Blockchain and Decentralised Autonomous Organisations (DAOs): the evolution of companies?

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(The final version of this article is forthcoming in the *New Zealand Universities Law Review*)

ABSTRACT

Blockchain's potential uses are wider than simply cryptocurrencies. Blockchain can and is being used to create Decentralised Autonomous Organisations (DAOs). DAOs represent a radical rethink of how organisations, such as companies, can be structured and run, including changes in ownership, governance, decision-making and profit distribution. DAOs not only lower transaction costs dramatically—and transaction costs are the very reason for a firm's existence—through their use of smart contracts they can prevent laws and other rules being broken. This article shows that business structures have evolved over the centuries and DAOs are simply another evolution. DAOs require a rethink of the law, including the granting of legal personality to DAOs as well as granting limited liability to DAO token holders.

Keywords: blockchain, Distributed Ledger Technology, DLT, DAO, distributed autonomous organisations, smart contracts, company, corporation, governance, separate legal personality, limited liability

INTRODUCTION

Companies can deploy blockchain[1] to assist with record-keeping such as share ownership, transfers of shares, and the voting of shareholders.[2] Such uses would be beneficial in terms of increased efficiency and transparency.[3] Blockchain can also be used in a transformational way to create Decentralised Autonomous Organisations (DAOs).[4] A DAO, however, could not be registered as a company because it has, for example, no directors. This article explores whether the law should be modified to accommodate DAOs:[5] should they be granted separate legal personality and limited liability granted to their token holders?

In contrast to the current way of people making decisions and taking actions, which may or may not comply with a company's rules (its constitution and policies), people and also the DAO have no option but to comply. Our current systems can be likened to traditional board games and DAOs to computer games. When playing Monopoly it is common to argue over the rules and the players need to monitor each other to ensure the rules are followed. With a computer game there is no ability to argue and no need for monitoring. If the ghosts in Pacman catch a player, that player is eaten. Pacman's computer code not only sets out the rules of the game it also enforces those rules. Thus code can be seen as law.[6] DAOs likewise implement code as law as they operate through a series of

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[1] This article uses the term blockchain to refer to the wider field of distributed ledger technology (DLT) of which blockchain is a part.

[2] See generally, David Yermack "Corporate Governance and Blockchains" (2017) Review of Finance 7.

[3] Primavera De Filippi and Aaron Wright *Blockchain and the Law: The Rule of Code* (Harvard University Press, Cambridge, Massachusetts, 2018) at 133-136.

[4] At 136-139, albeit the term "Decentralized Organisations" is used.

[5] See generally Carla L Reyes "Conceptualizing Cryptolaw" (2017) 96 (2) Nebraska Law Review 384 at 443-444.

[6] Lawrence Lessig *Code: Version 2.0* (Basic Books, New York, 2006) at 5 and Katharina Pistor *The Code of Capital: How the Law Creates Wealth and Inequality* (Princeton University Press, New Jersey, 2019) at 183.

smart contracts, which are self-executing computer programmes.[7] Traditional companies operate in the same paradigm as board games: rules, even when they are clear (which is not always the case), are not enforced automatically and many breaches go unnoticed. Even if the breach noticed, the harm has often been done. For example, companies in New Zealand are not permitted to undertake various actions unless the board is satisfied on reasonable grounds that the company will, immediately after the action, satisfy the solvency test.[8] By the time it is realised that the solvency test was not met the company is often in liquidation.[9] In contrast, a DAO's assets and liabilities could be known in real time[10] and it would be unable to make certain payments and enter into transactions if the solvency test was not satisfied.[11] It has been argued, therefore, that blockchain may help society "advance from a 'don't be evil' world to a 'can't be evil' world".[12] To be sure, there is justifiable concern that smart contracts cannot be coded ahead of time to deal with every eventuality.[13] For the foreseeable future, dispute resolution will be a vital part of the operation of DAOs.[14]

This article does not explore the questions that arise when AI (Artificial Intelligence) is sufficiently advanced that people no longer need to play any role in decision making within an organisation.[15] Another type of DAO, which is not looked at, are entities that own and operate themselves.[16] Rather the article is concerned with DAOs, which people use to co-ordinate their actions, thus people collectively make decisions on the DAO's operations. Nor are other issues that can potentially arise

[7] Smart contracts are described below in "Smart Contracts".

[8] The actions include: distributions to shareholders, Companies Act 1993, s 52; redemption of shares, s 70; and assistance by the company in the purchase of its own share, s 77. The solvency test requires that the company is able to pay its debts as they become due in the normal course of business and the value of the company's assets are greater than the value of its liabilities, including contingent liabilities (s 108(5)). Directors who vote in favour of the transaction are required to sign a certificate and provide grounds for why the solvency test will be met 52(2), 70(2) and s 77(2). Signing a certificate when the solvency test has not been met is an offence (ss 52(5), 70(4) and 77(4)). Failing to sign a certificate when one was required is also an offence, see *McKay Builders Ltd (In liquidation) v McKay* [2017] NZHC 1202.

[9] See generally *Fairway Holdings Ltd v McCullagh (in their capacities as liquidators of Hamilton Street Investments Ltd (in liq))* [2018] NZCA 2374.

[10] This is a future scenario and will require the use of cryptocurrencies and tokenisation of all assets and their ownership recorded on blockchains. To be sure, not all assets may be capable of being tokenised, for example, goodwill; however, a notional amount can be allocated to goodwill and used in automatic and real time calculations for the solvency test.

[11] A DAO would not have shares as such, rather they would be tokens.

[12] Spyros Makridakis, Antonis Polemitis, George Giaglis and Soula Louca "Blockchain: The Next Breakthrough in Rapid Progress of AI" in Marco Antonio Aceves-Fernandez (ed) *Artificial Intelligence: Emerging Trends and Applications* (IntechOpen, London, 2018) at 215.

[13] See generally, Eliza Mik "Smart Contracts: Terminology, Technical Limitations and Real World Complexity" (2017) 9 Law, Innovation and Technology 269; Kevin D Werbach and Nicolas Cornell "Contracts Ex Machina" (2017) 67 Duke Law Journal 313 and Pistor, above n 6, at 188 – 189.

[14] Alex Rea, Aron Fischer and Jack du Rose "Colony, Technical White Paper" (27 July 2018) <www.colony.io/whitepaper.pdf> at 4.

[15] See generally De Filippi and Wright, above n 3, at 146-155. While AI is developing rapidly, it will take decades before AI is sufficiently advanced to be able to make all the decisions for a DAO.

[16] Adam Greenfield *Radical Technologies: The Design of Everyday Life* (Verso, London, 2017) at 161-164, and see Leo Kelion "Could Driverless Cars own Themselves" *BBC* (London, 16 February 2015) <https://www.bbc.com/news/technology-30998361> and Mike Hearn "Autonomous Agents, Self-driving Cars and Bitcoin" Turing Festival (2013) <https://youtube.com/watch?v=MVyv4t0OKe4>.

with DAOs looked at, such as capital raising and financial markets,[17] as not all DAOs will need to raise capital.

The article is structured as follows. First, "Blockchain Technology" explains briefly blockchain technology, including the distinction between public and permissioned blockchains, tokenisation and smart contracts. Second, "The Evolution of Business Structures" shows that the company as a structure is relatively recent and explains the development of separate legal personality and the limited liability of shareholders. Third, "The history of DAOs" looks briefly at the short history of DAOs. Fourth, "A model DAO?" looks at whether there is an archetypal DAO, and explains that there is not, although there are defining features of DAOs. Fifth, "Why DAOs are Novel" explains the novel features of DAOs in addition to their use of smart contracts, which include: air drops; transaction costs are reduced significantly; profit distribution; governance, management and decision-making, the ability to exit the DAO easily, and the ability to fork. These features show that DAOs can be seen as a distinct organisational form. Sixth, "Separate Legal Personality and Limited Liability of DAO Token Holders' looks at granting of separate legal personality to DAOs and the granting of limited liability to DAO token holders. The final part concludes.

BLOCKCHAIN TECHNOLOGY

There are thousands of different blockchains. While many use what is now considered "traditional" blockchain technology—a series of blocks of information cryptographically linked together, newer "blockchains" do not use a chain of blocks,[18] although they do continue to use cryptography.[19] Cryptography is the science that allows information to be kept secret (encryption) and is also used for everyday actions such as making mobile phone calls, paying for goods and services using a credit card, or even getting cash from an ATM.[20] Blockchain also uses the internet and a range of other technologies.[21]

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[17] See generally, Jeremy I Senderowicz, K Susan Grafton, Timothy Spangler, Kristopher D Brown and Andrew J Schaffer "SEC Focuses on Initial Coin Offerings: Tokens may be Securities under Federal Securities Laws" (2018) 19 Journal of Investment Compliance 10.

[18] Examples of newer "blockchains" that do not use a blockchain include IOTA, designed for use by IOT (Internet of Things) devices and micro payments, which uses a Tangle rather than a series of linear blocks, Serguei Popov "The Tangle", Version 1.3 (1 October 2017) <www.iota.org/IOTA_Whitepaper.pdf>. Hashgraph, is another of the new DLTs, Leemon Baird "The Swirlds Hashgraph Consensus Algorigthm: Fair, Fast, Byzantine Fault Tolerance" (31 May 2016) <http://swirlds.com/downloads/SWIRLDS-TR-2016-01.pdf>. See also, Patrick Schueffel "10 years Blockchain. The Race is on: Blockchain vs. Tangle vs. Hashgraph" *Fintech News Singapore* (Singapore, 19 February 2018) <http://fintechnews.sg/16989/blockchain/10-years-blockchain-the-race-is-on-blockchain-vs-tangle-vs-hashgraph/>.

[19] Satoshi Nakamoto "Bitcoin: A Peer-to-Peer Electronic Cash System" at 1 <https://bitcoin.org/bitcoin.pdf> and World Bank "Distributed Ledger Technology (DLT) and Blockchain" (2017) at 2 <http://documents.worldbank.org/curated/en/177911513714062215/pdf/122140-WP-PUBLIC-Distributed-Ledger-Technology-and-Blockchain-Fintech-Notes.pdf>.

[20] Mark Ward "How the Modern World Depends on Encryption" *BBC News* (London, 25 October 2013) <www.bbc.com/news/technology-24667834>.

[21] The technologies that blockchain co-opted include: public key cryptography (Whitfield Diffie and Martin Hellman "New Directions in Cryptography" (1976) IEEE Transactions on Informational Theory 644); time stamping of electronic content (Stuart Haber and W Scott Stornetta "How to Time-Stamp a Digital Document" in AJ Menezes and SA Vanstone (eds) *Advances in Cryptology-CRYPT0' 90. CRYPTO 1990. Lecture Notes in Computer Science, vol 537* (Springer, New York, 1991)); proof of work, invented to combat spam (Cynthia Dwork and Moni Naor "Pricing via Processing, Or, Combatting Junk Mail, Advances in Cryptology" in *CRYPTO'92: Lecture Notes in Computer Science No 740* (Springer, New York, 1993) at 139); merkle trees (Ralph Merkle, US Patent 4309569A "Method of Providing Digital Signatures" 5 January 1982); and distributed computing (Maurice Herlihy "Blockchains from a Distributed Computing Perspective" (January 2018) <www.cs.brown.edu/courses/csci2952-a/papers/perspective.pdf>).

Distributed ledgers and decentralisation

The World Bank has defined blockchain as:

> "a novel and fast-evolving approach to recording and sharing data across multiple data stores (or ledgers). This technology allows for transactions and data to be recorded, shared, and synchronized across a distributed network of different network participants."[22]

Instead of participants keeping separate ledgers which require checking and reconciliation, the participants in a blockchain have a copy of the same ledger, which is synchronised and updated in real time. The data could relate to documents, such as health records, information about the provenance of goods, the list is endless, or it could record the ownership of assets, whether they are cryptocurrencies, shares in companies,[23] or land[24] and other physical assets.[25]

Blockchain is append only: the entire transaction record can normally be seen for all time.[26] The benefit of blockchain, with its append only feature and distributed nature, means it is unlike a traditional database where changes to data can be made. While it is sometimes possible for a computer forensics investigator to reconstruct a database's history, it is an expensive and time consuming process.[27] Moreover, if a database is held on just one or a few computers if that database is corrupted or destroyed the information is lost, unless there is an up to date back-up. Even with a back-up there is a delay in restoring the data. Because a blockchain is stored on many different computers, the chances of destroying all the copies of a blockchain are remote. Paper documents too can be forged or changes made to them. Again, while it is often possible for an expert to detect whether a document is genuine and has not had changes made to it, is a complicated and expensive process[28] and paper documents are relatively easy to lose or destroy, not to mention time consuming to transport.

No central authority controls a blockchain. If there is no central authority hosting a blockchain and vetting the accuracy of the information being entered into the blockchain, how is the blockchain updated and how are fraudulent transactions prevented? The following is a simplified explanation of the Bitcoin blockchain. If Alice wants to send Bob 0.00012 bitcoin, she transmits her request and the nodes—copies of the full ledger that are held on thousands of computers—are checked to see

[22] World Bank, above n 19, at iv.
[23] Yermack, above n 2, at 7 and see <www.securitize.io>.
[24] J Michael Graglia and Christopher Mellon "Blockchain and Property in 2018: At the End of the Beginning" (2018) 12 Innovations 90.
[25] Addison Cameron-Huff "How Tokenization Is Putting Real-World Assets on Blockchains" *Blockchain Magazine* (Nashville, 30 March 2017) <www.bitcoinmagazine.com/articles/op-ed-how-tokenization-putting-real-world-assets-blockchains/>.
[26] Criminals are unwise to use Bitcoin, see Chris Berg *The Classical Liberal Case for Privacy in a World of Surveillance and Technological Change* (Palgrave MacMillan, Basingstoke, 2018) at 198-199 and John Bohannon "Why Criminals Can't Hide Behind Bitcoin" *Science* (Washington, 9 March 2016) <www.sciencemag.org/news/2016/03/why-criminals-cant-hide-behind-bitcoin>. As with anything, however, there are exceptions, for example, privacy coins such as Zcash and Monero can hide the content of transactions from view, see generally, Chris Berg, at 195 – 210.
[27] Simson L Garfinkel "Digital Forensics" (2013) 101 (5) American Scientist 370.
[28] Don Vogel *Financial Investigations: A Financial Approach to Detecting and Resolving Crimes* (Diane Publishing, Collingdale, Pennsylvania, 1999) at 286-287.

whether the wallet[29] from which she is sending the request owns at least 0.00012 bitcoin.[30] If most of the nodes, ie the network, agrees that Alice's wallet has sufficient bitcoin, the transaction can be included in a block and when that block is added to the Bitcoin blockchain Bob will receive the bitcoin in his nominated wallet and Alice's wallet will be debited.[31]

Public blockchains, such as Bitcoin, can be therefore be considerably more secure than other traditional databases because of their decentralised nature and the need for a person or group of people to control more than fifty per cent of the computing power to successfully hack it.[32] While some smaller blockchains have been hacked as hackers have managed to acquire more than 50 per cent of the processing power of the relevant blockchain,[33] the hacks of Bitcoin have been through cryptocurrency exchanges where the exchanges have held their customers' private keys.[34] The lapses in security are due to peoples' practices, rather than the technology itself. For example, a high profile hack of an exchange in Japan of $400US million of XEM (the cryptocurrency of the NEM blockchain) could have been prevented had multi signatures been used.[35]

A common criticism of Bitcoin is the energy wasted in its mining process through proof-of-work.[36] Cognisant of electricity consumption, some newer blockchains use different consensus methods such as proof-of-stake[37] and proof of importance[38] as well as others.[39] The alternative consensus methods use significantly less electricity.

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[29] The term "wallet" is misleading: there is no wallet in the traditional sense. Instead Bitcoin transactions are linked to a public key, which is a long list of numbers and numerals. A person or entity can only make transactions from that public key if they know the private key, which is another long set of numbers and numerals. Whoever controls the private key is able transfer the bitcoin from the public key. Because bitcoin is decentralised, there is no central authority that a person can go to if they lose their private key.

[30] Normally the wallet will need to contain slightly more than the bitcoin attempted to be transferred as a transaction fee will need to be paid. In Bitcoin's early days there were no transaction fees. At one stage bitcoin fees were USD 20 per transaction: Kai Sedgwick "Bitcoin Fees have Become Infeasible" *Bitcoin.com* (17 December 2017) <www.news.bitcoin.com/bitcoin-fees-have-become-infeasible/>, but transaction fees have fallen considerably since their highs.

[31] There are some occasions where, due to the size of the Bitcoin blockchain two blocks are added at the same time, two chains are created. When this occurs the miners will mine the longest chain and the transactions in the blocks that are discarded and go back into the pool of unconfirmed transactions (mem pool) and will be included in a later block.

[32] Nakamoto, above n 19, at 1 "the system is secure as long as honest nodes collectively control more CPU power than any cooperating group of attacker nodes". Contrast Ittay Eyal and Emin Gün Sirer "Majority is not Enough: Bitcoin Mining is Vulnerable" (2018) 61 Communications of the ACM 95 who argue that a successful attack could occur with only one third of the computing power.

[33] Bonnie Conrad "Only a Matter of Time: 51% Hacks Imminent for Most Cryptocurrencies" *Blockt* (Bangkok 4 June 2018) <www.blokt.com/news/only-a-matter-of-time-51-hacks-imminent-for-most-cryptocurrencies>.

[34] Private keys are a long list of numbers and letters and are akin to a password for a bank account as anyone that has that password is able to spend money from that bank account. Unlike a password to a bank account, however, because there is no central authority for a blockchain, if you lose your private keys you lose everything owned by that private key.

[35] Danny Paez "Biggest Cryptocurrency Theft Ever as Exchange Confirms $400 Million Lost" *Inverse* (26 January 2018) <www.inverse.com/article/40605-cryptocurrency-coincheck-nem-hack-theft>. Multi signatures are where more than one person is required to sign a transaction.

[36] Harald Vranken "Sustainability of Bitcoin and Blockchains" (2017) 28 Current Opinion in Environmental Sustainability 5 at 7.

[37] With proof-of-stake block validators stake tokens, in effect locking them up while they are validators. An algorithm is used to decide at random who will validate each block, which is often decided upon the number of tokens staked, the more tokens staked, the more likely that person is to be chosen to validate the block. Proof-of-stake is more energy efficient that proof of work.

[38] NEM "Proof of Importance (POI)" <www.nem.io/xem/harvesting-and-poi/#proof-of-importance>.

[39] For example, Proof-of-Burn, Proof-of-Capacity and Proof-of-Stake Velocity.

Public and permissioned blockchains

Bitcoin and Ethereum are public blockchains, anyone can view the transactions recorded on them[40] or download a copy of their ledgers. Similarly anyone can receive a payment in bitcoin or ether (the cryptocurrency used on the Ethereum blockchain), if they have a wallet.[41] Once a person or entity has obtained bitcoin or ether they are able to send it to another person or entity. In contrast, permissioned blockchains are not open to all. Permission must be granted to access or even view the permissioned blockchain. Examples include Hyperledger Fabric (IBM),[42] Corda (R3),[43] Azure (Microsoft),[44] AWS (Amazon)[45] and Google.[46] To complicate matters, some public blockchains such as Ethereum offer permissioned versions.[47]

Permissioned blockchains allow for the management of access and viewing rights: different people and entities can be given the ability to see different parts if so desired. Some enterprises feel more comfortable using permissioned blockchains because they have more control, especially if mistakes in coding have been made. Yet, the fewer number of people involved in a permissioned blockchain means that it is easier for some participants to make changes against the wishes of other participants,[48] so they are not immutable to the same degree as public blockchains.[49]

Another difference between public and permissioned blockchains can be the speed of transactions. Bitcoin, for example, can process only 3-20 transactions per second. In contrast permissioned blockchains could process 1,000 transaction a second.[50] Albeit technology is advancing and newer public blockchains can also process 1,000 transactions per second.[51]

Tokenisation

Tokenisation is the act of converting rights over a physical or intangible asset into tokens, which are recorded on a blockchain.[52] For example, take the ownership of a patent. To be sure, New Zealand

[40] For Bitcoin <www.blockchain.com/explorer> and for Ethereum <www.etheploer.io>.
[41] See above, n 29.
[42] While IBM offers Hyperledger Fabric to its clients, Hyperledger Fabric (and the other Hyperledger blockchains are part of the Linux Foundation <www.hyperledger.org/projects/fabric>.
[43] R3 is a consortium of banks and other financial institutions <www.r3.com/>.
[44] <www.azure.microsoft.com/en-us/solutions/blockchain/>.
[45] <www.aws.amazon.com/blockchain/>.
[46] Darryn Pollock "Google Makes Another Move Towards Blockchain as Cloud Wing Partners with Cypherium" *Forbes* (14 August 2019) <https://www.forbes.com/sites/darrynpollock/2019/08/14/google-makes-another-move-towards-blockchain-as-cloud-wing-partners-with-cypherium/#89096db390d6>.
[47] Neil Ainger "Bigger than Bitcoin? Enterprise Ethereum Alliance Grows in Size" *CNBC* (New Jersey, 23 May 2017) <www.cnbc.com/2017/05/23/bigger-than-bitcoin-enterprise-ethereum-alliance-grows-in-size.html>. NEM is another public blockchain that also offers a permissioned version <www.nem.io/enterprise/>.
[48] Mike Orcutt "How secure is blockchain really?" *MIT Technology Review* (Cambridge Massachusetts, 25 April 2018) <www.technologyreview.com/s/610836/how-secure-is-blockchain-really/>.
[49] Interestingly IBM, which uses Hyperledger Fabric, has launched, IBM World Wire <www.ibm.com/blockchain/solutions/world-wire>, a service that appears to be designed to compete with SWIFT for the movement of value between financial institutions, has decided to also use a cryptocurrency (Stellar) to transfer the value. While technically IBM could have moved value within Hyperledger fabric, an external cryptocurrency platform such as Stellar may have been used to give the service more credibility.
[50] Morgan E Peck "Blockchain World - Do you Need a Blockchain? This Chart Will Tell You if the Technology Can Solve Your Problem" (2017) 54(10) IEEE Spectrum 38 at 39-40.
[51] Aleksandr Zavodovski, Nitinder Mohan, Walter Wong and Jussi Kangasharju "Open Infrastructure for Edge: A Distributed Ledger Outlook" USENIX Workshop on Hot Topics in Edge Computing (HotEdge), Renton, WA, USA, (July 2019) at 4 citing the Stellar blockchain.
[52] De Filippi and Aaron Wright, above n 3, at 93 and 111.

has a patent registry, however, there is no indefeasibility of title for patents, unlike with land,[53] and the registered proprietor may not be the legal owner. It is possible, therefore, for B to obtain a license from the registered proprietor (C) only to find that C had assigned the patent to a third party (E). E as the legal owner could sue B for patent infringement.[54] Time and cost is therefore baked into our current systems through the necessity of due diligence and the need to take out insurance to protect against claims of legal owners. If patents were tokenised the blockchain would provide for indefensibility of title: the person listed as the owner would be the owner.[55] Such an asset registry would likely be run on a permissioned blockchain as it would be desirable for an entity to grant a patent in the first place, in New Zealand that entity would be the Intellectual Property Office of New Zealand (IPONZ). In addition, it would be necessary to have the ability to revoke the patent if a court held that it should not have been granted or transfer the ownership of the patent if the patent's registered proprietor goes into liquidation.[56]

Smart contracts

"Smart contracts" are not smart and they are not necessarily contracts, although they can be. Smart contracts are self-executing computer programmes and are placed on a blockchain that supports them:[57] they "automatically and securely execute obligations when certain conditions are met".[58] In contrast to legal contracts, once the agreement has been reached and the smart contract is set in motion, no party can interfere and it will be executed without "interruption, deviation, or breach."[59]

A buyer and seller could agree to use a smart contract. The buyer sends the payment for the goods (in a cryptocurrency) to the smart contract, which holds the payment in escrow.[60] The goods are dispatched with an IoT (internet of things) device and once that device is picked up by location tracking technologies at an agreed place and within a specified time, the payment is released from the smart contract and sent automatically to the seller.[61] Should the goods not arrive on time the smart contract automatically returns the payment to the buyer.[62] Another form of a smart contract

[53] Even with indefeasibility of land the governments in both Sweden and the UK are exploring and trialling using blockchain to replace their existing land title systems, Christine Kim "Sweden's Land Registry Demos Live Transaction on a Blockchain" *Coindesk* (New York, 15 June 2018) <www.coindesk.com/sweden-demos-live-land-registry-transaction-on-a-blockchain> and United Kingdom Government "HM Land Registry to explore the benefits of blockchain" Press Release (1 October 2018) <www.gov.uk/government/news/hm-land-registry-to-explore-the-benefits-of-blockchain>.

[54] Of course B would have been wise to have secured an indemnity clause from C when obtaining the license. However, if C has insufficient assets the indemnity clause is worthless.

[55] Other advantages of using a blockchain for patents and other intellectual property rights is that all the information relating to that patent could be stored on the blockchain. Thus a potential licensor could see, for example, which licenses had been granted. To be sure, under the current system if a registered proprietor gives false information to a licensor, for example, that no other licences have been granted, when in fact they have, the licensor may have the ability to sue over the misrepresentation, but that is expensive and time consuming.

[56] Graglia and Mellon, above n 24, at 95-96 make this argument in relation to land.

[57] There is a difference, therefore, between the blockchain and the smart contract: the smart contract cannot be deployed without the blockchain.

[58] Karen E C Levy "Book-Smart, Not Street-Smart: Blockchain-Based Smart Contracts and The Social Workings of the Law" (2017) 3 Engaging Science, Technology, and Society 1, at 1-2.

[59] Pistor, above n 6, at 187.

[60] The payment is sent to a public key and the funds are not released until the conditions specified in the smart contract have been met.

[61] Levy, above n 58, at 3.

[62] Concerns about the self-enforcing nature of smart contracts have been raised, see generally Levy, above n 58 and Mik, above n 13.

would enable a company to engage in crowdfunding.[63] The smart contract would hold the cryptocurrency in escrow. If the crowdfunding met the pre-set amount the cryptocurrency would be sent to the entity raising the funds. If the amount was not reached the cryptocurrency would be returned automatically to the putative investors.[64] While people could be reimbursed in the latter example without the use of smart contracts, the transaction costs are high:[65]

> "Pre-tech, we would have had to employ bank accounts, escrow agents, clerks and cheques, envelopes and paper to manage all this. Even post-web we'd need a small army of programmers and interfaces into payment systems and websites."

The self-enforcing mechanism is therefore different to traditional systems. For example, with Amazon's one click system, although the credit card linked to the Amazon account is debited with the amount of the purchase, the seller does not receive the payment immediately: payment takes weeks, if not months. If the credit card was stolen, the seller will not be paid. Another difference with smart contracts and traditional systems is that for smart contracts that are run on a public blockchain, anyone can look at the source code to determine whether the smart contract was coded properly.[66]

DAOs will use two main types of smart contract. The first are for transactions, for example, a token holder sends DAO tokens to another person. The second are the rules of the DAO itself. While the first type of smart contracts are designed to be executed without the ability of either party to interfere,[67] the latter can and will be changed over time. An analogy can be made with the second type of smart contracts and a company's constitution, albeit the constitution analogy only goes so far. The smart contracts that run the DAO are far more detailed than a company's constitution and are more akin to a combination of a constitution and an operational manual. The limitation with constitutions and operation manuals is that they can be misinterpreted and are they are not always followed. In contrast, an action not permitted by the DAO's smart contracts cannot occur. Another different between constitutions and smart contracts is that in New Zealand a company can be incorporated without a constitution.[68] A DAO simply could not operate without a series of smart contracts.

THE EVOLUTION OF BUSINESS STRUCTURES

Business structures have evolved throughout the centuries in the United Kingdom.[69] Partnerships and joint stock companies were the main vehicles of commerce prior to rise of modern day companies.[70] Joint stock companies were incorporated by Royal Charter[71] or by a private Act,[72] and despite the use of "companies" in their name were not the same as what we now consider to be

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[63] Example taken from Ian Grigg "On the Intersection of Ricardian and Smart Contracts" (February 2015) <http://iang.org/papers/intersection_ricardian_smart.html>.
[64] Ian Grigg, above n 63.
[65] Ian Grigg, above n 63.
[66] Contrast, De Filippi and Wright, above n 3, at 141 who note that the ability to audit a smart contract is a highly skilled task, and few have the necessary skills to audit a smart contract.
[67] Pistor, above n 6 at 187.
[68] Companies Act 1993, s 26. If a company does not have a constitution the default rules of the Companies Act 1993 apply to it, ss 27 and 28.
[69] Paul G Mahoney "Contract or Concession? An Essay on the History of Corporate Law" (2000) 34(2) Georgia Law Review 873 at 880 and Alexander Fallis "Evolution of British Business Forms: A Historical Approach" (2017) <www.icaew.com/-/media/corporate/files/technical/ethics/evolution-of-british-business-forms.ashx?la=en>.
[70] See generally, Ron Harris "The Private Origins of the Private Company: Britain 1862-1907" (2013) 33 Oxford Journal of Legal Studies 339.
[71] The East India Company was an example of a company incorporated by Royal Charter, Frank Evans "The Evolution of the English Joint Stock Limited Trading Company" (1908) 8(5) Columbia Law Review 339 at 342.
[72] The East India Company Charter Act of 1813 is an example of a private Act.

companies.[73] Unincorporated joint stock companies, which were neither incorporated by Royal Charter or by private Acts, arose from jointly financed trading expeditions, which were created for a round trip.[74] To avoid the transaction costs of continually establishing and dissolving entities, people started to extend the entity's life and, as the investments increased, it was natural to merge entities to create larger ones.[75] Next, the unincorporated joint stock companies' stocks (shares) were traded and a stock exchange was created to cut the transaction costs of trading the shares.[76] The Bubble Act of 1720,[77] however, had prohibited such entities,[78] albeit the law was more honoured in the breach than in the observance as they continued to be formed. It has been argued that the authorities' tolerant attitude was due to the economic importance of those companies.[79] That was until, as explained by Ron Harris, a number of cases were brought under the Bubble Act which "placed in doubt the legality of the unincorporated company as a legitimate form of business organization"[80] and saw a flood of incorporation bills before Parliament.[81]

Proponents of the unincorporated joint stock companies argued that they expanded the economy and "made possible the development of capital-intensive projects: canals, docks, and other infrastructures that individuals could not and the government should not administer."[82] These arguments won and the Bubble Act was repealed.[83] The repeal of the Bubble Act, did not, however, grant the unincorporated companies separate legal status and shareholders continued to have unlimited liability. Albeit, ingenious drafting provided protection for the shareholders. The deeds of settlement, contracts with third parties and the use of trusts were used to contractually limit the liability of the shareholders.[84] However, there was confusion over the legal status of the unincorporated companies as some courts found them legal, whereas others found them illegal.[85]

Parliament clarified the legal status of unincorporated companies in the Joint Stock Companies Registration and Regulation Act 1844. The Act allowed joint stock companies to incorporate without royal charter or the passing of a private Act of Parliament:[86] "For the first time in at least 500 years corporations could be formed without explicit, deliberate, and specific State permission".[87] While such companies now had legal status, their shareholders were personally liable for the debts of the

[73] Paddy Ireland "Capitalism Without the Capitalist: The Joint Stock Company Share and the Emergence of the Modern Doctrine of Separate Corporate Personality" (1996) 17 Journal of Legal History 41 at 42-45.
[74] Nicholas Kyriazis and Theodore Metaxas "Path Dependence, Change and the Emergence of the First Joint-stock Companies" (2011) 53 Business History 363 at 365.
[75] At 365 and Mahoney, above, n 69, at 883.
[76] Kyriazis and Metaxas, above n 74, at 365.
[77] Royal Exchange and London Assurance Corporation Act 1719.
[78] Ron Harris "Political Economy, Interest Groups, Legal Institutions, and the Repeal of the Bubble Act in 1825" (1997) 50 Economic History Review 675.
[79] Colin Mackie, "From Privilege to Right: Themes in the Emergence of Limited Liability" (2011) 4 Juridical Review 293 at 301.
[80] Ron Harris "Political Economy, Interest Groups, Legal Institutions, and the Repeal of the Bubble Act in 1825", above n 78 at 678.
[81] At 682 where Harris describes William Huskisson, a member of Parliament, as being tired by the hundreds of private bills to incorporate companies.
[82] At 681-682.
[83] 6 Geo IV, c 91 (1825) "An Act to repeal so much of an Act passed in the Sixth Year of His late Majesty King George the First, as relates to the restraining several extravagant and unwarrantable Practices in the said Act mentioned; and for conferring additional Powers upon His Majesty, with respect to the granting of Charters of Incorporation to trading and other Companies".
[84] See generally, Ryan Bubb "Choosing the Partnership: English Business Organization Law During the Industrial Revolution" (2015) 38 Seattle University Law Review 337, 342-347 and Pistor, above n 6, at 60-61
[85] Ron Harris *Industrializing English Law: Entrepreneurship and Business Organization* (Cambridge University Press, Cambridge, 2000) 249.
[86] Harris, "The Private Origins of the Private Company", above n 70, at 342.
[87] Ron Harris *Industrializing English* Law, above n 85 at 284.

company unless legal trickery was successfully deployed, and the "unlimited personal liability of shareholders prescribed by the 1844 Act [was] contracted around."[88]

There was considerable debate about whether to grant shareholders limited liability as a right.[89] Earl Grey, in the House of Lords, typified the traditionalist's view when arguing against the Bill which would become the Limited Liability Act 1855. The Bill would:[90]

> "introduce an entirely new principle into our commercial legislation, and one which the highest authorities, both in law and in commerce, view with distrust and apprehension. It proposes to depart from the old-established maxim that all the partners are individually liable for the whole of the debts of the concern."

On the other hand, those arguing for limited liability believed granting shareholders limited liability would encourage and facilitate further enterprise and investment.[91] In particular, it would encourage those who would not invest through fear of unlimited liability, to invest.[92] Claims were made of a large flight of capital to jurisdictions such as France and the United States, which allowed the incorporation of companies with limited liability of shareholders.[93] Moreover, when those companies were incorporated in Paris the French Government extracted large duties, plus various other taxes and costs, "all this expense is incurred simply to get the benefit of the French law of limited liability."[94] Fear of missing out on tax revenue can therefore be seen as a driver in the recognition of limited liability in the United Kingdom.

The Limited Liability Act 1855 which granted limited liability for members of certain joint stock companies,[95] represented a "more modern approach to business, exemplified by investment in tradeable shares in railway companies and banks, involved the pooling of investments by largely anonymous rentier investors in large joint stock companies whose shares were traded."[96]

Notwithstanding that a subsequent Act, the Companies Act 1862, required a minimum of seven shareholders for a company, there was seemingly nothing to prevent a sole trader from incorporating a company with six nominal shareholders.[97] The House of Lords in 1897 in *Salomon v Salomon & Co Ltd*[98] affirmed that view: holding that incorporation conferred separate legal status, even upon "one man" businesses and thus limited shareholders' liability. Not surprisingly, the ability to incorporate and create a company as a separate legal entity has been viewed with suspicion,[99]

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[88] Colin Mackie, "From Privilege to Right: Themes in the Emergence of Limited Liability" (2011) 4 Juridical Review 293 at 305 citing *Halket v The Merchant Traders' Ship, Loan and Insurance Association* (1849) 13 QB 960; (1849) 116 ER 1530 where a clause was upheld that limited subscribers' liability to a company registered under the 1884 to the amount of their respective shares.

[89] Philip Lipton "The Introduction of Limited Liability into the English and Australian Colonial Companies Act: Inevitable Progression or Chaotic History?" (2018) 41 Melbourne University Law Review 1278, 1289-1297.

[90] HL Deb 7 August 1855, vol 139, col 1904 (Earl Grey).

[91] Colin Mackie "From Privilege to Right: Themes in the Emergence of Limited Liability" (2011) 4 Juridical Review 293 at 309.

[92] At 309.

[93] At 309.

[94] HC Deb 29 June 1855, vol 139, col 323 (Mr Bouverie, quoting Mr Baker, a London Solicitor), cited at 309.

[95] Limited Liability Act 1855, s 7.

[96] Philip Lipton "The Introduction of Limited Liability into the English and Australian Colonial Companies Act: Inevitable Progression or Chaotic History?" (2018) 41 Melbourne University Law Review 1278 at 1297.

[97] John D Turner "The Development of English Company Law Before 1900" in Harwell Wells (ed) *Research Handbook on the History of Corporate and Company Law* (Edward Elgar, Camberley, Surrey 2018).

[98] *Salomon v Salomon & Co Ltd* [1897] AC 22.

[99] Murray A Pickering "The Company as a Separate Legal Entity" (1968) 31 Modern Law Review 17.

which continues to this day:[100] "many of the concerns [about companies] linger on to some degree, including concerns about good governance, short-termism and financial probity. We might legitimately ask whether we have been going down the right path in facilitating the dominance of this form of business."

Despite continued concerns about companies, they perform an important role in society[101] and as we have seen they have evolved over the centuries. DAOs could herald a potential new evolution of for profit organisations, albeit as we shall see, not all DAOs will be for profit.[102] It must be borne in mind that much of the development of modern companies arose because of private ordering: lawyers fashioning the rules of companies and their liability, including their shareholders, to others and ultimately creating the law from below.[103] The creation of customs that are subsequently adopted by the legislature has occurred in the past, the law merchant is one example.[104]

THE HISTORY OF DAOs

The term "DAO" was first used in 2013, although the term Decentralised Autonomous Corporation (DAC) was used.[105] Bitcoin was used as an example of a DAO, albeit a limited one. This new entity generates revenue and pays people in a cryptocurrency to provide it with resources and services—the cryptocurrency is in effect shares in the entity. The resources and services include computer storage; transaction validation and security against double spend attacks.[106] Vitalik Buterin followed

[100] Institute of Chartered Accountants in England and Wales (ICAEW) "Future Enterprise: Assessing Forms of Business" (2016) 3 <www.icaew.com/-/media/corporate/files/technical/ethics/future-enterprise.ashx?la=en>.
[101] Albeit the operation of companies and the drive for shareholder value has been criticised, Roger Martin *Fixing the Game: Bubbles, Crashes, and What Capitalism Can Learn from the NFL* (Harvard Business Press, Boston, 2011) and Lynn Stout *The Shareholder Value Myth: How Putting Shareholders First Harms Investors, Corporations, and the Public* (Berrett-Koehler, San Francisco, 2012). Companies can, however, be used so that they benefit employees, customers and the environment, Michael J Gelb and Raj Sisodia *The Healing Organization: Awakening the Conscience of Business to Help Save the World* (Harper Collins, Nashville, 2019).
[102] For example, Moloch DAO is a non-profit DAO that collects the cryptocurrency ether from its members and uses that to fund developers for their work on the Ethereum blockchain, Simon de la Rouviere "The Moloch DAO: Collapsing The Firm" *Medium* (17 January 2019) <https://medium.com/@simondlr/the-moloch-dao-collapsing-the-firm-2a800b3aa2e7>.
[103] Harris "The Private Origins of the Private Company", above n 70, at 340.
[104] Robert D Cooter "Decentralized Law for a Complex Economy: The Structural Approach to Adjudicating the New Law Merchant" (1996) 144 University of Pennsylvania Law Review 1643.
[105] Daniel Larimer noted that DAC was changed to DAO "to avoid unnecessary legal entanglements, but the concept remains the same", Daniel Larimer "Is the DAO going to be DOA" *Tecknoids News* (25 May 2016) <http://www.teknoids.com/2016/05/25/is-the-dao-going-to-be-doa/>.
[106] Other services are privacy for customers and a viral marketing campaign. Bitcoin is pseudonymous, not anonymous. While the entity does not pay for the viral marketing campaign, Bitcoin certainly has had successful marketing campaigns as few people have not heard about it.

Lairmer's work in a series of articles and a blog post.[107] Neither Larimer nor Buterin are academics, rather they are leading figures in the blockchain industry.[108]

Notwithstanding the original conception of a DAO as a fully autonomous entity, people began to think about using such a vehicle for coordinating peoples' activities rather than as an entity devoid of human decision making.[109] In 2016 an entity somewhat unfortunately named, "The DAO", was created.[110] The DAO was an automated investment fund set up on the Ethereum blockchain. People transferred the cryptocurrency ether to the DAO and in return they were to receive DAO tokens. In turn proposals for projects would be submitted to The DAO. Token holders would vote on whether to fund those projects and the projects that were approved would be funded and profits remitted to The DAO and distributed to the DAO token holders. Human involvement in The DAO was limited to the following: a group of curators checked the identity of people submitting proposals and DAO token holders would vote on which proposals to fund. No managers or a board of directors were necessary: the token holders would vote on which projects to fund.[111]

The DAO experiment failed.[112] Before proposals were even submitted a hacker exploited an error in The DAO's code and transferred a considerable number of DAO tokens to a wallet the hacker controlled.[113] The hacker, however, was not able to abscond with the tokens. The DAO's code meant the hacker had to wait for 28 days to withdraw the tokens. Despite its name, the DAO was not a true DAO: there was no ability for a DAO token holder to put forward a proposal that other token holders

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[107] Vitalik Buterin "Bootstrapping A Decentralized Autonomous Corporation: Part I" *Bitcoin Magazine* (Nashville, 19 September 2018) <www.bitcoinmagazine.com/articles/bootstrapping-a-decentralized-autonomous-corporation-part-i-1379644274/>; Vitalik Buterin "Bootstrapping An Autonomous Decentralized Corporation, Part 2: Interacting With the World" *Bitcoin Magazine* (Nashville, 21 September 2013) <www.bitcoinmagazine.com/articles/bootstrapping-an-autonomous-decentralized-corporation-part-2-interacting-with-the-world-1379808279/>; and Vitalik Buterin "Bootstrapping a Decentralized Autonomous Corporation, Part 3: Identity Corp" *Bitcoin Magazine* (Nashville, 24 September 2013) <www.bitcoinmagazine.com/articles/bootstrapping-a-decentralized-autonomous-corporation-part-3-identity-corp-1380073003/> and Vitalik Buterin "DAOs, DACs, DAs and More: An Incomplete Terminology Guide" *Ethereum Blog* (6 May 2014) <htttps://blog.ethereum.org/2014/05/06/daos-dacs-das-and-more-an-incomplete-terminology-guide/>.

[108] Vitalik Buterin was awarded an honorary doctorate, at the age of 24, by the University of Basel, University of Basel "Dies Academicus of the University of Basel: Honorary doctorates for Hansjörg Schneider and Vitalik Buterin" <www.unibas.ch/en/News-Events/News/Uni-Info/Dies-academicus-2018-of-the-University-of-Basel.html>.Such is Buterin's standing in the blockchain community that some people will follow his ideas blindly. In one blog post Buterin stated "[w]arning: this post contains crazy ideas. Myself describing a crazy idea should NOT be construed as implying that (i) I am certain that the idea is correct/viable, (ii) I have an even >50% probability estimate that the idea is correct/viable, or that (iii) "Ethereum" endorses any of this in any way." Vitalik Buterin "Superrationality and DAOs" *Ethereum Blog* (23 January 2015) <https://blog.ethereum.org/2015/01/23/superrationality-daos/>.

[109] Albeit some people reserve the term "DAO" for entities that are truly autonomous and free from human decision making, see generally De Filippi and Wright, above n 3, at 146-155.

[110] Christoph Jentzsch "Decentralised Autonomous Organization to Automate Governance" (2016) <https://download.slock.it/public/DAO/WhitePaper.pdf>. The use of the term "The DAO" was unfortunate as The DAO was simply an example of a DAO, indeed, it would not actually be considered to be a DAO as there was no ability of its token holders to change its rules.

[111] Quinn DuPont "Experiments in Algorithmic Governance: A history and Ethnography of "The DAO," A Failed Decentralized Autonomous Organization" in Malcolm Campbell-Verduyn (ed) *Bitcoin and Beyond: Cryptocurrencies, Blockchains and Global Governance* (Routledge, London, 2018) at 157.

[112] See generally, DuPont, above n 111.

[113] Nils Winkler and Björn Mattheis "FinTech and Blockchain – Keep Bubbling? Or Better Get Real?" in Claudia Linnhoff-Popien, Ralf Schneider, Michael Zaddach (eds) *Digital Marketplaces Unleashed* (Springer, New York, 2018) at 382.

could have voted upon before the expiry of the 28 day period, for example, a proposal that would have seen the return of the DAO tokens to those that had been deprived of the tokens.

Not all was lost for the token holders, however. The DAO was running on the Ethereum blockchain, and it was technically possible to change the underlying blockchain. An intense debate occurred[114] and two schools of thought emerged.[115] First, the hacker did something that was not intended. The intention of the DAO was that it would use the funds it received to fund projects voted upon by token holders and the token holders would receive a share of the profits if those projects were successful. To prevent the hacker absconding with millions of dollars' worth of ether, the Ethereum blockchain should be forked at the point in time just before the hacker withdrew the first lot of tokens.[116] Forking in this sense is where the blockchain is divided in two, so there are now two blockchains. The second argument was that code is law.[117] The hacker was simply doing what the code allowed, thus the hacker was entitled to keep the DAO tokens.[118] Forking the Ethereum blockchain would harm the notion of immutability and damage Ethereum's reputation.[119]

The Ethereum community decided to fork the Ethereum blockchain.[120] The price of ether and thus the value of the Ethereum blockchain fell following the fork,[121] however, it soon recovered and indeed the price of ether subsequently increased. In addition, Ethereum did not lose its place as the most popular public blockchain on which to build projects upon.[122] It is arguable that the fork was beneficial as it demonstrated that for the foreseeable future code may not always be law and a practical and flexible solution was found.[123] Albeit the fork, which created Ethereum Classic, meant that those who objected to the fork were able to continue with a blockchain that lived up to the ideal of immutability,[124] which included the hacker as he or she received millions of ether classic.[125]

While the DAO did not succeed, it was an experiment. The genie is out of the bottle and other DAOs such as Dash, which is looked at below, are operating.[126] Aragon,[127] which offers services to create

[114] Jeffrey Wilcke "To Fork or Not to Fork" *Ethereum Blog* (15 July 2016) <https://blog.ethereum.org/2016/07/15/to-fork-or-not-to-fork/> and Aaron van Wirdum "Ethereum's DAO Forking Crisis: The Bitcoin Perspective" *Bitcoin Magazine* (Nashville, 1 July 2016) <www.bitcoinmagazine.com/articles/ethereum-s-dao-forking-crisis-the-bitcoin-perspective-1467404395/>.
[115] DuPont, above n 111, at 170 and Pistor, above n 6, at 196
[116] DuPont, above n 111, at 165 and Pistor, above n 6, at 196
[117] As DuPont notes, above n 111, at 165 "code is law" echoes Lawrence Lessig's influential slogan, Lessig, above n 6 and see generally Pistor, above n 6, at 196.
[118] Kelvin F K Low and Ernie G S Teo "Bitcoins and Other Cryptocurrencies as Property" (2017) 9(2) Law, Innovation and Technology 235 at 257.
[119] DuPont, above n 111, at 165.
[120] DuPoint, above n 111, at 165. Contrast Pistor, above n 6, at 197 who states that "The decision rules of The DAO required a majority vote, and the pragmatists won the day; they altered the code…"
[121] The price of ether fell from USD 21.52 before The DAO hack to USD $9.96 the day after, Charles Bovaird "Classic and the DAO: What Drove Ether Prices in 2016" *Coindesk* (New York 23 December 2016) <www.coindesk.com/classic-dao-drove-ether-prices-2016>.
[122] "94 Out of Top 100 Blockchain Projects are Built on Ethereum" *CCN* (Oslo, 11 June 2018) <www.ccn.com/94-out-of-top-100-blockchain-projects-are-built-on-ethereum/>.
[123] DuPont, above n 111, at 165.
[124] At 173.
[125] Michel del Castillo "The DAO Hacker is Getting Away" *Coindesk* (8 August 2016) <www.coindesk.com/ethereum-dao-hacker-getting-away-classic>.
[126] See generally Greenfield, above n 16, at 179 who noted that other DAOs would follow.
[127] <www.aragon.org/>. Aragon's tag line is "Aragon lets you freely organize and collaborate without borders or intermediaries. Create global, bureaucracy-free organizations, companies, and communities."

DAOs, reports that it has had 15,000 entities use its services, albeit those were on a testnet and were not therefore live.[128] DAOstack is another service that intends to help the creation of DAOs.[129]

A MODEL DAO?

Business and other structures of which people use to organise comprise many forms, including partnerships,[130] trusts,[131] co-operatives,[132] companies,[133] unincorporated and incorporated societies,[134] charitable trusts,[135] as well as others.[136] DAOs also cover a wide variety of forms and can be for-profit, or not-for-profit,[137] therefore, there is no model DAO as such. DAOs are also very early in their evolution. To add to the complexity, some organisations that use the term "DAO" are not yet operating as DAOs and instead intend to transition to a DAO and some are even currently constituted as a company.[138] For example, Databroker DAO has stated that:[139]

> "Though the community has learned a lot since initial DAO governance experiments, there is still a long way to go. Especially since a lot of the partners in this ecosystem are more enterprise minded at this time. Since agility and flexibility are crucial in the early stages we decided that, since best practices and adoption of this model are still a moving target, Databroker DAO will be run using a traditional company structure, until such a time we, in active collaboration with the community and industry, can determine a governance model that works for all parties involved."

What then are the features of a DAO beyond the use of smart contracts? One feature is that the DAO token holders propose and make all the decisions and no one person or entity has a controlling number of tokens. It is not necessarily the case that all token holders have a right to vote, however. In Dash, as we will see below, only masternodes are able to vote, albeit anyone can become a masternode if they hold 1000 dash.[140] The decision making includes not only changes to the rules of

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[128] Melanie Kramer "Aragon Goes Live On Ethereum Mainnet" *ETHNews* (1 November 2018) <www.ethnews.com/aragon-goes-live-on-ethereum-mainnet>. Another project that promises to help people create and run DAOs is DaoStack <www.daostack.io/>.

[129] DAOstack's tagline is, "DAOstack powers decentralized companies, funds and markets to make fast and innovative decisions" <www.daostack.io/>.

[130] Partnership Act 1908 (NZ).

[131] The Trusts Act 2019 (NZ), which will come into force on 30 January 2021 will modernise New Zealand's trust law.

[132] Co-operative Companies Act 1996 (NZ),

[133] Companies Act 1993 (NZ).

[134] Incorporated Societies Act 1908 (NZ) and see generally Mark von Dadelszen *Law of Societies* (3rd ed, LexisNexis, Wellington, 2013).

[135] Charitable Trusts Act 1957 (NZ).

[136] For example, Friendly Societies and Credit Unions Act 1982 (NZ).

[137] For example, Moloch DAO is a non-profit DAO that collects money (ether) from its members and uses that to fund developers for their work on the Ethereum blockchain, Simon de la Rouviere, above n 102.

[138] Steemit <www.steemit.com>, a decentralised social media platform, which is described as a DAO, but is run by a company (Steemit Inc) with its headquarters in Virginia. In addition, if the DAO is operating in a regulated industry, such as insurance, a company is required to be registered, for example, Nexus Mutual which offers mutualised insurance for smart contracts (Hugh Karp "DAO Governance: A Pragmatic Approach" Medium (15 June 2018) <https://medium.com/nexus-mutual/dao-governance-a-pragmatic-approach-27d529ad0819>) has had to register Nexus Mutual Ltd, which is a private company limited by guarantee without share capital in the United Kingdom. Company number 109117763.

[139] Matthew Van Niekerk and Roderik van der Veer "DataBroker DAO" Whitepaper (21 August 2017) at 24-25.

[140] There are over 4,000 masternodes, Iyke Aru "Total Dash Masternode Count Hits 5,000 in Sign of Market Demand" *Dash News* (18 July 2019) <https://dashnews.org/total-dash-masternode-count-hits-5000-in-sign-of-market-demand/>.

how the DAO operates, ie governance decisions, but also who and what work the DAO funds. In addition there is no small group that decides which proposals the token holders vote upon. Rather token holders propose a change to the DAO's rules or propose that they do work that the DAO pays for. There is also no pre vetting or barriers put in the way of proposals, albeit, it is common to require a payment with a proposal to prevent a flood of proposals.[141]

Another feature of a DAO is that the decision making occurs on-chain and is executed automatically. This means that first, the voting occurs on the blockchain, so it is visible to all. If the blockchain uses a public blockchain, anyone can view the voting, not just token holders. Second, once a proposal has been successfully voted upon, for example, for a change to be made to the DAO's rules, that change occurs automatically, without the need for further human involvement.

Some DAOs, such as Dash which is looked at below, have just one type of token that performs a number of different functions. Such tokens serve as the DAO's payment mechanism, represent an ownership interest in the DAO, allow the holders make proposals to the DAO as well as vote on proposals. Other DAOs have two types of coins, one used as the DAO's payment mechanism and the other as a governance token, the holders of the latter token only are able to participate in voting.[142] It is possible also for non-transferrable tokens to be issued based on the reputation a person gains in the DAO from the work they perform, which can be used to, for example, put forward a proposal.[143] Other forms of tokens are possible as well. [144]

Dash is an example of a DAO.[145] Dash runs a blockchain, the purpose of which is to create and maintain a cryptocurrency that is used as a form of payment. As with Bitcoin, miners validate transactions. In Dash, the miners receive 45 per cent of the block reward.[146] Next are masternodes that perform other functions including sending transactions, for which they also receive 45 per cent of the block reward. Decisions are made by masternodes and thus governance rests with them. Anyone can be a masternode if they stake 1,000 dash.[147] The final 10 per cent goes to the Treasury and is used to pay developers and others that contribute to the Dash eco-system. Any holder of dash can submit a proposal for funding.[148] Crucially the Treasury does not receive the dash to distribute, nor does a person or group of people make the actual distribution, instead at the end of the voting cycle all the dash is distributed automatically to those with successful proposals.[149]

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[141] Dash, which is mentioned below, currently requires a fee of five dash, at current prices, USD $363.86, Dash "Using Dash Governance" <https://docs.dash.org/en/stable/governance/using.html>.

[142] MakerDAO "What is MKR?" *Medium* (11 September 2015) <www.medium.com/makerdao/what-is-mkr-e6915d5ca1b3>.

[143] Rea, Fischer and Jack du Rose, above n 14, at 9.

[144] See Steemit, above n 138 which has Steem (STEEM), Steem Power (SP) and Steem Dollars (SBD), Steam "Steem: An Incentivized, Blockchain-based, Public Content Platform" Whitepaper (August 2017) 8-9 <www.steem.com/SteemWhitePaper.pdf>.

[145] Joël Valenzuela "Dash: The first DAO" (14 December 2017) <www.dashforcenews.com/dash-first-dao/>.

[146] Valenzuela, above n 145. The block reward consisting of Dash coins is given each time a block is mined, thus these coins are, in effect, created out of thin air. Dash (the coin) does have a value, as people see dash as being of value - at the time of writing, 5 November 2019 each dash was worth $72.76 USD from CoinMarketCap <https://coinmarketcap.com/>. Currently each masternode receives around six dash a month in block rewards – the block reward decreases by 7.14 percent every 383 days.

[147] Valenzuela, above n 145.

[148] Richard Red "Observations of the Dash Treasury DAO" *Medium* (17 May 2018) <www.medium.com/@richardred/observations-of-the-dash-treasury-dao-c94231b2b5c4>.

[149] If the proposals approved fall short of the dash the treasury has to distribute the remaining amount is burnt, that is, it is destroyed, Richard Red "Observations of the Dash Treasury DAO" *Medium* (17 May 2018) <https://medium.com/@richardred/observations-of-the-dash-treasury-dao-c94231b2b5c4>.

DAOs are susceptible to changes made to the underlying blockchain.[150] (Albeit with The DAO, as we saw above, that feature was used to prevent wrongdoing from occurring.) To avoid changes in the underlying blockchain negatively impacting a DAO, a DAO could create its own blockchain and run on top of that. Practically, however, it would not be prudent for a DAO to create its own blockchain as it would be akin to a company deciding to create and maintain its own suite of computer programmes because it was concerned that changes could be made to, for example, Microsoft Office. Creating and maintaining a blockchain is a complicated and time consuming endeavour, indeed, Dash is a DAO that has been created simply to run a blockchain.

WHY DAOS ARE NOVEL

This part explains the novel features of DAOs, beyond their use of smart contracts, and why the combination of features means that DAOs can be considered a new type of entity that should not be simply slotted into the existing legal framework.

Airdrops

Unlike company shares, which are not normally given away for free, some DAOs will use "airdrops" to distribute tokens to as wide a range of people as possible.[151] Airdrops are akin to dropping money from the sky: people are given tokens for free. There are different ways of distributing via airdrops. Some airdrops give tokens to a person or entity that holds a certain wallet, for example, MyEtherWallet.[152] Each wallet can be given the same number of tokens, or the number of tokens is calculated on the amount of another token in that wallet at a certain point in time.[153] For other airdrops people must apply for the tokens.[154]

DAOs will use airdrops for one of two primary reasons or for both. First, the ethos behind blockchain is decentralisation. Not only does decentralization mean the removal of a controlling central party, but also that the tokens and thus the value and governance are distributed as widely as possible. Second, to create a network effect: if a person has tokens in a DAO they are more likely to participate and the more participants the stronger the DAO.[155]

Not all DAOs will use airdrops, as we have seen above with Dash, tokens are earnt by participants in Dash's eco system. In addition, for those DAOs that use airdrops not all of their tokens will be distributed through airdrops. DAOs will need to pay people to provide services to it and some may want to use them to incentivise people to vote (see below).

Transaction costs are reduced significantly

[150] Christine Kim "Ethereum's Istanbul Upgrade Will Break 680 Smart Contracts on Aragon" *Coindesk* (30 September 2019) <https://www.coindesk.com/ethereums-istanbul-upgrade-will-break-680-smart-contracts-on-aragon>.

[151] A number of blockchain projects have used airdrops, Jeff John Roberts "Cryptofirms Turn to "Airdrops" to Boost Blockchain Projects" *Fortune* (New York, 4 June 2018) <http://fortune.com/2018/06/04/blockchain-airdrops/>.

[152] "Why am I Getting Random Tokens in my Wallet? (Airdrops) (MyEtherWallet)" <https://kb.myetherwallet.com/tokens/airdropped-tokens.html>.

[153] For MyEtherWallet the number of tokens would depend on the number of ether in the wallet, "Why am I Getting Random Tokens in my Wallet? (Airdrops) (MyEtherWallet)" <https://kb.myetherwallet.com/tokens/airdropped-tokens.html>.

[154] Dfinity, for example, required people to apply and it also used a Know your Customer (KYC) process, Michael Hunte "Liftoff! The DFINITY Community Airdrop is Here" *Medium* (30 May 2018) <www.medium.com/dfinity/liftoff-the-dfinity-community-airdrop-is-here-5a11b94a2d03>.

[155] Xen Baynham-Herd "Airdropping into the Future of Decentralised Networks" *Medium* (23 October 2018) <www.medium.com/@xen_26244/airdropping-into-the-future-of-decentralised-networks-e8b5cc7e6162>.

Ronald Coase in "The Nature of the Firm",[156] observed that firms formed when it was cheaper to gather goods and people together rather than obtain everything in the market.[157] Even when people organise together to form firms, such as companies, the transaction costs remain high. Transaction costs in the US economy in 1970 were estimated to consume over 45 per cent of national income.[158] Granted, the growing use of IT and changes in business models, has reduced transaction costs.[159] Some of this use of technology and the changes in the way of doing business include the outsourcing of work to external providers whether in the same country of overseas,[160] the use of cloud computing,[161] crowd sourcing and IT-based platforms such as Amazon and Alibaba.[162] Amazon, for example, allows third parties to sell goods online without the need to maintain their own website.[163] Amazon also allows the option of storing the goods, packing and delivery as well as returns.[164] Changing business models such as Uber, which does not own cars, and AirBnB, which likewise does not own the accommodation it provides, are changing our traditional idea of companies to the providers of a platform.[165] Yet organisations such as Amazon, Alibaba, Uber and AirBnB are large corporations with directors, managers and shareholders.[166]

One reason for a firm's high transaction costs is due to the "costliness of ascertaining violations and the severity of punishment".[167] As Coase noted, it was costly to make sure the terms of the contract were observed.[168] The ability of DAOs to remove a large part of the cost in enforcing rules through smart contracts, means that DAOs represent a radical departure from what has gone before because code can literally become the law.[169] Take the crowdfunding example used earlier.[170] The smart contract would be coded so that if the pre-set amount was not met the cryptocurrency is returned automatically to the putative investors. The DAO, or others acting on its behalf, cannot chose to retain the cryptocurrency.

To be sure, smart contracts are at odds with the concept of efficient breach—people should be able to breach their contracts if it would be more cost effective for them to do so.[171] While the concept of efficient breach has a seductive logic to it, it is not a good reason to prevent the use of self-enforcing contracts and thus DAOs. There are trade-offs with any change and the concept of efficient breach

[156] Ronald Coase "The Nature of the Firm" (1937) 4 Economica 386.
[157] De Filippi and Wright, above n 3, at 132.
[158] John J Wallis and Douglass North "Measuring the Transaction Sector in the American Economy, 1870-1970" in SL Engerman and RE Gallman (eds) *Long-Term Factors in American Economic Growth* (University of Chicago Press, Chicago, 1986) at 113 and 120, cited by DC North*, Institutions, Institutional Change, and Economic Performance* (CUP, Cambridge, 1991) at 28.
[159] Niels Bjørn-Andersen and Benoit Raymond "The impact of IT over five decades e Towards the Ambient Organization" (2014) 45 Applied Ergonomics 188.
[160] At 193.
[161] At 192.
[162] At 192.
[163] At 192.
[164] Amazon Services "Fulfilment by Amazon" <www.services.amazon.com/fulfillment-by-amazon/benefits.htm/ref=asus_soa_gs_fba>.
[165] See generally, Geoffrey G Parker, Marshall W Van Alstyne and Sangeet Paul Choudary *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You* (WW Norton & Co, New York, 2018).
[166] Amazon, in particular, micromanages those that work for it in fulfilment centres to an extraordinary level, see generally, James Bloodworth *Hired: Six Months Undercover in Low-Wage Britain* (Atlantic Books, London, 2018).
[167] DC North *Institutions, Institutional Change, and Economic Performance* (CUP, Cambridge, 1990) at 4.
[168] Ronald Coase "The Problem of Social Cost" (1960) 3 Journal of Law and Economics 1 at 15.
[169] Lessig, above n 6, at 5.
[170] Above nn 63 - 65.
[171] Mik, above n 13, at 283.

may be one causality. Indeed the concept of efficient breach is of relatively recent origin,[172] and has been the subject of criticism.[173] Moreover, if efficient breach was an overriding contractual rule, why are specific enforcement and injunctions among the array of remedies available to judges?

There are considerable benefits in rules (and promises) not being broken. While law is often used in the aftermath of the breaking of rules and promises, it is an expensive and time consuming process. The use of law to hold people liable for a breach of the law operates on the assumption that it is possible to restore victims to the position they would have been had there been no breach. For example, take a trustee that sells a valuable painting belonging to the trust to a third party. If the third party or have reason to know of the trust,[174] the beneficiaries have the legal right to sue the trustee for breach of trust; however, the beneficiaries are unable to regain the painting. Therefore, in addition to the considerable transaction cost savings of not expending resources in detection and punishment of infringers, there will be no victims who need to be restored to a position pre-breach.

The impact of ensuring rules are enforced cannot be overstated and goes beyond simply high transaction costs and the victims' harm. As North, observed:[175]

> "[O]ne cannot take enforcement for granted. It is (and always has been) the critical obstacle to increasing specialization and division of labour… without institutional constraints, self-interested behavior will foreclose complex exchange, because of the uncertainty that the other party will find it in his or her interest to live up to the agreement. The transaction cost will reflect the uncertainty by including a risk premium, the magnitude of which will turn on the likelihood of defection by the other party and the consequent cost to the first party. Throughout history the size of this premium has largely foreclosed complex exchange and therefore limited the possibility of economic growth."

If North is correct, DAOs and the overriding of the concept of efficient breach, could encourage economic growth because of the removal of the uncertainty of a person or entity failing to do as they promised. Currently because of the uncertainty over whether a contract will be performed people may resort to more expensive and less efficient means, such as integrating with their suppliers.[176]

While current systems are far from perfect and expensive to run, nonetheless for some they may be preferable to a potentially dystopian future and the loss of the ability to contest. For example, there can be errors in the smart contract[177] and not everything can be anticipated and thus coded ahead of time.[178] An error in The DAO's smart contract saw a person almost steal ether worth millions of dollars. Because of the impossibility of creating perfect smart contracts in the near or medium term future, it is likely that some putative DAOs are using permissioned blockchains as a testing ground. The fear of smart contracts may be overstated, however. It is possible to code a smart contract so that if all the parties to the smart contract agree to make changes they can and they can cancel the

[172] Ian R Macneil "Efficient Breach of Contract: Circles in the Sky" (1982) 68 Virginia Law Review 947 for a short history of the concept which Macneil asserts was first suggested in 1970 by Robert L Birmingham "Breach of Contract, Damage Measures and Economic Efficiency" (1970) 24 Rutgers L Rev 273.
[173] Gregory Klass "Efficient Breach" in Gregory Klass, George Letsas and Prince Saprai (eds) *Philosophical Foundations of Contract Law* (OUP, Oxford, 2014) and Daniel Friedmann "The Efficient Breach Fallacy" (1989) 18 Journal of Legal Studies 1.
[174] Bona fide purchaser for value without notice.
[175] North, above n 167, at 33.
[176] Daniel Friedmann "The Efficient Breach Fallacy" (1989) 18 Journal of Legal Studies 1.
[177] Mik, above n 13, at 281.
[178] At 282 - 283.

smart contract if so desired.

Even for those using permissioned blockchains (and especially for DAOs that chose to use public blockchains) dispute resolution mechanisms will still be required for some transactions. For example, while a shipment of goods may have arrived, the purchaser may claim the goods are not the same as those ordered or they have faults that are only discovered weeks or months later. Dispute resolution could take the form of mediation or arbitration.[179] While dispute resolution could occur within a DAO,[180] it is more efficient to use a third party to provide dispute solution and projects are working on providing dispute resolution services for DAOs.[181] Parties may decide to use the courts instead, but given the cost and time involved it would not be an attractive option. In relation to third parties, for example, third parties that the DAO has contracts with, the contracts should specify the dispute resolution that will be used.

Profit distribution

DAOs would not typically distribute profits to token holders in the form of infrequent payments of profits in fiat currency as some companies distribute dividends to shareholders, although some may.[182] Instead all payments to actors within the DAO's ecosystem would be in the DAO's tokens rather than fiat currency. The token holders, if they wish to liquidate some or all of their tokens, could exchange them for other tokens, or, if necessary, fiat currency.[183] For example, people providing services to the Dash DAO are paid in Dash, which they are able to sell.

Crucially, the DAO in making payments in its tokens could go some way towards reducing inequality between capital and labour because participants would, if they retained the tokens, in effect gain a share of ownership of the DAO. Currently, those working for or providing services to the likes of Amazon and Uber do not share in the increase of value of Uber and Amazon's shares.

Governance, management and decision-making

DAOs are not constructed the same way as traditional companies. Shareholders in a traditional company have a limited decision-making role: the decisions reserved to shareholders are limited.[184] Employees in traditional New Zealand companies, unless they are shareholders, a part of

[179] Mattereum <https://mattereum.com/>.
[180] See, for example, Rea, Fischer and Jack du Rose, above n 14.
[181] Aragon "Aragon Network Jurisdiction Part 1: Decentralized Court" (18 July 2017) <https://blog.aragon.org/aragon-network-jurisdiction-part-1-decentralized-court-c8ab2a675e82/>. See also Juris <www.jurisproject.io/>. Creating alternative dispute resolution bodies is nothing new. Merchants in the United Kingdom created their own merchant courts for a number of reasons. Merchants preferred judges from the relevant merchant community when technical issues were involved; transactions needed to be completed quickly; rules of evidence were simpler than in the royal courts; and there were no appeals, Bruce L Benson *The Enterprise of Law: Justice without the State* (Independent Institute, Oakland, California, 2011) at 33-34.
[182] See Artonymousart "The Art Collective DAO" (12 May 2019) Cent <beta.cent.co> who floats that idea that a DAO could pay dividends to token holders.
[183] While there are exchanges many are not particularly user friendly and not all tokens are available, largely due to regulatory concerns. Thus the ability to freely trade the tokens of all DAOs in an open marketplace is someway off in the future. Notwithstanding the limitations of exchanges, tokens can still be transferred peer-to-peer.
[184] The rights reserved to shareholders include adopting, altering and revoking a constitution, Companies Act 1993, s 32 (a special resolution is required which means a resolution approved by a 75 per cent majority, or higher if required by the constitution), s 2. One of the other rights is permitting the company to enter into a major transaction, s 129 (a major transaction is when the company will acquire or dispose of assets or acquire rights or incur obligations or liabilities that are worth more than half of the value of the company's assets) again a special resolution is required.

management or are directors, have no say in decision-making,[185] nor do creditors. If ordinary employees do have a say in decision-making it is because of a management decision allowing them to do so. Directors and thus the Board make strategic decisions. Granted, some organisations such as John Lewis[186] and Mondragon,[187] allow for limited employee involvement in decision-making. However, with John Lewis employees—who are called partners—do not vote directly, rather they elect members on to the Partnership Council.[188] The Partnership Council in turn is just one of three bodies,[189] and is not the body responsible for major policy.[190]

As regards day-to-day functions of a traditional company, and even organisations such as John Lewis and Mondragon, managers direct co-ordination.[191] Another requirement when managers are used is that a support network consisting of people and other resources is needed so that information can be provided to managers to assist their decision-making.[192] While blockchain can be used to provide information to all, due to bounded rationality,[193] not all token holders will be in a position to make informed decisions.[194] However, just as with Bitcoin and other blockchains, where humans do not make decisions about which blocks to mine, DAOs do not necessarily require token holders to make decisions as many decisions will be automated.

There will, however, be times when decisions need to be made. Token holders make the decisions instead of decisions of managers or a board.[195] Albeit, this does not necessarily mean that all token holders vote: with DASH masternodes only are able to vote and with MakerDAO only those that hold

[185] Contrast Germany with its legally mandated employee representation on publically listed German company boards, Larry Fauver and Michael E Fuerst "Does Good Corporate Governance Include Employee Representation? Evidence from German Corporate Boards" (2006) 82(3) Journal of Financial Economics 673.
[186] Hugh Willmott and Bernard Paranque "Cooperatives—Saviours or Gravediggers of Capitalism? Critical Performativity and the John Lewis Partnership" (2014) 21 Organisation 604.
[187] Mondragon "Corporate Management Model" <www.mondragon-corporation.com/wp-content/themes/mondragon/docs/Corporate-Management-Model.pdf> and Baleren Bakaikoa, Anjel Errasti and Agurtzane Begiristain "Governance of the Corporación Cooperativa" (2004) 75 Annals of Public Cooperative Economics 61.
[188] John Lewis Partnership Constitution (2017) <www.johnlewispartnership.co.uk/content/dam/cws/pdfs/about-us/our-constitution/john-lewis-partnership-constitution.pdf> at [12].
[189] Willmott and Paranque, above n 186, at 610.
[190] John Lewis Partnership Constitution, above n 188, at [38], albeit the Partnership Council does elect five partners to the Partnership board that is responsible for major policy at [18].
[191] Wallis and North, above n 149, at 105.
[192] At 105.
[193] Herbert A Simon "A Behavioural Model of Rational Choice" (1955) 69(1) The Quarterly Journal of Economics 99 and De Filippi and Wright, above n 3, at 132.
[194] See generally, in relation to consumers and standard form contracts, Yannis Bakos, Florencia Marotta-Wurgler and David R Trossen "Does Anyone Read the Fine Print? Consumer Attention to Standard-Form Contracts" (2014) 43 Journal of Legal Studies 1.
[195] Contrast, Philipp Hacker "Corporate Governance for Complex Cryptocurrencies? A Framework for Stability and Decision Making in Blockchain-Based Organizations" in Philipp Hacker, Ioannis Lianos, Georgios Dimitropoulos and Stefan Eich (eds) *Regulating Blockchain. Techno-Social and Legal Challenges* (OUP, Oxford, 2019) at 26 who argues that "Blockchain-based organizations must establish organs for core developers (responsible for the management of everyday affairs) and users (responsible for deciding fundamental matters)."

certain tokens can vote.[196] DAOs can require token holders to stake (deposit tokens)[197] and during the time they are staked the owner is able to vote. [198] Moreover, unlike traditional companies where each share in a class is normally worth the same as any other share — although some companies such as Facebook use differential weighting of shares—[199] it is possible for a DAO to use a system so that some people's tokens are worth more than others.[200] A reputation system could also be used so that those who had acquired a higher reputation because of the work they had contributed to the DAO or the esteem with which they were held by other DAO token holders,[201] meant the value of their tokens in terms of their voting rights was higher than other token holders. Reputation systems are not new: organisations such as Trade Me have used reputation systems for many years.[202]

Potential issues with decision making and how to overcome them

There are potential stumbling blocks with the requirement that people vote on the DAO's actions. Who decides what is voted upon? Are votes treated equally? How can people be incentivised to vote in the DAO's long-term interests? How can "minority" interests be protected? As the following demonstrates the issues have been identified and potential solutions are being worked upon. There will, of course, be other ways of addressing these issues. Before looking at each issue it must be noted that collective decision-making is not new, much work has been done on exploring decision-making in the commons.[203] The difference between the work on the commons was that the size of the commons was limited: blockchain potentially solves the coordination problem of larger groups.[204]

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[196] MakerDAO, in addition to its DAI coins (stable coins that are designed to be pegged to the US dollar), has MKR coins to be used inter alia for governance, MakerDAO "What is MKR?" *Medium* (11 September 2015) <www.medium.com/makerdao/what-is-mkr-e6915d5ca1b3>. For other projects with different tokens see Steemit, above n 138 which has Steem (STEEM), Steem Power (SP) and Steem Dollars (SBD), Steam "Steem: An Incentivized, Blockchain-based, Public Content Platform" Whitepaper (August 2017) at 8-9 <www.steem.com/SteemWhitePaper.pdf>.

[197] Dominic Williams "The Dfinity 'Blockchain Nervous System'" *Medium* (5 January 2017) <www.medium.com/dfinity/the-dfinity-blockchain-nervous-system-a5dd1783288e>.

[198] Williams, above n 197.

[199] Despite Mark Zuckerberg owning 16 per cent of Facebook's shares he controls 60 per cent of the voting rights as some of his shares have 10 times the normal voting rights. "Facebook and the meaning of share ownership" *The Economist* (30 September 2017) <www.economist.com/business/2017/09/30/facebook-and-the-meaning-of-share-ownership>.

[200] DAOstack "An Operating System for Collective Intelligence" Whitepaper (22 April 2018) at 5 <www.daostack.io/wp/DAOstack-White-Paper-en.pdf>. Ehrsam, a co-founder of the exchange Coinbase, has stated, "a new token holder may have diminished voting power until they have been a member of a community for a while, similar to not being able to vote until you are a full citizen of a country", Fred Ehrsam "Blockchain Governance: Programming our Future" *Medium* (28 November 2017) <www.medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74>.

[201] See generally, Rea, Fischer and Jack du Rose, above n 14. Designing reputation systems will be an art in itself, as will be assessing the esteem with which others hold people.

[202] Audun Jøsang, Roslan Ismail and Colin Boyd "A Survey of Trust and Reputation Systems for Online Service Provision" (2007) 43(2) Decision Support Systems 618.

[203] Especially Elinor Ostrom's work for which she received a Nobel Prize in Economics in 2009 for analysis of economic governance, especially the commons, Elinor Ostrom *Governing the Commons: The Evolution of Institutions for Collective Action* (CUP, Cambridge, 1990) and Elinor Ostrom, Joanna Burger, Christopher B Field, Richard B Norgaard and David Policansky "Revisiting the Commons: Local Lessons, Global Challenges" (1999) 284 Science 278.

[204] David Rozas, Antonio Tenorio-Fornés, Silvia Díaz-Molina and Samer Hassan "When Ostrom Meets Blockchain: Exploring the Potentials of Blockchain for Commons Governance" <https://ssrn.com/abstract=3272329> and David Bollier "The Blockchain: A Promising New Infrastructure for

Who decides what is voted upon? Some DAOs, such as Tezos[205] and Dash can be seen as an example of direct democracy as any token holder can put forward proposals. In Tezos there are rounds of voting to determine which, if any, are adopted.[206] While there is a rich literature on direct democracy,[207] DAOs such as Tezos and Dash go further because of the ability for just one person to put a proposal forward, unlike the more traditional system of requiring a person to gather the support of a substantial number of others. The drawback, of course, is that token holders may be overwhelmed with proposals to choose between. Dash attempts to limit the number of proposals by requiring the payment of a set fee.[208]

Will people vote? With the exception of jurisdictions where voting is compulsory, the number of people who vote in central and local government elections is falling.[209] What will happen if more regular votes are needed? As an incentive token holders can be paid in a DAO's tokens if they vote.[210] It is arguable, however, that there is a danger of rational ignorance on the part of token holders if payment was made for voting.[211] It would be economically rational for people not to spend time analyzing the proposal and the code, if the proposal was about implement specific code, and simply vote and collect their payment. To incentivise people not to make decisions that are good for that person in the short term, but poor for the DAO in the long term, token owners could be prevented from selling their tokens for a set period after voting on an issue. Dfinity, for example, is proposing at least a three-month stand down period between a token holder requesting the release of their tokens and their actual release.[212] The longer the stand down period for the return of the tokens the higher the payment for voting could be.[213] Yet, it may well be that the harm does not manifest for some years, and by that time the errant token holders may have divested themselves of the tokens. And what of the well-informed token holders who were harmed by the rationally ignorant voting? The potential danger of rationally ignorant voting would in turn act as an incentive for well-informed token holders to vote.

An alternative for proposals competing for peoples' scare attention is DAOstack's Holographic Consensus, which uses prediction markets. Token holders review proposals and assess whether they believe a proposal will be successful or unsuccessful, by staking tokens on the outcome.[214] The

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Online Commons" (3 April 2015) <http://bollier.org/blog/blockchain-promising-new-infrastructure-online-commons>.

[205] Tezos Foundation "A Digital Commonwealth" <www.tezos.foundation/a-digital-commonwealth>.

[206] Tezos Foundation "A Digital Commonwealth" <www.tezos.foundation/a-digital-commonwealth>.

[207] For example, Zoltán Tibor Pállinger, Bruno Kaufmann, Wilfried Marxer and Theo Schiller (eds) *Direct Democracy in Europe: Developments and Prospects* (Springer, New York, 2007); Bruno S Frey "Direct Democracy: Politico-Economic Lessons from Swiss Experience" (1994) 84(2) The American Economic Review 338; and Arun Maira "The Problem with Direct Democracy: The Case of California" *The Globalist* (21 October 2017) <www.theglobalist.com/technology-democracy-society-social-media-surveillance/>.

[208] Dash "Using Dash Governance", above n 141. Another solution has been proposed by Dfinity which requires a fee, which has two parts. A non-refundable component as work is performed by researchers on a bounty system, the scale of fee will depend on the type of proposal and a security deposit, which is refunded if the proposal is accepted, designed to prevent spam proposals, Williams, above n 197.

[209] Dan Kopf "Voter Turnout is Dropping Dramatically in the 'Free World'" *Quartz* (New York, 2 February 2017) <www.qz.com/899586/global-voter-turnout-is-dropping-dramatically-across-the-world/>.

[210] Williams, above n 197.

[211] Anthony Downs "An Economic Theory of Political Action in a Democracy" (1957) 65(2) Journal of Political Economy 135; César Martinelli "Would Rational Voters Acquire Costly Information?" (2006) 129 Journal of Economic Theory 225; and Ilya Somin "Voter Ignorance and the Democratic Ideal" (1998) 12 (4) Critical Review 413.

[212] Williams, above n 197.

[213] Williams, above n 197.

[214] Matan Field "Holographic Consensus – Part 1" *Medium* (12 November 2018) <https://medium.com/daostack/holographic-consensus-part-1-116a73ba1e1c> and Matan Field "Holographic

amount staked in favour is pooled, as is the amount staked against. If a proposal passes, because it has gain sufficient votes from token holders, all those who those predicted in favour receive a pro rata share of the amount that had been staked against it passing and visa versa.[215]

Under most current voting systems an expert's vote is worth the same as a person who has no knowledge and even no interest in the issue. A reputation system could be used, so the value of votes cast by people who have higher reputations is increased. Alternatively Dfinity is proposing a form of liquid democracy.[216] While liquid democracy was first proposed in 1969,[217] limitations in technology hampered its use.[218] Token holders can set up a "neuron" in Dfinity to follow the votes of neurons owned by other people that they think will make good decisions.[219] Token holders create a neuron by staking tokens in a smart contract, which also means that during the time they are staked the token holder is unable to transfer their tokens. The neuron creator can set it up to follow the voting pattern of people on certain issues automatically, or just one person for all issues. It would also be possible to set the token up so that if five experts on an issue were identified, the neuron would follow the majority vote of the five experts. The neuron owner can also choose to make decisions manually.

Fifth, how can token holders be protected if they do not agree with the direction the DAO is taking? As we shall see below, token holders have the ability to exit the DAO easily.

Ability to exit the DAO easily

People within firms and other institutions have the choice of voice or exit.[220] Voice can be exercised by a member attempting to agitate and exert influence from within the institution, which may or may not be effective. Exit is where the member switches to a competing product. For example, a shareholder can, depending on the company, sell their shares if they are not happy with the company's performance. Albeit while shares in publically listed companies are usually easy to sell, the ability to sell shares in privately held companies may be more difficult as people may not want to purchase those shares, especially if they will be a minority shareholder. In contrast, DAO tokens can be transferred easily. Albeit for reputation tokens, which cannot be transferred, the token holders would exit without their reputation tokens.

Exit is more nuanced with DAOs. Not only is there the ability to sell tokens, a weak exit,[221] there is also the possibility of a strong exit: forking.[222]

Ability to fork

Consensus – Part 2" *Medium* (19 June 2019) <https://medium.com/daostack/holographic-consensus-part-2-4fd461e8dcde>.

[215] Other DAOs have incorporated Holographic Consensus into their governance, Martin Köppelmann "A Brief Discussion of the Protocol Governing the dxDAO" *Medium* (10 January 2019) <https://blog.gnosis.pm/a-brief-discussion-of-the-protocol-governing-the-dxdao-7331407a2555>.

[216] Williams, above n 197.

[217] Christian Blum and Christina Isabel Zuber "Liquid Democracy: Potentials, Problems, and Perspectives" (2016) 24 Journal of Political Philosophy 162 at 163 who credit James C Miller as first introducing the idea into academic debate in James C Miller "A Program for Direct and Proxy Voting in the Legislative Process" (1960) 7 Public Choice 107.

[218] Melanie Swan *Blockchain: Blueprint for a New Economy* (O'Reilly, Sebastopol, California, 2015) at 49-50.

[219] Williams, above n 197.

[220] See generally, Albert O Hirshman *Exit, Voice, and Loyalty Responses to Decline in Firms, Organizations, and States* (Harvard University Press, Cambridge, Massachusetts, 1970).

[221] Hacker, above n 195, at 21.

[222] At 22 and Ehrsam, above n 200.

The central tenet of open source software, which most DAOs will use, is that the software can fork to replicate an identical and competing "separate, backwards-compatible platform".[223] If a DAO forked there would be two DAOs in operation. Forks are not merely theoretical: the Ethereum blockchain was forked following The DAO hack to create Ethereum and Ethereum Classic.[224]

Granted, dividing in two can occur with traditional forms of organisations.[225] However, minority shareholders are often locked in and are unable to exit from the company with their value of their shareholding.[226] Even if minority shareholders are bought out, they will find it hard to compete with the company and certainly would not be able to use the name and, in effect, the resources of the company from which they have split. It is inconceivable that Facebook, for example, would allow a clone to operate.

Uber serves as a good example of the effects of forking. Imagine if Uber was a DAO.[227] If a significant number of token holders did not like how Uber was operating, they could fork it and create their own ride sharing DAO,[228] There would now be two versions, the parent DAO (the Uber that existed before the fork) and the child DAO (the newly created Uber). Immediately after the fork both Ubers would have the identical code, and transaction history and so on. The two Ubers would slowly drift apart as changes were made to each one. The users who had been using the parent Uber and now wanted to use the child Uber would need to contact the parent Uber to get their information deleted from the parent Uber's databases.[229]

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[223] Christian Catalini and Joshua S Gans "Some Simple Economics of the Blockchain" MIT Sloan Research Paper No 5191-16 at 16-17 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2874598>. The creation of a new ledger is called a hard fork. See also Linus Nyman and Juho Lindman "Code Forking, Governance, and Sustainability in Open Source Software" (2013) Technology Innovation Management Review 7 and Bruce Kogut and Anca Metiu "Open-Source Software Development and Distributed Innovation" (2001) 17(2) Oxford Review of Economic Policy 248.

[224] See generally, DuPont, above n 111, at 157. Other forks have occurred, particularly with Bitcoin, which was forked to create Bitcoin Cash and other forks of Bitcoin include Bitcoin Gold and Bitcoin Diamond. In the non-blockchain space, forks of other open source software have been successful, for example, LibreOffice was forked from OpenOffice in 2010, Jonas Gamalielsson and Björn Lundell "Sustainability of Open Source Software Communities beyond a Fork: How and Why has the LibreOffice Project Evolved?" (2014) 89 Journal of Systems and Software 128 at 132.

[225] In Australia, Wesfarmers and Coles demerged in 2018, however, these were formerly two independent companies and after the demerger were two distinct companies, Patrick Hatch "Investors back Coles Spin-off as Wesfarmers Hits Back on Debt" *Sydney Morning Herald* (15 November 2018) <www.smh.com.au/business/companies/investors-back-coles-spin-off-as-wesfarmers-hits-back-on-debt-20181115-p50gbw.html>.

[226] In New Zealand shareholders have minority buy-out rights in limited situations only, Companies Act 1993, ss 110-115.

[227] See generally, De Filippi and Wright, above n 3, 138-139 for a discussion of Uber operating as a DAO. Albeit De Filippi and Wright use Uber as an example of a DAO that is free from human decision making.

[228] For forking, see generally, Ehrsam, above n 200. There is no requirement that the person or people that initiate the fork to be token holders.

[229] The amount of information held by a DAO may well be considerably less than what is currently held by organisations. Blockchain allows for a user to hold information instead of others holding that information, Guy Zyskind, Oz Nathan and Alex Pentland "Decentralizing Privacy: Using Blockchain to Protect Personal Data" 2015 IEEE Security and Privacy Workshops. For an example of the use of blockchain to protect privacy see <www.civic.com>. One concern about blockchain technology is that if personally identifiable information (PII) is stored on a blockchain it will be viewable by all and would not be able to be removed, in particular this concern has been highlighted by the European Union's General Data Protection Regulation 2016/679 (GDPR). Work, however, is being undertaken to address these concerns, see generally, Simon Schwerin "Blockchain and Privacy Protection in the Case of the European General Data Protection Regulation (GDPR): A Delphi Study" 2018 1(1) Journal of the British Blockchain Association 1.

There have been forks of Ethereum and Bitcoin which have not harmed either blockchain, however, there will no doubt be increased concern when DAOs own physical property, such as a building or part of a building. The concern, however, is overblown. Even if the building had been tokenized,[230] the blockchain controlling the building's tokens (or rather the tokens for the land) would be a separate blockchain from the blockchain the DAO was running on and it would record the DAO as the owner. Thus if a fork should occur the child DAO would be a new entity and as a new entity would not be the owner of the building's tokens. (Digital identity is a key feature of blockchain and each person and entity would have its own digital identity.) Thus the child DAO would not be identical to the parent DAO at the time of the fork as it would not have ownership of the physical assets. In addition, if the DAO had other assets that resided in other DLTs, for example, it might own ether, the child DAO would not obtain ownership of those assets.

Finally, there are two schools of thought over forking. The threat of forking in DAOs means that the value of the platform may decrease because of the uncertainty over possible forks, yet, on the other hand, the ever present threat of forking encourages better forms of governance.[231] Forking should therefore be seen as a feature rather than a bug.[232] While in theory the DAO's token holders could agree not to fork the DAO and provide for that in the code, later token holders, or token holders that change their mind, could later agree to change the code, thus overriding the earlier agreement.

In addition, the ability to fork a DAO may mean that DAOs do not grow into large monopolies with their associated negative consequences that current organisations do. Indeed, with the necessity of voting on decisions, while DAOs can co-ordinate large groups, the larger the group the more difficult the co-ordination problems will be. Therefore DAOs are likely to remain on the smaller side for the foreseeable future.

SEPARATE LEGAL PERSONALITY AND LIMITED LIABILITY OF DAO TOKEN HOLDERS

Under current New Zealand law DAO token holders would likely be treated as partners in a partnership:[233] section 4 of New Zealand's Partnership 1908 states "partnership is the relation which subsists between persons carrying on a business in common with a view to profit."[234] Partners are liable for all the debts of the partnership,[235] as well as the wrongs,[236] incurred at the time they were a partner. Using partnership law as a vehicle is not appropriate for DAOs. First, when a partner enters or leaves a partnership that partnership ends and a new one is formed.[237] A DAO's tokens may be traded many times a day, therefore, the partnership would technically end and a new one formed each time a new person acquired tokens or an existing token holder divested itself of all its tokens. Second, because the partnership is not a separate legal entity it is unable to hold and own assets. Those assets would have to be held in token holders' names which would defeat much of the purpose of a DAO, because the DAO itself would be unable to enter into most smart contracts. Instead the DAO would need to rely on token holders to hold its tokens and other assets and be

[230] Above nn 52 - 55.
[231] Catalini and Gans, above n 223 and Ehrsam, above n 200.
[232] Steve Tendon and Max Ganado "Legal Personality for Blockchains, DAOs and Smart Contracts" (2018) Corporate Finance and Capital Markets Law Review 1 at 7 where forking is seen as facilitating the evolution of blockchain technology.
[233] Laila Metjahic "Deconstructing the DAO: The Need for Legal Recognition and the Application of Securities Laws to Decentralized Organizations" (2018) 39 Cardozo Law Review 1533 at 1554; Dirk A Zetzsche, Ross P Buckley and Douglas W Arner "The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain" (2018) University of Illinois Law Review 1361 at 1400; and De Filippi and Wright, above n 3, at 141-142.
[234] Partnership Act 1908, s 4.
[235] Partnership Act 1908, s 12.
[236] Partnership Act 1908, s 15.
[237] *Hadlee v Commissioner of Inland Revenue* [1989] 2 NZLR 447 at 455.

parties to the smart contract. Third, the personal liability of token holders for the debts, liabilities and wrongs committed by the DAO would limit the number of people prepared to become DAO token holders and thus stifle their development.

In New Zealand, there are also limited partnerships which are separate legal entities.[238] The liability of limited partners is limited to their capital contribution to the limited partnership (provided they do not take any part in the management of the partnership),[239] which would be problematic given the token holder's ability to vote in the DAO's operations.[240]

The law has been used creatively an attempt to clothe some DAOs in legal form and shield their token holders, by using a "legal wrapper", for example, by incorporating a company and linking that to a DAO.[241] NexusMutual, which offers mutualised insurance for smart contracts, has incorporated a company in the United Kingdom.[242] Dash has been even more creative and, in addition, to incorporating Dash Core Group, Inc a C-corporation in Delware, a trust has been established in New Zealand.[243] Such legal manoeuvres are reminiscent of the lawyers' creativity prior to the ability to incorporate a company and for shareholders to be granted limited liability. The lawyers used what they had to hand including trusts to allow unincorporated companies to operate and to shield their members from liability.[244]

Just as the United States and France recognised the corporate form and limited liability of shareholders before the United Kingdom, jurisdictions are beginning to move in this area. In May 2018 Vermont legislated for BBLLCs (Blockchain-based Limited Liability Companies)[245] and at least one BBLLC has been registered.[246] Malta has proposed that DAOs as well as other technological arrangements "will be able to register with the Registrar for Legal Persons in Malta and acquire legal personality upon satisfaction of a number of requirements.[247] If a river[248] can be granted separate legal personality then new forms of business structures are not a stretch.

Granting DAOs separate legal personality would mean that the DAO could own assets and it could both sue and be sued. However, what about the DAO token holders' liability? With traditional companies, the directors can be personally liable for some of a company's actions.[249] On the other

[238] Limited Partnerships Act 2008, s 11.
[239] Limited Partnerships Act 2008, s 31.
[240] Limited Partnerships Act 2008, s 25. There are also general partners who are decision makers and are liable for the partnership's debts and liabilities and the partnership's omissions and wrongs, Limited Partnerships Act 2008, ss 25 and 27.
[241] See generally Christine Kim "New Interest in DAOs Prompts Old Question: Are They Legal?" *Coindesk* (29 September 2019) <https://www.coindesk.com/new-interest-in-daos-prompts-old-question-are-they-legal>.
[242] Nexus Mutual Ltd, which is a private company limited by guarantee without share capital in the United Kingdom. Company number 109117763 and see Karp, above n 138.
[243] "The Dash Trust" <https://dashcrypto.org/legal-structure/the-dash-trust/>.
[244] Bubb, above n 84.
[245] 11 V.S.A. § 4173.
[246] Gravel & Shea "dOrg Launches First Limited Liability DAO" (June 2019) <https://www.gravelshea.com/2019/06/dorg-launches-first-limited-liability-dao/>.
[247] Government of Malta "DLT Regulation Consultation Document" (2018) at 18 <www.meae.gov.mt/en/Public_Consultations/OPM/Documents/PS%20FSDEI%20-%20DLT%20Regulation%20Document%20OUTPUT.PDF>.
[248] Te Awa Tupua (Whanganui River Claims Settlement) Act 2017, s 14(1) "Te Awa Tupua [the Whanganui River] is a legal person and has all the rights, powers, duties, and liabilities of a legal person."
[249] For example a director cannot "agree to the business of the company being carried on in a manner likely to create a substantial risk of serious loss to the company's creditors; or cause or allow the business of the company to be carried on in a manner likely to create a substantial risk of serious loss to the company's creditors." Companies Act 1993, s 135.

hand, shareholders who participate in decision making when casting votes at company meetings are not liable for their votes. As some token holders may not have known the DAO was engaging in illegal activity and took no part in the decisions, it would make little sense for those people to be held liable for the DAO's actions, any more than a shareholder of a traditional company. For those that did vote on a decision, should they be held liable? To require each person who votes to risk personal liability would mean that most people would not vote, which would hinder the purpose behind decentralised governance as it would decrease the number of people participating in the decision making process. Not imposing liability on the token holders for voting would be akin to how shareholders are treated currently. Potential losses to creditors could be minimised by allowing the DAO to recover distributions to token holders.[250]

One potential solution would be to hold liable the person or persons who put forward the proposal that was voted upon. While at first glance such a move it looks attractive, a token holder may be cajoled by someone else to make the proposal, thus the true proposer may hide behind someone else. Moreover, imposing liability on proposers would stifle the development of DAOs, for example, errors in the code may not be fixed as token holders would be unwilling to propose changes if that would expose them to liability, thus potentially harming not just the DAO but all token holders and others dealing with the DAO. Therefore, placing liability on proposers may not be a sensible idea.

As the development of separate legal personality in the United Kingdom demonstrated, the presence of separate legal personality only for companies was not sufficient: the other side of the coin was the limited liability of shareholders. In companies the decision was made to limit shareholders' liability to creditors to what they have invested in shares in the company, if the same line of reasoning is used for DAOs, the token holders also require limited liability.

CONCLUSION

The brief history of DAOs has been eventful. "The DAO",[251] an automated venture capital fund, which can be seen as a proto DAO, caused considerable hype, money poured into it,[252] and it ultimately failed. The frenzy and ultimate failure of The DAO, simply carries on a rich tradition: bubbles surrounding new business structures and legislative reaction and inaction are not new. The Bubble Act of 1720,[253] passed to remedy the harm caused by rampant speculation in joint stock companies, "cast a shadow on the joint-stock company as a form of business organization for more than a century and ultimately stopped its development".[254] Care must be taken so that the development of DAOs is not unnecessarily stifled and any response to DAOs should not take the time that was required with early company legislation. The relatively simple question of limited

[250] Although s 56(1) of the Companies Act 1993 allows for a company to recover a distribution made to a shareholder when immediately after the distribution if the company did not satisfy the solvency test, recovery cannot occur if the shareholder received the distribution in good faith and without knowledge of the company's failure to satisfy the solvency test; and the shareholder has altered the shareholder's position in reliance on the validity of the distribution; and it would be unfair to require repayment in full or at all. This could be changed for DAOs so that the distribution could be recovered regardless of the token holder's knowledge or changed circumstances.

[251] Jentzsch, above n 110.

[252] Richard Waters "Automated Company Raises Equivalent of $120m in Digital Currency" *Financial Times* (UK, online ed, 17 May 2016) <www.ft.com/content/600e137a-1ba6-11e6-b286-cddde55ca122>.

[253] (6 Geo 1, c 18) "An Act to Restrain the Extravagant and Unwarrantable Practice of Raising Money by Voluntary Subscription for Carrying on Projects Dangerous to the Trade and Subjects of the Kingdom".

[254] Ron Harris "The Bubble Act: Its Passage and Its Effect on Business Organization" (1994) 54 Journal of Economic History 610 at 611 and see Mahoney, above n 69 at 888.

liability of shareholders[255] took the United Kingdom Parliament more than 20 years to resolve.[256] Other jurisdictions are exploring whether to grant DAOs separate legal personality and with that the limited liability of token holders. Moreover the current use of "legal wrappers", that is linking a company to a DAO, will have the de facto effect of granting limited liability to the DAO's token holders.

The DAO, which, while it did not succeed, has not prevented others from carrying on the experimentation and successful DAOs are operating, such as Dash. DAOs, therefore, cannot be dismissed as thought experiments. As Vitalik Buterin, one of the first people to discuss the concept of DAOs, observed.[257]

> "One of the more interesting long-term practical benefits of the technology and concept behind decentralized autonomous organizations is that DAOs allow us to very quickly prototype and experiment with an aspect of our social interactions that is so far arguably falling behind our rapid advancements in information and social technology elsewhere: organizational governance. Although our modern communications technology is drastically augmenting individuals' naturally limited ability to both interact and gather and process information, the governance processes we have today are still dependent on what may now be seen as centralized crutches and arbitrary distinctions such as "member", "employee", "customer" and "investor" - features that were arguably originally necessary because of the inherent difficulties of managing large numbers of people up to this point, but perhaps no longer. Now, it may be possible to create systems that are more fluid and generalized that take advantage of the full power law curve of people's ability and desire to contribute. There are a number of new governance models that try to take advantage of our new tools to improve transparency and efficiency…"

A more succinct formulation of Buterin's observation about our social interactions and institutions falling behind technology is that we have "we have Palaeolithic emotions; medieval institutions; and god-like technology".[258]

The experimentation in governance mechanisms is continuing and from even from The DAO's ashes, a new DAO has been proposed that has learnt from The DAO's failure and has a sophisticated governance system.[259] To be sure, there are significant issues regarding governance, management and decision-making, which will need to be overcome for DAOs to operate beyond their current limited scope and it will take some time to settle upon optimal methods of governance.

Treating token holders of a DAO as partners will hamper the development of DAOs and their use because of the concern amongst potential token holders that they will have unlimited liability for the DAO's debts. As we have seen companies were once viewed with considerable concern and

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[255] The premise of the United Kingdom's Limited Liability Bill was simple, "the Law of Partnership which renders every Person who, though not an ostensible Partner, shares the Profits of a Trading Concern liable to the whole of the Debts, is unsatisfactory, and should be so far modified as to permit Persons to contribute to the Capital of such Concerns on Terms of sharing their Profits, without incurring Liability beyond a limited Amount." HL Deb 7 August 1855, vol 139, col 1895 (Lord Stanley of Alderley).

[256] At 1896. "The question [of limited liability] had been before the country for more than twenty years; had been the subject of inquiry of several Committees of both Houses, and of a Royal Commission."

[257] Vitalik Buterin "An Introduction to Futarchy" *Ethereum Blog* (21 August 2014) <http://blog.ethereum.org/2014/08/21/introduction-futarchy/>.

[258] E O Wilson, from a public discussion between Wilson and James Watson moderated by Robert Krulwich, reported in "An Intellectual Entente" *Harvard Magazine* (Cambridge, Massachusetts, 9 October 2009) <www.harvardmagazine.com/breaking-news/james-watson-edward-o-wilson-intellectual-entente>.

[259] DAO Community & Friend, "The DAO" Whitepaper (August 2019) <https://github.com/the-dao/whitepaper>.

suspicion. Thus concerns and suspicion in themselves are not a good reason to prevent the use of DAOs or take action or inaction that would stifle their development.

DAOs potentially offer the ability to transform the way that business is conducted and decrease significantly the amount of wrongdoing that occurs within organisations, which will outweigh the potential disadvantages of granting separate personality to DAOs and limited liability to the token holders. The current focus of the law of attempting to hold people to account once the wrongdoing is detected—the ambulance at the bottom of the cliff—does not always work. Even if the victims are restored to their pre-breach state, the time, money and other resources involved is considerable. Placing a barrier at the top of the cliff is a much wiser strategy and better use of resources. A DAO's use of smart contracts means that rules and laws can be coded directly into the DAO's operations. DAOs that could show their smart contracts complied with, for example, New Zealand law, should be able to be registered as separate legal persons and their token holders granted limited liability. Granted token holders could vote to change the smart contracts so they no longer complied with the law, but changes to the smart contracts which had a legal effect could, for example, require not only a super majority of votes, the change could not be implemented if a regulatory supervisor believed the change would result in the DAO operating outside the law.[260]

There should be nothing therefore surprising in the potential reorganisation of organisations and the recognition of different forms. Companies in their current form with their separate legal entity and limited liability for shareholders are not a natural state of affairs, such legal fictions and rules had to be created.[261]

[260] In practice the decision making speed of a supervisor could be slow, which would unduly restrict the operation of a DAO. The supervisor could therefore be alerted to the fact that a vote on a given smart contract was taking place and the supervisor would be given a set period of time in which to raise an objection. If the objection was not made the result of the vote would be implemented.
[261] ICAEW, above n 110.