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Blockchain: A Panacea for Trust Challenges In Public Services? A Socio-technical Perspective

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Abstract

Trust in corporations, governments and public services has been steadily declining over the last few decades. Lack of transparency and auditability has been a key driver for this decline. Blockchain technology has been commended as a solution that can help with disintermediation and filling the consistently increasing trust challenges faced by the corporate and public sectors. Public services are seeking solutions that can help establish trust and increase transparency with its citizens and businesses are undertaking extensive business analysis to determine the need and effectiveness of blockchain-like platforms as the basis for transforming their existing platforms. Due to the decisive nature, most of the analysis results thus indicate that if a trusted third party is an option, then blockchain should not be used. Here we highlight the challenges and opportunities of establishing trust and how blockchain technology can help public services bridge the trust gap with its citizens. We argue that all information technology systems rely on a suite of technologies, thus blockchain should be added to the current technology stack rather than taking an 'all or nothing' approach. We also argue that analysing the effectiveness of futuristic technology like blockchain with industrial age methodology and mindset may limit the realisation of its impact on society and economy. Therefore, we propose to take a heuristic approach, where different properties of blockchain technology need to be mapped against different aspects of current business process with a futuristic view in mind. Taking Companies House – a government organisation that holds over 4 million UK-based companies' records – as an example, we demonstrate how certain business processes in Companies House can benefit from adapting a blockchain-based solution.

Keywords: *trust, blockchain, public services, distributed ledger technology, business process*

JEL Classifications: *C8, C9, I2, L3, O31*

1. Introduction

Sir Mark Walport, the UK government's chief scientific adviser (2013–2017), states in his 2015 report that 'in distributed ledger technology we may be witnessing one of those explosions of creative potential that catalyse exceptional levels of innovation. The technology could prove to have the capacity to deliver a new kind of trust to a wide range of services'. [1]. Joseph Schumpeter coined the term 'creative destruction' to explain how the process of industry transformation revolutionises the economic structure from within, by destroying the existing one and simultaneously creating a new one [2]. Carlota Perez took the notion further to explain how technological revolutions driven by 'creative destruction' redefine not only an industry but also the infrastructures and economic institutions surrounding it [3]. Perez called the phenomenon of the diffusion of new technologies that spread and proliferate their impact across economies and eventually transform the socio-institutional structure a 'techno-economic paradigm' (TEP) [4]. As the technology evolves, the way businesses and work are organised transforms along with it. Public and private institutions frequently re-evaluate their business models to take advantage of the technological innovations. Furthermore, the technology influences the business model possibilities [5]. We have witnessed this in the shape of assembly lines during industrial revolution, office work with the introduction of computers and life as we know it since the World Wide Web (WWW).

The economies now are data driven. Organisations collect and process data at a rate never seen before. Since data has value and utility, it encourages hackers and criminals to exploit vulnerabilities in the information technology infrastructure of the organisations, leading to all sorts of hacks and breaches. Blockchain technology (BCT) has seen its utility for information security in several ways such as protecting

personal data [6, 7], secure data sharing [8], access management [9], data integrity [10] and digital identities [11]. However, analogous to any other disruptive technical breakthrough, when the horizon is unclear and uncertainty is high, there is a substantial hype around BCT.

The 'Gartner Hype Cycle' illustrates the typical progression of an innovation, from the phases of inflated expectations through disillusionment to a realisation of the relevance of the innovation and its applications [12]. BCT has been one of the considerably hyped technologies and has been on the Gartner Hype Cycle for the recent few years. The world has witnessed the initial coin offer bubble, to the 'blockchain for everything' bubble and now we are seeing the exploration of serious use cases. Several industries have spent billions of dollars exploring the blockchain use cases for their business models. International Data Corporation forecasts the spending on blockchain solutions (including Distributed ledger technologies (DLTs)) in 2023 to approximately $15.9 billion, with a compound annual growth rate of 60.2% [13].

With such potential of growth, businesses seek guidance to help them decide if blockchain is a potential solution to their use case. Several different decision schemes have been proposed over the recent years to assist businesses in determining if BCT is the right solution for their use case. However, since the technology is relatively recent and quite distinct, several proposed schemes conclude differently. Koens and Poll [14] analysed 30 blockchain decision schemes and found several contradictions between those schemes, arguing that most of them were inherently flawed [14]. Twenty out of the thirty schemes that Koens and Poll studied argued that *if a trusted third party (TTP) can be used then blockchain should be avoided.* However, we argue that this argument contradicts the basic ethos of Satoshi Nakamoto's design of the bitcoin blockchain and the whole principle of decentralised trust.

In his landmark paper titled 'Bitcoin: A Peer-to-Peer Electronic Cash System', S. Nakamoto writes: 'What is needed is an electronic payment system based on cryptographic proof instead of trust, allowing any two willing parties to transact directly with each other without the need for a trusted third party' [15]. Nakamoto has noted down only one condition for transacting on the bitcoin blockchain and that is 'willingness to transact'. There is no further reasoning on only when the transacting parties should use the blockchain-based payment system (Bitcoin). If Nakamoto was to follow the same principle of 'is there a trusted third party that the transacting parties can use?' then bitcoin may not have been conceptualized, since the transacting parties can potentially 'trust' the conventional banking system. Therefore, we argue that the potential use cases of blockchain should be explored with an open mind and vision for future, so that the future potential applications and implausible solutions that the blockchain might hold are not excluded.

In this article we first establish the definition of trust in the online and offline world, followed by different forms of trust. Secondly, we compare the pros and cons of having a trusted third-party system or a blockchain-based system. Here we argue that the selection of blockchain (or blockchain-based systems) should not be an 'all or nothing' approach against current systems, but it should be aligned with business and process innovations, as it was noticed by Perez [4] and Fuller and Haefliger [5]. Thirdly and finally, we take Companies House UK (CH) as an example to demonstrate how BCT can improve or replace some of the current business processes, aiming at increasing trust, transparency, information integrity, cost reduction and efficient processing.

2. What is Trust?

Trust is paramount for the society to function. Nobel laureate Arrow called trust 'a lubricant for social systems' [16]. There is no agreed-upon definition of trust, but several definitions have emerged from multiple disciplines [17]. One of the widely cited definition of trust by Mayer, Davis and Schoorman is 'the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor and control that other party' [18]. For example, when we need purchase online, we trust the seller to send us the same product that we have purchased, without having any control over it.

Trust is often classified into broad categories [18, 21] such as calculative (based on rational choices), relational (derived from repeated interactions), organizational (based on expectations from an organisation) and institutional trust. Institutional trust refers to the confidence of individuals (trustor) in public institutions (trustee) such as military, parliament, police and other public services on a macro level [20]. While some scholars regard trust as a personal or inter-personal attribute [21, 22], others consider trust as an institutional property [23, [24, 25]. Even though the later acknowledge the importance of social trust, they argue that social controls, personal bonds or local mechanisms may work well within limited social boundaries, but formal institutions are of critical importance to establish cross-situational trust where direct personal contact is very limited [25]. However, trust is subjective and evolves with the societal shifts.

Miles and Creed [26] noted over two decades ago that the society was moving towards 'small-scale' relations where there would be a rise of independent contractors and flexible forms of organisations resulting in the breaking up of large firms. Miles and Creed [26] argued that it will result in the shift in predominant forms of trust. Furthermore, Saxenian [27] noticed a shift from institutional trust to individual and network-based trust. Neil et al have argued that social distance has an impact on the trust level [28]. The authors suggest that distributed teams with minimal physical or cultural contact operate at a limited trust level as compared to the teams

functioning at the minimal social distance, which operate at the highest level of trust.

Trust is critical for businesses and individuals to transact. Since, in most cases, the transacting parties do not trust each other, a TTP is usually chosen to facilitate the transaction. The TTP acts as a gateway to establish trust. A strong assumption of trust reduces transaction cost, agency issues (entity acting on behalf of someone else to conduct a transaction) and governance expenses. It also helps to improve relationships, supports decision making when information is scarce and supports cooperation [29, 30]. The development of organizational ecology [31], institutional theory [32] and transaction cost economics [33] have all been underpinned by the assumption that organizations are the centralized source of trust and legitimacy [34].

Even though these assumptions have been historically effective, the recent emergence of distributed trust systems such as BCT has fundamentally challenged these core tenets of organizational theory [35].

3. Centralised vs Distributed Trust

In centralised trust, the trust is embedded in a central authority or institution and the transacting parties assume that the central authority will act in their best interest, following all written and unwritten rules. Examples of centralised trust are banking, public services, stockbrokers and so on. A TTP is inherently centralised. All users of such centralised system are by default required to rely on the trusted party for the provision of truth and assume that the trusted party will act selflessly in their best interest. This saturation of power leads to a single point of failure, both in technical and social terms.

The top-down coordination and hierarchical structures like governments, bureaucracy and centralised public services have been the solution to the ever-growing trust problem and facilitate mutual interactions among distant societies. Even though these centralised institutions have historically served their purpose, organizations with top-down centralized coordination and hierarchical structures tend to be inherently inefficient [36]. Furthermore, this concentration of power in the hands of few poses significant threats, such as corruption, misuse of power, lack of transparency and even regression into authoritarianism [36].

In decentralised trust, trust is disseminated to a decentralised network (DLTs, for the sake of this article), so no one entity has the sole power or monopoly over the act of transacting. By doing so, DLTs shift the trust from a central authority to a network of participants while simultaneously enabling shared information and governance. Bitcoin transactions, smart contracts and decentralised autonomous organisations (DAO) are examples of decentralised trust. DLTs lower the uncertainty regarding the otherwise 'non-trusting' parties and allow them to transact without the need of a mutually trusted party [37]. However, this new trust enabler for exchange of information does not completely remove the need of trust but shifts the trust from intermediaries and institutions to the technology (the peer-to-peer network, cryptographic protocols, code, smart contracts, etc).

The lack of trust and need of establishing trust have always been there; however, until DLTs, centralised trust was the only dominant form of trust known to the world. The societal shift noted by Miles and Creed [26] along with a shift in trust (Saxenian) [27] enabled by the TEP [4] has led to the creation of behemoths such as Uber, Google, Amazon and Facebook which have now become the de-facto monopolies, leading to centralisation and single point of failure, among other socio-political issues.

4. The Cost of De-facto Trust

The cost of trust can be established in two ways (1) the cost of establishing the trust and (2) the repercussions when trust is breached. During the 2007–2008 economic crisis, 1.3 million people were made redundant in the United Kingdom, and 10 years later, we were still, on average, 30 pounds a week worse off than we were before the crash [38]. One of the key triggers of the 2007–2008 economic crisis was the bankruptcy of a 158-year-old business, Lehman Brothers. Only 9 months prior to declaring bankruptcy, Lehman brothers reported a record revenue and profit which was endorsed by their auditors Ernst & Young (EY) [39]. In the end, the organisations responsible for the biggest economic crisis since the great depression shrunk their responsibility to be only the agent of trust in a transaction; however, the consequences of their negligence are still felt to this day.

Furthermore, a dominant third party in any given industry poses a risk to become the 'gatekeeper' for that industry. This highly saturated centralisation, where trust is not a choice but a requirement, risks exclusion and monopoly. In the recent turmoil of events, the United States has threatened to shut down Iraq's access to the country's central bank held at the Federal Reserve Bank of New York where all funds of global oil sales are kept, depriving them from all the oil sale revenue, leading them to an economic crisis [40].

Even if the trusted central authority is honest, it poses risks to data manipulation by external parties such as hackers. A hacker may modify the vital information and cause significant losses without even being noticed. Consider, for example, if the hackers were to alter the expiry dates on the batches of milk. Valuable resource would be discarded and numerous may get sick for drinking the hazardous milk. Volkswagen's emission scandal is a recent example of data manipulation in order to pass the safety or legal requirement [34]. The same principle can be applied to medical institutions, banks and public services, leading to appalling consequences.

Breach in trust has a significant and lasting impact on the business, particularly on branding and reputation of the business.

People will forget about the third party that was the main reason of the breach, but the brands will face ongoing trust issues.

5. Trust and Society

Trust in centralised entities is declining. According to a 2018 study by Ipsos Mori on a base of over 16,000 respondents, only 14% deemed government as trustworthy [41]. Similarly, media, oil and gas companies, banking and pharmaceutical companies were highly rated as untrustworthy. When the respondents were asked if 'it [bank and public sector] is open and transparent about what it does', only 26% and 23% agreed, respectively [41]. A 2015 study of Pew Research Center, USA, indicates that the public's trust in the federal government has been steadily declining since 1958 and it is at historically low levels with only 19% of Americans having reported to trust the government [42].

Not only the trust in organisations is at decline but the trust in people is declining too. The general social survey (GSS) has recorded a downward trend to the 'can people be trusted' category, over the past 32 years (Figure 1) (1972–2018, data available for 28 out of 32 years) [43]. Wilson & Rule found a prejudiced relationship between the perception of 'untrustworthiness' from facial appearance and death sentences given to convicted murderers, even for the people exonerated after originally being sentenced to death [44].

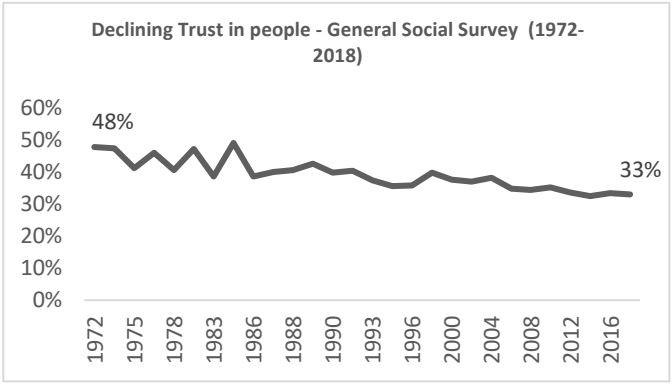

Figure 1. General social survey (GSS) 'Can people be trusted' (1972–2018 dataset). Declining trust among people with only 33% responding that they can trust other people as compared to 48% in 1972 [43].

Higher level of trust has a positive casual effect on the efficiency of public services, tax compliance, anti-corruption and participation in civic activities [45]. On the contrary, lack of trust serves as a motivation for citizens to not comply with government demands and regulations. They may actively resist government policies and make the government incapable of performing its tasks [46]. Tyler argues that trust helps reduce the public sector's administrative costs of control and enforcement by encouraging citizens to voluntarily comply and perform their due diligence [47].

The socio-political and technical indicators [2, 3, 4] are hauling up that BCT is ready for disruption and can flourish between the fissures between human and institutional behaviour. We call it 'digital disruption 2.0'. The first wave of online disruption saw the brick and mortar businesses being displaced by the digital intermediaries. The digital disruption 2.0 is challenging the whole notion of a 'trusted intermediary' and shifting trust from people and institutions to code and computers in impending industry 4.0 revolution.

6. When Can You Use a Blockchain?

Blockchains come with some intrinsic properties, given some degree of variation between public and private blockchains. Some of the key features of a blockchain are (1) *decentralisation* (transactions without a central authority), (2) *persistency* (very temper evident and strictly validated against the set rules), (3) *anonymity* (no central party keeping user's private information), (4) *auditability* (all transactions have a log) and (5) *resiliency* (no single point of failure) [48, 49] (see [49] for a literature review on the characteristics of blockchains). We must take a heuristic approach when designing systems and make use of the combination of these properties, if and as needed.

There has been a lot of debate about when a blockchain makes sense. Similar to the mid 1990s, when only a handful of people could predict the emergence of the behemoths like Google, Facebook and Amazon, we believe that it is too early to really conclude on the potential usability of the technology. The social shift, along with change in the user's perception and awareness would determine what ends up on the distributed, temper evident ledger. We believe that the 'killer apps' of the BCT are being conceived. These ideas will not be able to progress if we strictly evaluate them against the established technologies.

However, some of the key areas where most of the organisations can benefit from a blockchain-based solution are reduced verification costs, cost of exchanging value without relying on an intermediary, data integrity and reduction in frictions [50]

7. Public Service Perspective

As discussed in section 5, trust in public services and governments is decreasing. Public services can benefit from incorporating a decentralised infrastructure as a tool to gain the trust of the people. BCT can provide an infrastructure for exchanging information between public services and significantly enhance the administrative function of the governments by reducing the complexity, cost and time in inter-governmental and public information exchange. Citizens can benefit from the increased automation, accountability, auditability and transparency of the information available on the public registries [51].

Ølnes et al suggest that BCT can be potentially used for any transaction or information exchange which involves government engagement [49]. Some of the potential use

cases of BCT are secure information exchange, asset registry, both tangible assets like land and property and digital assets like reputation, health data, patents and ideas and inter/intra-governmental transactions [52]. BCT can increase government's efficiency and help in reducing corruption [53], improve digital security, privacy and enhance trust with its citizens [49]. Furthermore, BCT can improve data integrity both in terms of accuracy and consistency of the information, leading to error reductions and low infrastructure costs [54].

Table 1. Countries exploring BCT use cases worldwide with an aim of improving public services and trust with their citizens.

Government service	Country	Potential benefit
Land title registry	Georgia [55] [51], Sweden [56], United Kingdom [57], Ghana [58], South Africa [59], India [60]	Provenance, transparency
Birth certificates	India [61], Brazil [62]	Provenance, transparency
Academic/skill certificates	Malta [63] [51], Canada [64]	Provenance, efficiency
Digital identity	Switzerland [51], Luxembourg [51], Estonia [65]	Governance
Benefit management	The Netherlands [51]	Governance, transparency, efficiency
Remittance	Philippines [66]	Financial inclusion
Immigration services	Finland [67]	Governance
Voting	Sierra Leone [68]	Transparency, auditability, accountability
Business registry	Malta [69]	Governance, efficiency
E-government	Estonia [65], Dubai [70], Liberia [71]	Governance, efficiency, automation
Credit history	Sierra Leone [72]	Provenance
Bureaucratic processes/administration	China, Tanzania, Canada [73]	Transparency, auditability, reduce corruption
Clearing system for imports and exports	South Korea [74]	Efficiency, traceability
Digital currency	Tunisia, Ecuador [75]	Governance
Secure data exchange	Abu Dhabi (UAE) [70]	Digital security
Medical (organ donation and transplant)	UAE [70]	Efficiency
Taxation	China [76]	Transparency, compliance

Governments across the world acknowledge the potential of BCT to transform the public services and citizen's expectations and they have been actively exploring the BCT use cases to improve on the existing public services infrastructure. Table 1 lists some of the countries that have evaluated BCT projects to improve the services for its citizens.

We do not assume that BCT will completely eliminate the role of institutions or governments, but we believe that we will see a shift in the roles. While BCT can (to some extent) disintermediate the role of institutions in record keeping and establishing trust, we must appreciate the fact that BCT requires governance and regulatory frameworks to operate legitimately. Governments can act as trusted administrators who manage the registry and define transaction rules and regulations to ensure the functioning of the facility. Governments must remain the data stewards – accountable for running the operations and be accountable for any failures or issues [49]. BCT can act as a trust enabling technology layer, operating in conjunction with the existing technology stack.

Organisations globally are pushing for transparency and information sharing to provide better service and improved transparency. Section 35 of the recently passed Digital Economy Act (UK) encourages data sharing among public services to improve the public service delivery for the benefit of individuals or households and provide targeted public service [77]. Since the focus of this article is CH, we will only discuss the challenges that CH face to establish trust in the data that they hold, simultaneously improving transparency and accuracy in the processes of corporations and the activities of persons behind those corporations. The aim for addressing these challenges is to reduce fraud, money laundering, tax evasion and general bad behaviour.

About Companies House UK

CH is the UK's executive agency and the registrar of companies. All types of companies are incorporated and registered with CH and file-specific details, as per Companies Act 2006 [78]. The data held is of high importance to the UK's economy, and CH is aiming to improve the quality of the data that they hold, with a focus on increasing the transparency of UK corporate entities, and help combat economic crime [79]. CH recently consulted on a proposal regarding the newly proposed reforms. The reforms will require companies to disclose additional information which will be verified before acceptance and the steps to be taken to improve the exchange of intelligence between CH and UK Law Enforcement. The reforms will include knowing (1) who is incorporating, managing and controlling companies, (2) improving the usability and accuracy of data on the companies register, (3) ensuring compliance and protecting personal information on the register and (4) sharing intelligence and other measures to daunt abuse of corporate entities [79].

Here we investigate how BCT can improve the existing processes in CH and discuss three use cases that we have examined as part of our research partnership with CH. The use cases that we have chosen as part of the study are

1. Company incorporation,
2. Sharing information with law enforcement (LE) and
3. A blockchain-based legal entity identification and verification system that can add trust to the data collected and held by Companies House.

Company Incorporation

CH has a record of over 4 million limited companies registered in the United Kingdom and over 500,000 new companies are incorporated each year [80]. Each newly registered company gets an incorporation certificate as a proof that they are legally entitled to trade in the United Kingdom. The incorporation certificate is a public document and is only issued once to a company in its lifetime. We believe that issuing a proof of the incorporation certificates on the blockchain can increase the trust in the certificate while simultaneously protecting the integrity of the certificate.

Moreover, the process can be easily integrated in the current workflow, since the only addition to the current certificate issuance process is committing a transaction with the hash of the document to the blockchain. Once the confirmation is received, the reference of the transaction is added to the metadata of the certificate and is made available for the user. For verification, the verifier can upload the certificate to the online portal. Proof of the transaction is obtained from the metadata of the document and verification is successful if a valid hash is found on the blockchain.

One could argue that the owner of the certificate should hold the private keys of the transaction to prove the ownership. However, we believe that this requires a lot more awareness and hinders the usability and acceptance of the scheme. The model discussed here is very similar to some of the current semi-automated verification processes and abstracts all caveats of the BCT from the end user.

Information Sharing With Other Public Services

A private-permissioned blockchain network can facilitate the sharing of confidential information among public services [81]. Smart contacts can be deployed for access control and data handling. We recommend not adding any confidential data to the blockchain but only adding a commitment or a proof to the network [82]. For example, consider a scenario where LE has to request data from CH regarding an ongoing investigation. LE shall submit a data protection request, requesting the data on the person. Upon successful verification, CH prepares the data, encrypts and uploads it to a safe storage such as cloud or IPFS [83]. CH will then encrypt the link to the data using LE's public key and post it on DLT along with the data hash for integrity checks. LE decrypts the link, verifies hash and accesses the data. A smart contract facilitating and governing the transaction will remove the link and data will be deleted once the requirement has been satisfied. Sharing information on a DLT provides a complete secure audit trail of the activity.

Identity System for Legal Entities

Accurately identifying legal entities on a global scale is a complex task, requiring significant amount of time, money and resources. There is no single open and up-to-date database that can provide all the required background information. This lack of information is partially responsible for the financial crisis, fraud and market abuse. Several initiatives have been taken to identify the global legal entities and their connections to each other. Established by the Financial Stability Board in June 2014, the Global Legal Entity Identifier Foundation (GLEIF) is the most renowned of all. GLEIF is tasked to support the implementation and use of the Legal Entity Identifier (LEI), with an aim of having a unique identity for every business [84]. A total of 1.4 million LEIs have been issued to the companies worldwide [85]. This number is only a small fraction of the companies registered worldwide. There are estimated 200 million registered companies globally; China alone has over 77 million registered companies. Less than 140,000 of the 4 million registered companies in the United Kingdom has an LEI [86]. The LEI is not global in a true sense since less than 1% companies globally have an LEI. Furthermore, companies and individuals will not always trust a centralised system managed by a third party. We propose a global company and individual identifier system that runs on the blockchain and benefits from the inherent security and privacy features of a cryptographically secured distributed ledger. We believe that a blockchain-based company and related person's network can be a potential solution for CH initiative on transparent and reliable data. The architecture proposed is based on the open source identity network, Sovrin [11] (Figure 2).

On an abstract level, identity is a composite of (1) identifiers that the subject has with different stakeholders, (2) self-asserted and verifiable claims and (3) proofs from others about the relation and interaction with others. We propose using self-asserted and verifiable claims [11] to establish trust among the interacting entities and the individuals controlling those entities. Blockchain network records the claims that a subject makes about themselves and their company, respectively. All relationships with stakeholders are also recorded as the public/private key pairs. The relationships can assign claims to the subject or the company. For example, Her Majesty Revenue and Customs (HMRC) can assert a claim about Bob's company that it has defaulted or CH can assert a claim about the records being up to date. These claims can then be used to make disclosures about the identity, which can be verified by the verification authority.

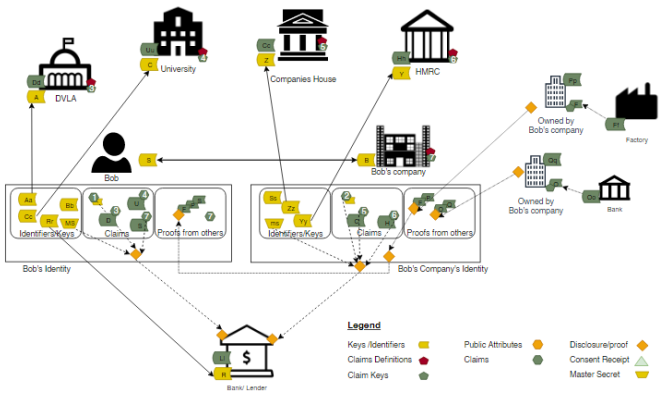

Figure 2. Different aspects of identity on the blockchain. Entities have identifiers, claims about identity attributes and proofs from others regarding their relationships. Relationships with other entities are recorded on the blockchain and entities collect verifiable claims about their identity. Solid lines represent relationships, whereas dotted lines represent a verifiable claim disclosure and the dashed line represents a delegated claim from a third party. The longer they are on the blockchain, the more verifiable claims they will collect from the relations they have on the blockchain. Entities can disclose verifiable claims to a third party, on need basis. Entities can mix and match certain aspects of their identities without revealing more than what is required. This helps in preserving privacy. Legend shows different relationships and proofs that an identity can have. Any participant in the network will have different identifiers that it uses to identify itself.

Data Sharing and Fraud Mitigation

A network of this capacity can be easily scaled to hundreds if not thousands of nodes. Data can be shared easily between governments, LE and other stakeholders such as insurance agencies. Privacy of the entity is preserved using Zero Knowledge Proofs (ZKP) and relevant data can be disclosed easily. On a blockchain identity infrastructure with verifiable claims asserting the truth about an entity's identity, fraud becomes extremely difficult. Department of Work and Pensions (DWP), CH, HMRC, banks and so on will all see Bob as the director of the company and forging Bob's identity would be nearly impossible in this trust network (Figure 2). Furthermore, we propose a relative ranking-based system that gives a score to each legal entity based on their relations and interactions on the blockchain (Figure 3). This also makes the KYC (know your customer) and on-boarding process easy. Businesses can significantly benefit from such a system that cuts their KYC and on-boarding process from weeks to minutes, not to mention the cost savings that come with it.

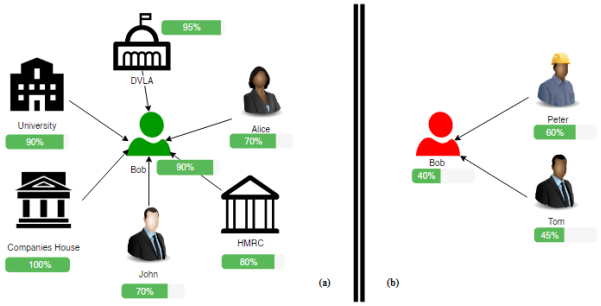

Figure 3. (a) Real Bob with several trusted verifiable claims on the left and (b) imposter Bob with few claims about his identity. If Bob is proved to be a malicious person, both Tom and Peter risk losing their score too, hence they will have to vote for the real Bob in order to preserve their own identity score.

Inter-company Trust

An infrastructure like bitcoin for intercompany settlements can be very helpful as a source of trust in today's accounting structure. It can be used to verify the integrity of records, providing a complete audit trail. Companies can write transactions directly into a joint register instead of keeping separate records based on the receipts of transactions. BCT enables the creation of an interlocking system of durable accounting records, making the destruction or falsification of information to conceal activity practically impossible [87].

BCT can be a digital equivalent of a notary. This will save significant time for the verifiers as they need not dig into piles of paper to verify the books. Transaction becomes the evidence itself.

8. Conclusion

BCT could drastically reduce the cost of trust, introduce new social constructs and pave the way to new structures of economic organisations. While we appreciate the fact that BCT has a long way to go before it can be widely adapted, we argue that different aspects of BCT should be utilised in business models where it can add value. A more appropriate question could be 'do you want to use a trusted third party?' rather than 'can you use a trusted third party?' DLTs such as BCT are paving the path of a new secure, honest and level-playing field for all and we shall see mass economies emerging from this new form of trust model.

We took three use cases from Companies House UK's business processes and mapped them to the properties of BCT, demonstrating how adding BCT to the existing Tech Stack can add an additional level of security to CH data, while also improving on the trust in the data held at CH. We believe that a solution utilizing digital identities and verifiable claims can truly transform the trust factor in companies and Companies House data and add greater value to the data

acquired by the relevant authorities while simultaneously making data sharing and verification easy.

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Ethical Approval:
Not applicable.

Author's Contribution:
Author's contribution (confirm you are the main author responsible for writing the manuscript, collecting data, proof reading etc)
AS designed and coordinated this research and prepared the manuscript in its entirety under the supervision and guidance of RM, CH and IK.

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