securing their power and sway public opinions; but such conduct is evidently unfit for dealing (directly) with nature. In addition, mainstream news chiefly focusses on post-disaster reporting, thus letting preventive or preparative measures fade out of public attention, in particular if their outcome cannot be cast into catchy footage. Consequently, there is a glaring need to provide a tool to implement grass-roots led actions of global impact for the good of everybody.

"Saving the planet" may be deemed a prime, if not the ultimate example of a "Commons", which may be defined as a social practice of governing a resource, not by state or market, but by a community of individuals that self-governs the resource through institutions that it creates [10]. In the absence of a central organisation guided by a commercial interest, this Commons faces a list of serious challenges including decision making on significant funding between highly diverse interest groups, allocation of (financial and in-kind) resources, e.g., manpower and materials, management and governance. In parallel, such an organisation will have to vigilantly guard against operational inefficiency, corruption, monopolisation, nepotism and other unfair exploitation, which would be detrimental for the capability to raise crowdfunding and community engagement, and to deliver on its objectives.

This paper proposes a novel approach to efficiently stage global grass-roots initiatives towards "Saving the Planet" based on "Blockchain". This the Web3 [11] technology has gathered significant momentum since its first practical implementation "Bitcoin" in 2009 [12]. Through a strategic combination of cryptography and sourcing globally distributed computing resources from the crowd, this Distributed Ledger Technology[1] (DLT) uniquely bestows an unprecedented level of trust between potentially anonymous players without the need for a middleman. Hence, blockchain-enabled 'operating principles and protocols' can serve to pool stakeholders across physical and virtual environments, and provides the foundation for concerting actions on globally shared goals [13].

Bitcoin [12] has already become a (still quite volatile) store of value. Underlying blockchain concepts also bear further perspectives for monetary systems, accounting and supply chains [14, 15]. The introduction of the "Ethereum" blockchain [16] and a cohort of its derivatives after Bitcoin has significantly extended the application space of DLTs. Ethereum's conceptually "Turing-complete" virtual machine [17] can execute "smart contracts", which can be described as "programmable money" by encoding conditionals for transactions of cryptocurrencies on a time-stamped, unforgeable ledger. Of particular interest has been the recent emergence of decentralised Finance ("DeFi") and the introduction of relatively stable, fiat-currency pegged tokens [18-20].

By now, a remarkable variety of (decentralised) applications ("DApps") [21] has been crafted on top of these smart contracts. While some of them pursue a direct commercial focus, blockchain could also be implemented to increase the sustainability of businesses, e.g., for promoting 'greenness' and enabling traceability, fair trade and supply chain transparency [14, 22, 23]. Other initiatives are currently being assessed to deliver 'socially responsible' Commons, e.g., in enabling digital audit and disclosure capabilities, informing platform governance protocols and new measures of fairness in food security contexts [24]. Yet, the overwhelming majority of these designated, typically Ethereum based applications are still geared for the advancement of blockchain and its immediate cryptoeconomic ecosystem, e.g., for governance [25, 26], prediction markets [27], bounty networks [28], crowdsourcing [29], crowdfunding [30], data handling [31-33], privacy [34] and gaming [35].

[1] While the terms Blockchain and DLT are used interchangeably in this paper, strictly speaking, DLT also includes ledger technologies (such as Hashgraph) that do not technically use "blocks".

In focusing on the practicalities of such implementations versus conventional solutions offered by existing processes [36], it seems to be just a matter of time before blockchain solutions will widely materialise in the virtual worlds of financial transactions, accounting, supply chains, data and information. In 2016, the first Decentralised Autonomous Organisation ("TheDAO" or Đ) [37] was launched; while the original DAO was short-lived for reasons [38] also discussed later, we still want to resort to strong elements of its underlying idea.

This paper elaborates a best-practice, blockchain-based approach for establishing "trust" and finding "truth" as the backbone of a global Commons, which operates and delivers in the material world. Such a novel type of DAO needs to be soundly firewalled against unintentional error and manipulation, whether by abuse of assets or misdirection of objectives. Within smart contracts, so-called "oracles" [39] enact automatic decision making based on inputs; a major vulnerability lies in forged or biased information furnished by humans on the "state of the world", including records, and physical sensors. To this end, we suggest how "truth" and intimately related "trust" can be provided at the interface of blockchain with the real world by the mechanisms of "competitive parallelisation" of work and "wisdom of the crowds" (also referred to as "collective intelligence") enabled prediction markets.

Commons

Structure

The basic elements involved in delivering on a project addressing a shared goal, with the prominent case of "Saving the Planet", are displayed in Figure 1. There is a set of historic records and a wide range of "sensors", i.e., devices that spatio-temporarily characterise the physico-chemical quantity, that feed models with real-world data that are processed into information. Their interpretation guides the selection of projects, which may operate in the political domain, e.g., protests and lobbying, fundraising, projects to physically address a problem, e.g., cleaning up land and oceans, or Research and Technology Development (RTD) for creating novel solutions, e.g., negative emission technologies (NETs) to remove greenhouse gases from the atmosphere or to improve simulation models, for advising subsequent decision making.

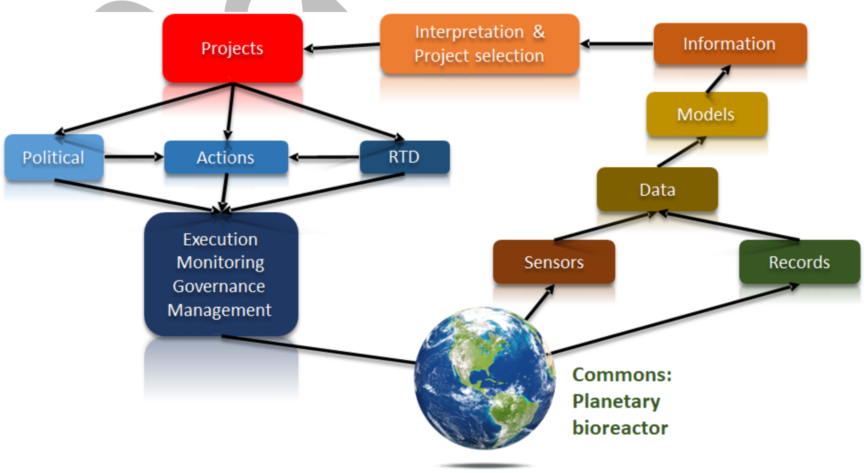

Figure 1 Organisational structure of "Commons" with blockchain-enabled trust finding mechanisms. In order to gear a best-practice for "Saving the planet", first data about the "state of the world" is collected from sensors and records in order to feed models. These models provide information, which can be interpreted by (expert) groups or artificial intelligence (AI), e.g., to identify "quick win" (physical) actions that are likely to make a direct, highly beneficial impact on the environment at good value for money, measures to influence policies or research and

technology development (RTD). These projects are then executed, managed, monitored and governed, and the circle reinitiates with the next round of measurement, analysis, selection, delivery and assessment of projects.

These measures need to source “workers” for execution, monitoring and management of tasks, and for performing governance. While Commons tend to activate an extraordinary level of volunteers and in-kind support, especially physical actions, RTD and publicity involve significant expenses, e.g., for professional services, infrastructure and materials. Even more than in a pure financial investment, and similar to charities, it is critical for the positive spirit and engagement of the participating community that resources are spent as wisely, fairly, efficiently and transparently as possible, while only grudgingly accepting somewhat inevitable friction losses.

Commercial Objectives versus Commons

Whether in the real world or on the virtual blockchain, there are projects that cannot be (entirely) carried out by volunteers and donations. In the case where there is a commercial promise for a project, funding may be raised by private equity or shares in a company through an initial public offering (IPO). A similar, yet legally not fully elaborated tool [40, 41], called initial coin offering (ICO, with a “coin” mostly referring to a so-called “ERC20” token on the Ethereum blockchain) has been implemented for numerous blockchain-based projects.

Such ICOs may be deemed an intermediate of crowdfunding and an IPO. While pros and cons of such token economies have been discussed [42], a Commons, such as “Saving the Planet”, distinguishes from commercially directed endeavours by a fiscally unfavourable “return-on-investment”, even upon a successful “completion”. A global Commons would actually contribute to the good of mankind, rather than focussing on generating (individual) wealth or oligopolies, and also those who have not provided funding (or even opposed it) will benefit in the end.

Still, governments and charities already allocate significant, but by far insufficient funding to such planet-saving initiatives, including subsidies, tax relief and support for charities or non-government organisations (NGOs), if compliance with a certain set of rules and proper governance can credibly be demonstrated. As compelling unique selling point (USP) for a blockchain-based implementation, the DAO offers fully transparent accounting and transactions based on a tamper-free distributed ledger requiring only minimum administrative overhead and eliminating middlemen. Furthermore, through “certification” of efficient spending, good procedural practices, high transparency and regulatory / legal compliance, such a novel DAO may attract major crowdfunding from individuals, organisations and governments.

Challenges for Implementing Real-World Commons

It is critical that all participants of such projects are appropriately incentivised to deliver their contributions at the highest level of quality, efficiency and honesty. This is a notable challenge in Commons as its contributors are not listed on the payroll of a traditional centralised organisation where a solid commitment may be linked to attractive contracts, longer-term career perspectives and social pressure of co-located colleagues. Instead, the global distribution of players may be characterised by a certain level of anonymity and lack of daily oversight, which bears a significant risk of defocussing and malevolent exploitation. Simply speaking, all contributions from real-world sources, especially when involving humans, whether work, data or expertise, might be flawed, either to unfairly collect rewards, e.g., for poor-quality or entirely fabricated contributions, to introduce a bias to undermine overall project objectives, or simply by inadvertent error. A solid method of validation is, therefore, key to project success.

Truth Finding through ”Wisdom of the Crowds”

This section reviews where “wisdom of the crowds” mechanisms already underpin important mechanisms in the real world before interweaving them through the blockchain-based tools as outlined in the subsequent section.

Business

The persistent success of market economies over the last millennia. When embedded in a somewhat regulated, level-play landscape, it well proven that monetary rewards issued in a competitive process are best suited to attract, direct and steer efforts; they typically induce efficient (even though not perfect) self-organisation and validation. Governments impose a set of rules to minimise adverse effects of raw capitalism such as formation monopolies, exploitation of work force and the toll on the environment. Market economies further rely on the concept of “wisdom of the crowds” based prediction markets, as, for example, epitomised by stock exchanges, financial futures, opinion polls and betting agencies. In these markets, a diverse community of stakeholders, preferentially those with expertise and some “skin in the game”, e.g., through their assets or reputation, advise decision making by taking a collective punt at future (eventually economic) prospects such as return on investment.

Web2.0

Access to “wisdom of the crowds” has been implemented very successfully in the form of Web2.0 platforms, for instance through social media (e.g., “likes”, “followers”), online shopping and travel (e.g., “rating”, “comments”). Perceived quality and conciseness of information can generate, for example, positive customer recommendations and reviews, social influence, and high rating levels in terms of engagement with an app [43, 44]. Even though these systems appear to be easy to manipulate, most portals have found ways to monitor and thus minimise forgery, whether driven by businesses or consumers. The information obtained from such forums has to be taken with a grain of salt, but can be very useful, especially in the paucity of other sources. For instance, a Web 2.0 platform to monitor disease outbreaks was able to indicate the onset of the Covid-19 pandemic at a very early stage [45-47]. There is also a trend towards “citizen science”, e.g., for involving the public in a puzzle-like protein folding challenge [48].

Science & RTD

The need for decision making in the absence of “absolute truth” particularly holds for the realm of explorative science and technology. Researchers typically start by pitching an idea or hypothesis that often roots in an assumption of an (at least partial) understanding of an underlying functional context, e.g., supported through a simplified model or initial data. By embedding this hypothesis into an attractive objective, e.g., to solve a technological problem addressing a market need, to cure a disease or to advance knowledge, researchers request funding for a project.

In most cases a panel of experts, who are not involved in the project, is consulted to objectively assess the opportunity, the proposed implementation plan and the requested resources. Upon their positive evaluation, the team carries out the project, and publishes or commercially exploits its results. The latter steps are normally preceded by a second tier of validation, e.g., through another panel of vetted peers or investors. Note that all steps within this sequence of project conception, planning, evaluation, implementation and dissemination are, in principle, prone to subjectivism, misjudgement and even fraud, whether from the originators or the assessors.

Science addresses the system-innate imperfection in truth finding by its decades-old peer-review system [49] and the requirement of transparent documentation in order to allow independent, multi-source validation. Even if fabricated work slips through, competitors are recognised for confirming and expanding important results, thus installing a second stage for effectively disguising fraud. So while manipulation is rarely sanctioned in the legal domain, abuse compromises reputation in the scientific community, which then, indirectly, affects future access to reward mechanisms such as funding, high-calibre journals and career promotions.

In the academic world, reputation is often quantified by metrics such as the amount of funding raised, the number of publications, their citations and the weighting according to the so-called “Hirsch” or *h*-index [50]. Similar procedures are employed by various “trusted” organisations for ranking universities and their departments [51, 52]. While their downsides have been well exposed, these metrics are still widely used as a coarse measure for the impact of researchers and institutions within their scientific / academic community. So while it certainly exhibits occasional flaws or friction losses, this reputation-based peer-review system may be deemed “best practice”, as confirmed by its persistence over many decades, if not centuries.

Also numerous platforms for fostering scientific collaboration have been successfully promoted. These, for instance, may share information, e.g., on genomic data, clinical research, elementary particles or astronomy; they may also provide open standards and protocols to enable competitive parallelisation of technical and scientific work and their validation. In applied RTD, the potential for global crowdsourcing will be further stimulated by globally ubiquitous resources for making “things”, by 3D printing and Fab Labs [53] as well as global cloud services for computing and artificial intelligence. For example, there have been several initiatives to establish open standards and development platform in specific research communities [54-60].

There have also been initiatives to create canonical standards for public or volunteered data in order to facilitate more open research. For example, the decentralised data exchange protocols OCEAN [31]; EDNA [61] allows individuals to bypass DNA aggregators such as 23andMe [62] to anonymously share DNA samples and be directly compensated by researchers.

ICT

In the scenario illustrated in Figure 1, in addition to the “human factor”, also hardware and software for acquiring and transmitting signals and data might be compromised. Evidently methods such as printing on packages or labels is not very secure. Alongside the fast expansion of the internet, various tamper-proof and privacy preserving cybersecurity technologies such as end-to-end encryption (E2EE) and decentralised mix networks have been created, protecting communication against eavesdropping and manipulation while retaining the privacy of all involved parties [63, 64]. One of the main issues is whether the hard- and software installed are genuine, and, even if they are, they may contain secret backdoors [65-68]. Electronic signatures implemented by cryptographic public-key schemes have proven to be effective. To authenticate ICT hardware, systems like Trusted Platform Modules (TPMs) [69, 70] have been introduced on endpoint devices that store cryptographic keys specific to the host system.

Software still provides a considerable vulnerability that has frequently been exploited, especially via downloading from insecure, fake online sources and email attachments. Various schemes have been implemented for verifying data integrity and authenticity; yet, online security experts would still discourage handling highly sensitive data such as passwords on computers that might have been tampered with, primarily through unauthorised online activities.

Sensors

The easiest entry gate for infringing data integrity in Figure 1 are physico-chemical sensors. As a very simple example, a temperature measurement might be rigged quite effortlessly by exhaling or holding a lighter near the sensor. Even normal environmental impacts, which are somewhat unavoidable during longer-term exposure to outdoor conditions, may "naturally" impair signal quality, e.g., by corrosion, biofouling, physical damage, power failure, flora or fauna.

Apart from regular maintenance checks, acceptable trust in data acquired by such physico-chemical sensors might be best instituted by pursuing a generalised form of "wisdom of the crowds" or *vires in numeris* (Latin: the strength in the numbers, a popular phase in cryptography) strategies. Instead of trusting a single unit or measurement, parallel, independently owned and operated sensor networks based on a repertoire of different functional / transduction principles should compete for monetary rewards and formalised reputation. Linked to provision of quality data displaying high spatio-temporal density, such "Big Data" may be efficiently validated, e.g., by artificial-intelligence (AI) supported consistency algorithms.

The issue of genuineness of sensor hardware is already addressed by various stakeholders. Other than for computer hardware, each class of sensor system tends to require individual anti-counterfeit technologies [71, 72]; their choice is determined by acceptable costs and the appeal to fraudsters. Sensor data can be made trustworthy through a combination of techniques to create accountability for its accuracy. Critically, it is important for sensors to adhere to a Proof of Location protocol. These protocols use radio signals, IP addresses, and artificial intelligence to ensure Location cannot be misrepresented.

Second, devices may use localised Proof of Stake networks to manage penalties and rewards for counterfeit or defective sensors. Sensors, as economic principals, must stake tokens (value) on the accuracy of their readings and their nearby peers may burn their tokens if they vote that the sensor is not providing accurate readings. Finally, audit has proven effective at managing accountability in general [73]. Other principles may nominate sensors for audit, and independent technicians, also compensated by tokens, can be prompted to perform checks and maintenance procedures for sensors.

Blockchain Platform

Toolbox

In the virtual world, blockchain has already succeeded to master projects within corporate structures for commercial objectives [74-76]. Especially Commons, so far primarily advancing DLTs and related applications, have been developed by rather loosely organised global communities of often purposely anonymous and autonomous players. Management and governance are frequently founded on certain democratic decision making mechanisms and jurisdiction [77]. Interestingly, the paramount issue of authenticity, e.g., for financial transactions on the blockchain, has been quite convincingly implemented through the above mentioned, cryptographically secured public-private key and file distribution schemes.

One of the most valuable tools available to blockchain communities is seigniorage, i.e., the difference between the value of new money and the cost required to create it. Modern governments use central banks to create new money, granting them the authority to decide how seigniorage is captured. Blockchain technology allows this to be decided in new and innovative ways, usually based on votes or other forms of transparent governance. It also enables precise microtransactions to underlie the seigniorage. For example, voters may ballot on policy to reward certain sensors, sensor-types, or geographic locations differently based on the collective needs of the Commons. The ultimate consequence of collectively-decided use of seigniorage incentivises free market behaviours for the benefit of the DAO's Common values.

Establishing trust at the heart of blockchains themselves relies on crowd-based mechanisms involving "skin in the game" schemes referred to as proof-of-work and proof-of-stake, respectively. In the meantime, the blockchain community has created an ample ecosystem encompassing formalised reputation and staking schemes [78], idea markets [79], bounty networks [28], token bonding curves [80, 81] and curation markets [82]. Stablecoins are available to tackle the volatility of crypto- against fiat currencies [83-85] and a huge community advances technologies to widen the blockchain-innate bottlenecks regarding scalability, transaction throughput [86-90] and interconnectivity [91, 92]. There are several blockchain portals to support scientific publishing [93, 94], and RTD [95, 96].

New interactive "Social Web" platforms that include cryptoeconomic incentivisation, objective vetting of experts via immutable reputation, track records and community-based validation of technological concepts will emerge. Data on the state of the world, e.g., obtained from simulation, historical records and "Internet of Things (IoT)" sensor networks [91, 97], can form the keystones of next-generation DAOs [98, 99] to (self-)organise conception, fundraising, selection, management, monitoring and governance [77, 98] of borderless grass-roots projects. Such organisation will efficiently funnel public engagement to successfully address the complex challenges of sustaining our global biosphere.

Overall, the blockchains providing smart contracts and manifold options for tokenisation [42], such as Ethereum [16], appear to be a natural choice as a blockchain platform.

Challenges

Scamming, exploitations, and poor governance constitute major setbacks for any project. Blockchain has already suffered, e.g., through the notorious hack of "TheDAO", the biggest crowdfunded project at its time having raised over $150 million from its more than 10,000 supporters [37, 38] in 2016. This attack concerned a clever exploitation of TheDAO's blockchain-encoded smart contract. In the meantime, there have been substantial improvements in smart contract security and other mitigation techniques, and even much larger projects raising several billion dollars have been launched [100, 101].

High-tech RTD projects are often classified according to the vagueness associated with value creation outcomes (conventional versus novel) and associated risk (low versus high) [102, 103]. Experimentation, in the face of uncertainty and risk, has been extensively studied in individual projects [104]. As a "Guinea pig" or genesis project, TheDAO undeniably exposed a major deficiency of DLTs; blockchain still struggles to find suitable test beds that can source a sufficiently large and diverse user base, including friendly and malicious actors, in particular when significant monetary incentives may irreversibly be siphoned off. Given the potential diversity of actors and their contributions here, platforms and associated governance protocols play key roles in ensuring equitable distribution of value, and in mitigating 'appropriability' concerns for specific use cases (e.g., safeguarding from opportunism) [103, 105].

Hence, Blockchain might learn some important lessons from well-proven procedures of risk management in the introduction of potentially hazardous products like medical devices and drugs, such as (pre-)clinical trials and triaging, which promise great benefit for mankind, but may entail fatal consequences. Similarly, the “code is law” paradigm propagated by certain blockchain communities might clash with legislation, and may undermine contingency plans usually required to mitigate the fall-out of unintended effects, for instance in relation to program bugs and abuse.

Newer blockchain technologies and networks, such as Telos [106], implement easily upgradable smart contracts and elected arbitrators to address the “code is law” challenges [107, 108]. The blockchain operators (miners or block producers) are expected to execute the orders of arbitrators, and if they reject to, they may be voted out by the token holders governing the network. Much like branches of government, these parties hold each other accountable with ultimate authority given to voting by token holders.

In addition to proper testing, their crowd-based fabric already suggests that blockchain concepts may only bear fruits once a certain economy-of-scale kicks in, including a critical mass of (initially) blockchain-agnostic regular users. In other words, platform-enabled leverage can trigger ‘flywheel-type’ effects with increasing membership. However, the strength of such ‘network effects’ can vary dramatically, with consequences for the nature of value creation and capture [109].

Many of blockchain’s USPs are simply not easy to get across to the general public as they often require substantial understanding and rethinking; this demand runs against the vast majority of potential users who are often completely unaware which concrete problems blockchain actually solves, and what would be the tangible advantage to make it worth the “hassle”. Undoubtedly, and arguably the largest hurdle to widespread success, there is still tremendous work required to sophisticate, validate and converge its constituent technologies in the real and virtual world, and find ways to clearly articulate this to the (arguably widely apathetic) general public.

Also lack of barrier-free access and rather poor user convenience presently pose major impediments to the ‘’scale out” of DLTs. It might be fair to compare the maturity of this Web3 technology with the internet in the first half of the 1990s when it needed the combination of the WWW, HTML, ICT infrastructure, software support, affordable hardware and disruptive business ideas like social media and the formation of unprecedented “superorganisations” such as Google, Apple and Amazon to leverage the present age of information. Undoubtedly, underpinning cryptoeconomic Web3 concepts still require substantial optimisation and streamlining towards real-world viability including user convenience.

Another challenge represents the significant power consumption required to secure first-generation blockchains by “Proof of Work”. Newer protocols such as “Proof of Stake” or “Delegated Proof of Stake” [110], massively reduce the environmental footprint.

As for many blockchain-based technologies, there is also a risk of compromising financial regulation, e.g., whether (U.S.) securities laws may apply to virtual organisations [41] and their related tokens. In response to these legal issues, models like dual token sales [40] have been elaborated. Volatility and taxation of crypto-assets as well as regulatory compliance, e.g., on DAOs, tokens and prediction markets, and their anchoring in legal frameworks, e.g., regarding intellectual property rights (IPR) and the status of organisations that cannot easily be assigned to a specific country, need to be resolved. Also the promise that blockchain tokens may fulfil a future “utility” within its superordinate “ecosystem” has not materialised thus far.

Despite these significant challenges, there are significant developments towards government-sanctioned blockchain technologies in numerous countries, e.g., in Germany

[111, 112]. The world of investors seems to be divided on the future prospect of “crypto” enabled businesses into enthusiastic supporters and fierce critics [113].

Grass-Roots Driven Solutions for Saving the Planet

Even in the face of striking evidence that has amassed up over recent decades [1-3], governments are unable or reluctant to internationally fund, coordinate and implement urgent countermeasures to effectively mitigate severe consequences for mankind. The most jarring example is the immediate need to enact measures for shielding the global biosphere from detrimental and irreversible changes to its climate and biodiversity, and thus to guarantee a safe habitat and food supply for future generations. As opposed to other catastrophic scenarios like pandemics, the consequences on our vital ecosphere reach too far in the future and do not offer any substantial return-on-investment for private stakeholders; so taking effective, but possibly painful immediate actions is likely to seriously jeopardise re-election of governments [9].

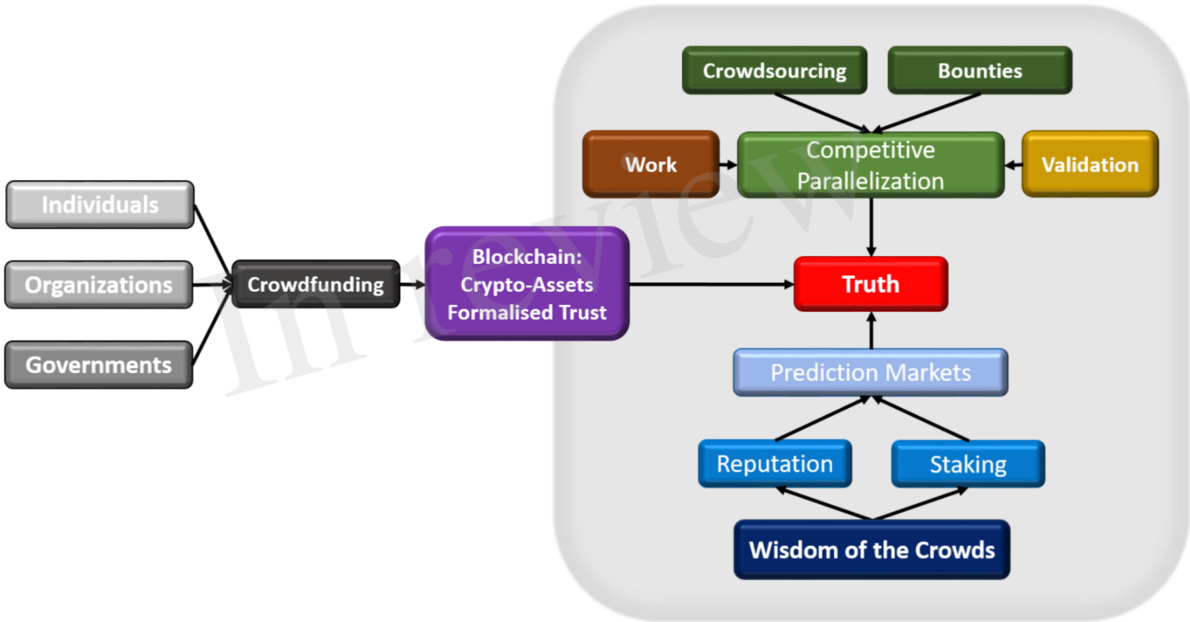

Figure 2 Truth finding mechanism at the pivot of a new type DAO for “Saving the Planet” straddling the real and virtual world. A blockchain platform implements formalised trust and transactions of (crypto-)assets raised through crowdfunding from individuals, organisations and governments. To ensure high quality and credibility of results, activities encompassing work packages, validation and acquisition of data is crowdsourced and incentivised by bounties through competitive parallelisation involving a cohort of independent players. Decision making of the new DAO is based on creating prediction markets where contributors offer “skin in the game” through formalised reputation and staking schemes.

Therefore, this paper encourages crafting a new type of DAO so that highly complex and multi-facetted projects involving significant budgets can be initiated and led by even loosely organised and diversely structured, community-driven international initiatives. It is suggested that the central problems of finding “trust” and “truth” may, in principle, be addressed by synergistically combining a set of mechanisms that are already available – to varying extent and maturity - in each contributing discipline. The tamper-proof distributed ledger of rapidly emerging blockchain technologies and its smart contracts provide a solid backbone to endow trust and transparency, and to furnish safe transactions, formal reputation schemes, data handling and governance.

Figure 2 proposes a basic principle of truth finding in a DAO for the global Commons "Saving the Planet". Best quality and maximum credibility of work is achieved through pairing competitive parallelisation of crowdsourcing, which is incentivised by bounties. Decision making is backed by "Wisdom of the Crowds" or "Collective Intelligence" where a large and diverse group of pundits creates prediction markets and provides assessment. Credibility of judgement is underpinned by their "skin in the game" in terms of putting their reputation and assets on the line. The system is fuelled by crowdfunded (crypto-)assets that is managed on the tamper-free distributed ledger of a blockchain.

Conclusions & Outlook

The global community needs to find mechanisms that can take effective actions to Save the Planet. This paper proposes to devise, advance and converge a set of foundational technologies that are coordinated through a repertoire of DLTs to leverage large-scale and long-term Commons. These initiatives are driven and operated by pancontinental, shared-interest groups, rather than entirely relying on predominantly nationally focussed politics. This unified approach to the design of a DAO with 'operating principles and protocols' for coordinating stakeholders across physical and digital environments may be particularly effective, given the increasing complexity (greater dispersion of communities geographically) and interdependency (increasing dispersion of activities across 'national' boundaries) in taking action. Flanked by proper marketing, the successful creation of an efficient and transparent Commons project is likely to provide a prime vehicle for global crowdfunding from individuals, charities, corporations, governments and transnational organisations.

Similar solutions may apply to other Commons where issues of trust, transparency and truth finding are satisfactorily addressed by wisdom of the crowds / crowdsourcing / crowdfunding. Areas of bottom-up organised measures might, for instance, be relevant in the context of prevention, preparation and management of arising issues in health (e.g., pandemics [114], life-style related diseases [115, 116]), financial crises [12, 117], education [118], fair trade [119], food and animal welfare [120], natural (e.g., earth quakes [121], tsunamis [122], asteroids [123]) and man-made (e.g., nuclear power [124-126], wildfires [127], monoculture [128], microplastics in food chain [129]) disasters where the question is mostly "when", rather than "if".

Conflict of Interest Statements

I, author Martin Etzrodt, was employed at Akasha Foundation. I declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

I, author Sönke Bartling, am the sole proprietor and owner of Blockchain for Science GmbH. I declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

I, author Max Gravitt, am the sole proprietor and owner of Digital Scarcity LLC. I declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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