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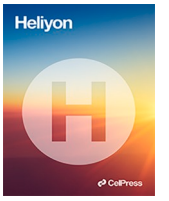

Review article

# Blockchain governance and trust: A multi-sector thematic systematic review and exploration of future research directions

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ABSTRACT

This paper aims to critically examine the scholarly work conducted in blockchain (BC) governance. Without venturing into the wide range of governance paradigms, this research considers governance structures based on trust as a foundation for BC governance. A thematic systematic literature review is conducted to understand the literature on this topic, employing the SALSA (Search, Appraisal, Synthesis and Analysis) technique. An examination of 155 papers shows that using BC technology (BCT) replaces the cognitive attribution of trust in the material and human-independent code. It is also found that further research anchored to the 'trust' concept is required in building BC governance structures. To provide the direction in which the literature is travelling, future research questions on trust and governance are documented. In general, the literature review suggests that BC has the potential to revolutionize the way in which businesses operate. By improving transparency, efficiency, and security, BC can help businesses to reduce costs, improve customer satisfaction, and make better decisions. This research can help policymakers, industrialists, and researchers to identify where BC governance is being used and which aspects of governance are to be focused on. This paper is a general review of literature and evidence on contemporary developmental issues.

## 1. Introduction

With the onset of the internet and content generation, cross-border exchange of information has increased. World Bank reports that in the year 2020, the global data flows were estimated to be more than 3 zettabytes [1]. Further, the World Economic Forum reports that cross-border e-commerce is worth USD 2.7 trillion, a 45-fold increase in a decade [2]. All the data flows and the resultant economic value is a result of the internet and allied applications. A market report estimates that in 2021, the market value of the Internet of Things (IoT) was USD 113.82 billion, projected to reach USD 321.11 billion by 2027 [3]. Research also asserts that gig jobs will become the future due to Artificial Intelligence (AI) and other advancements in digital technologies [3]. When the internet gains such

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importance, and all the digital services are anchored on data flows, the entire digital ecosystem must be secured.

However, people must trust digital platforms/products to use them ubiquitously. In the case of IoT, it is asserted that trust will be based on product features, social factors surrounding the product and consumer plus data safety [4]. In other words, a holistic trustworthy environment is required and should be provided by the state, private companies, or perhaps in collaboration. Other than these agents, technology itself can be used to generate trust among the digital services and the public. Blockchain technology (BCT) is one such technology which operates on trust [5]. BCT has found its ground in global markets with the release of bitcoin code written by Satoshi Nakamoto [6]. It is suggested as a replacement for existing intermediaries like the Reserve Bank of India in the case of regulating financial systems in India; the Export-Import Bank (EXIM) currently regulates exports and imports in India [7]. It provides a trusted ecosystem for users to conduct their economic activities, because of its features like immutability and transparency.

The usage of BCT in governance promises decentralised decision-making. Such decentralisation can be used in public governance, corporate governance and also in the governance of the blockchain itself. For public governance, blockchain can create shelling points so that a consensus is arrived at regarding an issue [8]. A shelling point is a solution that participants choose when they are not able to communicate. When participants are incentivised to choose the correct solution (the solution proposed by an average of the participants), they are then forced to prioritise the group requirements rather than their individual requirements. This is an example of how decentralised governance might work in public governance. Decentralised Autonomous Organisations (DAOs) are being advocated for corporate governance. However, there are issues when it comes to the usage of blockchain in defining governance systems or using BCT for governance. Events involving hard forking the code establish that there needs to be a systematisation for the BCT to adopt. Realising the importance of BCT, the Organisation for Economic Cooperation and Development (OECD) has advocated for the development of compliance procedures and governance frameworks for the adoption of blockchain [9]. This review paper will also add scholarly input to the formulation of governance frameworks.

### *1.1. Blockchain and trust*

Many research papers conclude that trust is the root of all social interactions [10,11]. Trust is based on three factors [12]. One is an individual's (the trustor) beliefs and attitudes towards the other. Secondly, an individual's trustworthiness (here, the individual is the trustee) is based on their past actions. Thirdly, there is a common institutional framework for both the trustor and the trustee. George Simmel claims that trust is an integral part of social communication, and individuals in a society interact because of the existence of knowledge and non-knowledge [13]. This is the third factor of the common institutional setup mentioned earlier. According to Nikalas Luhmann, trust simplifies the complexity of society, called 'systemic trust' where an individual believes in a system to produce a certain outcome [13]. This again is similar to the third factor. Both emphasise the institutional setup that establishes trust between individuals in a society.

Blockchain characteristics such as decentralisation, trust built on analytical algorithms, transparency, unforgeability, traceability, and credibility [14], make this technology a significant tool to re-engineer human-to-human interpersonal trust or societal confidence [15]. Technology changes how people place their trust in other individuals and institutions and removes human factors when people put their trust in institutions [12]. Even though blockchain is not widely used or implemented, its significance is established because of the provision of unhindered authentication, confidentiality, privacy, access control, data and resource provenance, and integrity assurance. It also helps in the study of connections among users [16]. This technology, as it acts as a medium to construct systemic trust, has the potential to become a great organisational tool that strengthens existing institutions and improves their efficiency. It offers to protect and authenticate any data without any intervention from a third party [17]. It promises to quantify trust by gathering transactional immutable evidence between two entities [18]. For example, BCT increases trust in global supply chain systems by securely sharing logistics information [19]. In other words, BCT promises to put trust as a pre-condition for the system it will build. Currently, the known cases of BCT use are observed in the financial sector [20], supply chain management [21], sustainable economy [22], manufacturing [23], and shipping [16], to name but a few.

A quick search using the terms "blockchain, governance, trust" in the Jstor platform results in 31 journal articles from 2022 to 2024 (March 26, 2024). Discussions are centred around the usage of BCT in raising public funds, which provides the donors with an assurance that the fund is used for the intended targets [24]; incentivising sustainable practices [25,24]; deliberation on potential illegal and frauds using BCT [26], and drug development [27]. Though there is some research advocating a governance framework providing an integrated view on decentralisation, types of blockchain, accountability, decision rights, incentivisation benchmarks of BCT [28], and legal compliances to establish governance frameworks [29], there is limited literature emphasizing the trust and governance aspects together. Some recognise a lack of research within supply chain management [30], while some strongly advocate further research in the governance aspects of blockchain as this is seen to act as the key element in forming trust in the BCT [31].

As BCT is known for trust-building, it is imperative to understand the existing literature on how BCT enables trust and what procedures are followed to enhance the existing trust-building processes or to re-engineer that trust. When blockchain brings trust among users and confidence in the technological system, its governance should be based on 'building trust' [12]. Governance of, and with, blockchain should have trust at its foundation. Following the latter rationale, this review is conducted to evaluate the themes that previous studies focus on and to understand how the aspects of trust and governance are situated. Given the paucity of research in this area, thematic analysis provides a descriptive analysis of existing literature. This provides an overview of the scholarly understanding of the governance frameworks that are built on trust and also identifies the gaps. Accordingly, a suitable framework for blockchain governance is proposed which preserves trust among parties.

Before moving ahead with the review, it is necessary to define the term 'governance.' As per the corporates, governance encompasses a network of connections among a company's leadership, its board of directors, its shareholders, and various stakeholders [32].

It serves as the framework through which the company's goals are established, the methods for achieving those goals are defined, and the process for assessing performance is established. Oxford Dictionary of Politics defines governance as the process of collective decision-making and policy implementation used distinctly by government to reflect broader concerns with norms and processes relating to the delivery of public goods [33]. Taking the crux from both definitions, the operational definition for this review is "*a set of processes, network of connections set by or among the stakeholders to achieve a desired goal.*"

This paper undertakes a qualitative systematic literature review to answer the questions presented below.

**RQ1**. What are the major themes presented by research on blockchain governance?

**RQ2**. How is the concept of 'trust' situated in the research of blockchain and governance?

**RQ3**. What are the gaps and research questions on blockchain, governance, and trust indicated by the literature?

To answer the above research questions, this paper considers 155 journal articles, categorising them into eight themes. The analytical description for each theme is provided from the perspective of governance mechanisms. This provides an answer to RQ1. To delve into RQ2, the aspects of trust and confidence-building are kept in hindsight while reviewing the literature. The thematic analysis of the literature provides the gaps and future research questions on blockchain governance and the aspect of 'trust.'

## 2. Method

A qualitative systematic literature review is conducted to understand the diverse research in governance and blockchain. The SALSA (Search, Appraisal, Synthesis and Analysis) method is employed to conduct this review; this is considered to be the usual method in a systematic literature review [34]. This method is found to be used in other similar literature reviews that focus on the roles of AI and blockchain in supply chain optimization [35], as well as the impact of the Fourth Industrial Revolution (4IR) on the

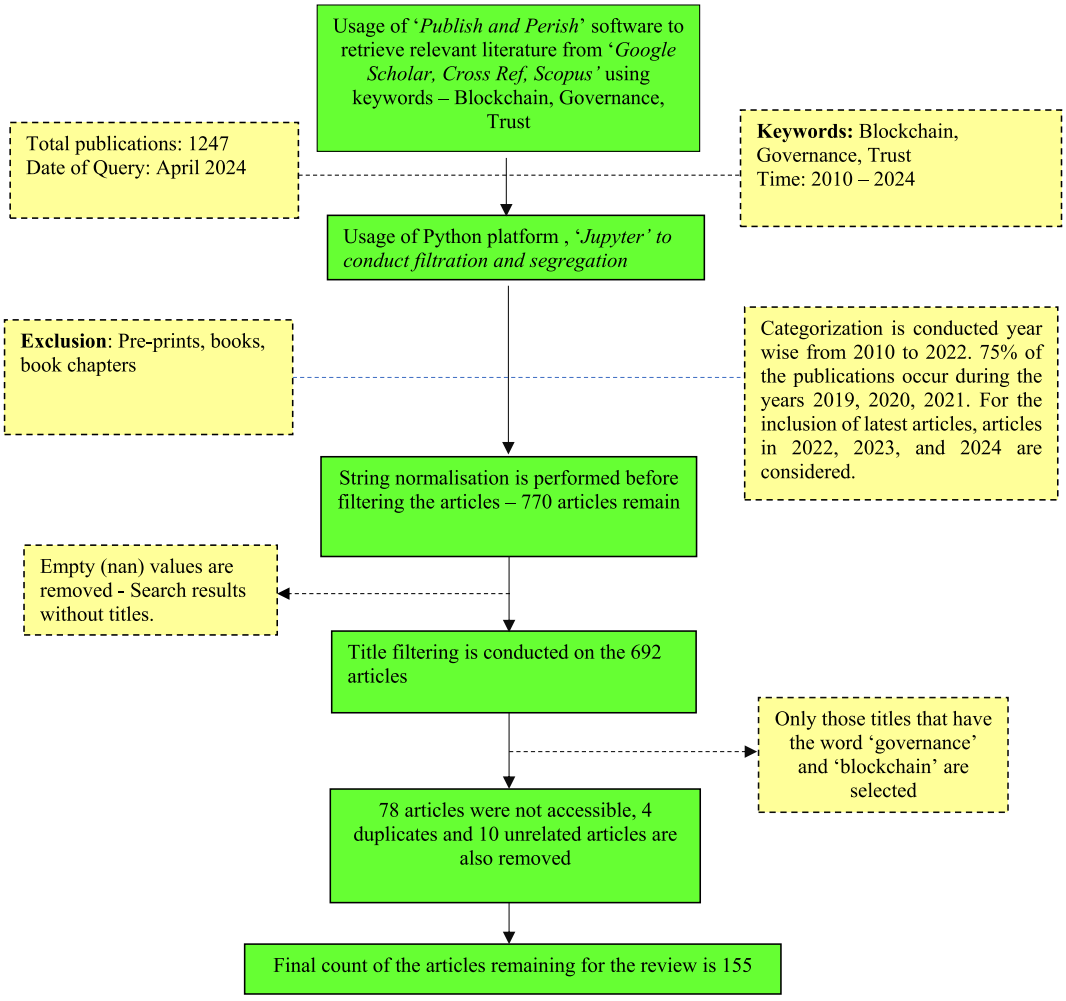


**Fig. 1.** Flowchart of article selection.

competitiveness framework [36]. This method has four basic steps: search (define a searching string and types of databases), appraisal (pre-defined literature inclusion and exclusion, and quality assessment criteria), synthesis (extract and categorise the data), and analysis (narrate the result and finally reach a conclusion) (SALSA). The selected papers are analysed and presented thematically using qualitative research software - Atlas.ti 9.

The method being undertaken will by no means exhaustively analyse all the existing literature. Making an exhaustive literature review would not be possible because of the number of journals being published online. Because of this, some opt to scrape articles from selected journals [37]. Similarly, this review considers scraping journals using the open-source software Publish and Perish 8 which scrapes journal articles from Google Scholar, Cross Ref, and Scopus. This software is used by many scholars in various fields to conduct literature reviews [38,39,40,41]; it also performs bibliometric analysis [42] and citation analysis [43,44].

### 2.1. Article selection

The process covers the search and appraisal parts of this SALSA method – Search, Appraisal, Synthesis and Analysis. As per this search process, the keywords 'blockchain, trust, governance' are finalised after iterations over other keywords conducted by the authors. These three keywords are selected as they provide more search results, and they also broadly cover all the sectors of the discussed blockchain and where the aspect of trust is emphasised. Publish and Perish 8 software extracts the relevant English language journals from Google Scholar. The keywords extracted from the literature are 'blockchain, governance, trust'. The period for the search is from 2010 to April 2024. A total of 1247 articles are scraped using the above search query.

For the next part of the appraisal, the Python platform, Jupyter Notebook, is used to filter the literature further. The univariate analysis conducted includes analysing the year-wise publications, dropping the articles that have no access links, removing duplicates, identifying titles with the words blockchain and governance, and categorising the articles based on the four questions derived by the authors. Further, articles that are in pre-print versions and book chapters are not selected as they would undoubtedly have researcher bias. The detailed process of article selection and the inclusion criteria is shown in the flowchart presented in Fig. 1.

Table 1 shows that most papers are published in the period 2019–2021. However, the latest articles will have new contributions that previous papers would not have captured. Thus, papers from 2019 to 2024 are considered for the thematic analysis.

Table 1 shows that the number of papers published related to blockchain governance has increased since 2018. Almost 72.4 % of the papers are published in 2019, 2020, 2021, and 2022. If 2018 is added to the count, approximately 86.3 % of the total papers retrieved are published in these four years. However, after examining the titles, there is a conceptual overlap between all the papers from 2018 and those published in 2019, 2020, and 2021. Further, per the inclusion criteria, only those titles with either 'governance' or 'blockchain' are selected for the review. Further, to incorporate the latest research, articles from 2023 to 2024 are also considered. The articles for the latter years are scraped later and thus, a separate dataset is created for them.

After the selection process for the articles until 2022 (initial dataset), 692 articles are retained in the dataset scraped till 2022. Next, a final list of articles is made, consisting of 196 publications. Within these 196 articles, 57 articles are excluded as they were not accessible. Four duplicates and another five articles are excluded as they do not fit the blockchain and governance criteria. Finally, the total number of articles remaining for analysis is 130 within the initial dataset. To this count, another dataset is made that includes articles from the years 2023 and 2024. This data set has 54 entries; only 25 were accessible and six are book chapters or pre-print versions. Therefore, only 25 are selected in the final list. The final number of articles from the two datasets thus amounts to 155.

### 2.2. Process of conducting thematic analysis

After Woods et al. [45], Table 2 provides an overview of the process followed for the thematic analysis used in this research.

The research process consists of four stages aimed at analyzing and synthesizing a collection of 155 documents using Atlas.ti software. In Stage I, all documents are imported into Atlas.ti as part of a single project. Moving to Stage II, a comprehensive literature review is conducted, and relevant arguments made by the authors are coded. The coded arguments are stored alongside selected paragraphs or sentences, referred to as quotations, and accompanied by critical comments for further analysis. Stage III involves

**Table 1**
Year-wise publication distribution.

| Year | Published Papers | Percentage |
|---|---|---|
| 2010 | 1 | 0.09 % |
| 2011 | 1 | 0.09 % |
| 2015 | 7 | 0.64 % |
| 2016 | 25 | 2.29 % |
| 2017 | 83 | 7.59 % |
| 2018 | 158 | 14.46 % |
| 2019 | 246 | 22.51 % |
| 2020 | 236 | 21.59 % |
| 2021 | 210 | 19.21 % |
| 2022 | 99 | 9.06 % |
| 2023 | 24 | 2.20 % |
| 2024 | 3 | 0.27 % |

**Table 2**
Analysis procedure of a literature review.

| Stage | Process description |
|---|---|
| Stage I | 1. Import all 155 documents into Atlas.ti – 9 project. |
| Stage II | 1. Review the literature and code the relevant arguments made by the authors. |
| | 2. The codes will be stored by citing the paragraphs or sentences selected. The selected text from the documents is called quotations. |
| | 3. Provide a critical comment alongside the code. Atlas.ti stores the comment where the code is positioned. |
| Stage III | 1. Group the codes and documents. |
| | 2. Create a code – document co-occurrence table. |
| | 3. Create a schematic diagram mapping the codes and documents from the code-document co-occurrence table. |
| Stage IV | 1. Export the report of all the codes, quotations, and comments. |
| | 2. The report is organised per the code groupings in stage III. |
| | 3. Deliberate on bringing various codes decided by the individual authors into limited categorisation. This includes clubbing of codes and deciding on the themes. |

grouping the coded arguments and documents, followed by the creation of a code-document co-occurrence table and a schematic diagram mapping their relationships. Finally, Stage IV focuses on exporting a detailed report containing all coded arguments, quotations, and comments, organized according to the groupings established in Stage III. Additionally, this stage involves deliberation on consolidating various codes identified by individual authors into limited categorizations, including the amalgamation of codes and the determination of overarching themes.

Initially, all the codes are marked randomly while reviewing the 155 journal articles individually using Atlas.ti 9. After reviewing all the articles, 298 instances are coded. Of the 298 codes, 102 are found to be unique. All the codes and respective quotations are studied and grouped. This grouping is made to remove the duplication of codes and to bag similar codes. These 102 codes are grouped into eight groups, also themes that emerge from the literature. Apart from grouping the codes, the documents are also grouped as per the evolved themes. A total of 155 documents along with their themes (groups) are presented in Fig. 2. It can be seen from the literature that most work has been done on public governance usage of the blockchain (43), blockchain technology governance (31), business and corporate governance (36), and sector-wise governance using blockchain technology (19). These four categories account for 82 % of the articles.

The literature is scraped and reviewed by authors with an agenda to determine whether the blockchain literature on governance focuses on the trust aspect. For literature analysis on governance and trust, a table is constructed in which column variables represent the broad aspects of the journals and whether they talk about the governance of BCT or its usage in the governance of other aspects. In addition, it also reveals whether the literature reviewed has the 'trust' aspect in analysing or providing a governance framework. Categorisation is carried out by the authors after manually reviewing the papers. The software Atlas.ti 9 is not used to automatically categorise the literature. As the literature review is focused on blockchain technology, governance and its aspect of trust, the questions are pre-determined and accordingly, the articles are tagged. A short version of the literature categorisation is presented in Table 3 for a clear understanding.

### 2.3. *Avoiding bias*

While conducting the analysis and selection of the literature, care is taken to avoid manual scraping of the articles. The articles that

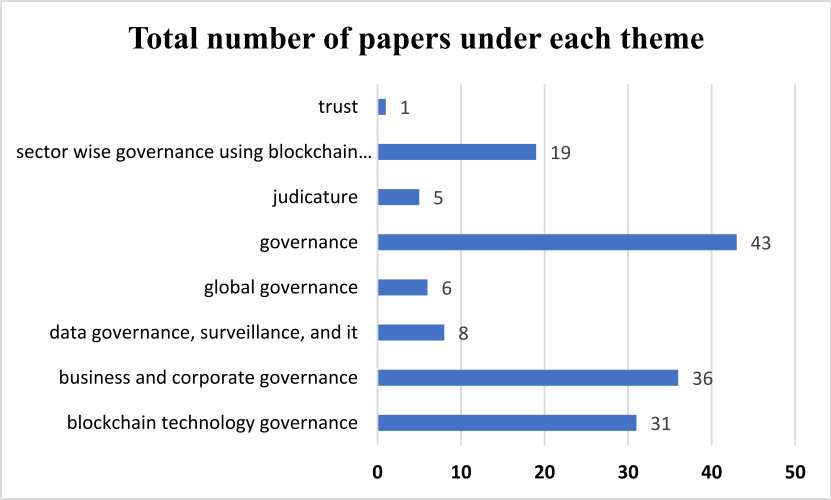


**Fig. 2.** Document groups and number of documents in each group.

**Table 3**
Categorisation table of the literature evaluating whether the literature has an emphasis on trust (sample).

| Title | Area | Does it talk about Trust? | Governance of the BCT? | Governance using BCT? | Governance based on Trust? |
|---|---|---|---|---|---|
| Frontiers in Blockchain | Usage of BCT in governance | No | No | Yes | No |
| Information Systems Management | Blockchain governance | No | Yes | No | No |
| Discrete Dynamics in Nature and Society | Smart city | No | No | Yes | No |
| International Journal of Production Research | Supply chain | No | No | Yes | No |

**Table 4**
Categorical distribution of literature.

| Category | Does it talk about Trust? | Governance of the BCT? | Governance using the BCT? | Governance discussion based on Trust? |
|---|---|---|---|---|
| **Yes** | 41 | 27 | 27 | 5 |
| **No** | 144 | 128 | 128 | 150 |

the software identifies are taken into consideration to avoid researcher bias. Book chapters and pre-print versions are avoided to remove any author bias in the papers. In addition, the codes are generated by the authors individually and the clubbing of the codes is done blindly twice to avoid bias. The adoption of the SALSA method to conduct review reduces bias significantly [34].

## 3. Thematic analysis

The thematic categorisation of the findings from the literature review addresses research question 'RQ1' in this section. It also accounts for the third part of the SALSA method – synthesis. This includes a detailed analysis of the literature and description of the broad arguments made by the literature. This analysis is conducted by the authors individually coding the literature, while dividing the final articles among the four authors. The identified codes are discussed and consensus is achieved to merge the codes into eight themes. As blockchain governance is rarely researched when anchored to the trust concept, narrative analysis/descriptive analysis is conducted to create the codes. Further, the selected papers do not have a homogenous methodology, making them unviable for meta-analysis.

Thematic categorisation results in eight themes. These themes are the major areas under which the existing literature (as scraped from Publish and Perish software) is situated. The themes are detailed in the sections below, with lists provided in Tables 5 and 6. Each theme is detailed in accordance with research question RQ2.

The division of the literature into named themes is carried out based on the analysis made by the authors. Based on the titles, there may be some overlapping. However, the arguments are exclusively divided from each other. Even though a paper might argue on multiple identified themes, arguments are separated exclusively.

### *3.1. Sector-wise governance using BCT*

BCT is used in finance and accounting [53,122], health care [140], academia [141], and sustainable exploitation of natural resources [71,133]. Some claim that BCT can maintain, distribute, and facilitate sustainable natural resource exploitation [141,133,136]. The latter claim can be understood from the following example. Consider that government approval for natural resource mining is provided using a blockchain platform and a statutory body governs it. The blockchain platform rules are made to take inputs from the satellite imagery and calculate the impact assessments of the resource exploitation based on certain scientific parameters. In that case, a government cannot sideline the blockchain to provide approvals. It becomes impossible for any government to engage in corruption. This is how blockchain enhances governance specific to allocating guidelines on natural resource mining, while protecting the natural ecosystem.

Similarly, within academia, BCT monitors and allocates university tenders, certificate distribution for extra-curricular events, and assignment submissions [141]. Blockchain can also be used in designing scientific publication platforms. It is considered the best way to advance the Kuhnian idea of expanding scientific knowledge [142]. That means that any new scientific knowledge in the form of a journal article can be uploaded onto the platform only if the majority of the scientific community accepts it.

Considering the examples given above, it is evident that BCT can govern a resource allocation process. Though this technology is promising, some believe that algorithms cannot replace human decisions [53]. This means that trust is not yet easily transferred from humans to machines. Supporting the latter argument, some argue that blockchain often has highly centralized elements present. The degree of this centralisation varies across blockchains and might be connected to the business cases and origins of the different systems [112]. However, there are some decisions in which a machine can invariably perform better than humans. Mergers and acquisitions, capital decisions, and investment decisions are based on quantitative or say data-driven analysis [69]. These decisions can be automated; thus, machines can make them more efficiently [143]. Blockchain technology is promising, but arguments for and against the

**Table 5**
Literature distribution per sector category.

| Theme | Select References | Major Findings |
|---|---|---|
| Blockchain Technology Governance | [8,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62] | • Governance of blockchain is conducted in three layers - off-chain community, off-chain development, and on chain protocols. |
| Data Governance, Surveillance, and IT | [63,64,16,65,66,67] | •Data governance using BCT ensures data privacy by providing a single shared ledger to service providers. |
| Business and Corporate Governance | [68,69,70,71,72,73,74–76,77,78,79,80,81,82,83,84,85,86,87] | •Blockchain reduces the need for mediators, eases the exchange of documents and removes third party verification in supply chain management.<br>•In corporate governance, BCT reduces proxy voting and assists in decision making for company shareholders. |
| Global Governance | [5,88,89,90,91–93] | •BCT provides effective decision making in multi-lateral organisations.<br>•Voting rights or members can be strictly coded.<br>•BCT based international aids reach directly to the beneficiaries without political involvement of certain actors. |
| Public Governance | [94,95,96,97,98,99,100,101,102,103,104,105,106,107,108,109,110,111,112,113,114,115,116,117,118,119] | •Multi-stakeholder deliberations and decision making will be possible using blockchain platforms.<br>•Blockchain will reduce corruption and enhance resource distribution. |
| Judicature | [120,121,122,123] | •BCT implementation challenges GDPR regulations.<br>•Lack of international enforceable data legislations |
| Sector-wise Governance using Blockchain Technology | [124,125,126,127,128,129,130,80,131,132,133,134,135,136,137,138,139] | •Blockchain can also be used in maintaining, distributing and the sustainable exploitation of natural resources<br>•Some use cases within academia are university tenders, certificate distribution for extracurricular events, and assignment submissions |
| Trust | [120] | •BCT establishes a systemic trust. To construct blockchain governance systems, partially controlled proof algorithms should be used. |

**Table 6**
Article categories under the question
'***Does it talk about trust?***'

| Theme | Does it talk about Trust | Count |
|---|---|---|
| Blockchain Technology Governance | No | 25 |
| | Yes | 30 |
| Business And Corporate Governance | No | 28 |
| | Yes | 11 |
| Data Governance, Surveillance, and IT | No | 6 |
| | Yes | 2 |
| Global Governance | No | 4 |
| | Yes | 2 |
| Public Governance | No | 27 |
| | Yes | 16 |
| Judicature | No | 6 |
| | Yes | 1 |
| Sector-wise Governance Using Blockchain Technology | No | 16 |
| | Yes | 3 |
| Trust | No | 0 |
| | Yes | 1 |

usage of blockchain are still significant in current literature.

### *3.2. Business and corporate governance*

#### *3.2.1. Supply chain*

The supply chain is one of the most successful sectors where blockchain is used. Removal of middle men is an important factor in improving supply chain management. Many articles [70,84] that fall under the theme of '*Business and Corporate Governance*' state that blockchain can be used to reduce middle men, exchange documents with confidence and automate transactions as per the smart contract. A notable example found is that of IBM. It partnered with Maersk and is developing a BCT platform to trace and authenticate its supply chain nodes [82]. Such platforms reduce third-party interventions and recurring costs.

Another example to showcase the latter assertion is a product called 'Bunker Trace' [144]. This is a secure digital infrastructure that establishes trust among shipping fuel suppliers and users. The immutable blockchain serves as a secure log for tracing fuel. The blockchain used here is not a distributed one but a centralised one. This way, BCT can be used to enhance supply chain management.

Supply chain management through blockchain goes beyond authentication. It is usually integrated with other IoT-based technologies [124]. Such complex machine integrations over the internet and blockchain authentication require multi-stakeholder governance systems. They require both management and the user to trust the technology. Conversely, it can be said that to have

trust in the system, BCT can be used in supply chain management.

#### 3.2.2. Corporate governance

BCT is opined to be capable enough to improve any decision-making aspects of corporates [145]. The technology can tackle governance issues like proxy voting and empty voting [68]. One way of achieving this is by adopting a Decentralised Autonomous Organisation (DAO) [81]. DAO instantiations like anonymity and non-fungible tokens increase confidence in the system [75]. Anonymity involves hiding a voter from other voters. Non-fungibility is the uniqueness of tokens issued to stakeholders which cannot be duplicated. The voting process is generally vested with the miners individually or with the mining pools [71,146]. Of many existing consensus algorithms, it is asserted that a delegated proof of stake consensus system is used in corporate governance [71]. In this system, the shareholders can delegate their stakes in the blockchain to any node (person or entity), giving them the power to add a new block to the existing chain. As no one knows the node's identity, it is difficult to influence the voting. This system cannot only be used in increasing the efficiency of corporates, but can also be used for effective functioning and sustenance of NGOs. One such case identified is establishment of reputation token based governance of NGOs [134]. Reputation tokens are digital tokens that represent the reputation or trustworthiness of an individual or organization within a network. By implementing a reputation token-based governance model, NGOs can incentivize good behavior, track performance, and foster trust among stakeholders. This can lead to more transparent and accountable operations, crucial for the sustenance and credibility of NGOs. Though it may be premature to judge the trustworthiness of blockchain in corporate governance, from the literature, it appears to be a good alternative to the present corporate governance structure.

However, there are instances of failure of corporate governance by DAOs. Some scholars show that blockchain governance requires offline and online governance [146]. This also should include forking, dispute resolutions [120], and shareholder voting backed by digital infrastructure [84]. In addition, the proposals to change blockchain governance systems should also be available for shareholder voting [74]. Further, it is argued that BCT centralises the decision-making process [113], pushing corporate governance into the hands of a few [69,147]. The larger the capital investment, the greater the voting power of the node. However, the argument that the rules of blockchain contracts are written by code developers [69] is baseless. Developers contribute to the technical implementation of the blockchain, they do not unilaterally determine its rules and governance structure. Another issue identified is the conduct of internal audit in the companies when BCT is used. It is argued that company documents cannot be provided to all token holders or for security purposes; this negates the decentralised governance idea [78].

Blockchain is seen as a useful tool in shielding company board members from targeted influence. At the same time, it is also seen as a tool that shifts decision-making power into the hands of a few. However, the centralisation of decision-making can be restricted by making clear rules on the transfer of stakes in the consensus algorithm. An effective cooperation between regulators, corporations and technology specialists is an essential element to create an ecosystem that can fully utilise blockchain's potential while minimising hazards in the business [76].

### 3.3. Data governance, surveillance, and IT governance

Businesses use big data analysis to formulate their marketing, product, and sales strategies. The data used here is not experimental data but real-time data that is continuously generated. Blockchain can be used for better governance of user data by anchoring on three aspects - data de-coupling from applications, overall control of data usage, plus transparency and traceability of usage [55].

Data-sharing services become separate when data is decoupled from the applications. By decoupling the consent mechanism from the applications, the problems of 'necessary consent', which has been an unsolvable problem worldwide, can be avoided. Some argue that the consent-based legislation is opined to be a mockery of the law [148].

For effective governance of digital platforms - transparency and control of data by the users - participation rights to users are required. At the same time, some vital platform decisions are to be vested with the owners. It is suggested that by using a blockchain platform, governance can be decentralised [36]. This will divide control over the data between users and the company, which is technically enforced. However, the government is seen to acquire blockchain data and snoop into private matters unduly [103]. This leaves us to wonder about the possible structures to be adopted to restrict improper access to data.

### 3.4. Global governance and international organisations

Global institutions such as World Bank and the International Monetary Fund were set up as a result of the world wars of the twentieth century. As per the neo-realism school of thought on International Relations (IR), global institutions are built to bring order to an anarchical world [149]. It appears that blockchain might bring order to anarchy by creating a technical platform for a mutually trusted international organisation [5].

BCT platforms can establish a certain governance model that provides limited power to the member states of global organisations [150]. Blockchain provides self-formalisation of rules and automatic enforcement [92]. Any rule should be coded into the blockchain system and cannot be changed dynamically. This means that a blockchain enacted treaty is completely enforceable.

One successful example of blockchain usage at the global level of transactions is cross–border charitable payments [90]. The Irish Red cross-company aided 500 Syrian refugees in Lebanon to directly redeem cash in partnered stores through a unique identifier. This removed the issues of middle men and transaction costs. Ostrom's principles of global commons governance are achievable through blockchain [91,93]. Ostrom's principles advocate defined boundaries, contextual rules, user participation, accountability, graduated sanctions, low-cost conflict resolution, and nested layers of an organisation. Blockchain's features of immutability distribution

tokenisation and its consensus processes, will help achieve all the principles advocated by Ostrom. However, a global acceptance of blockchain platforms would require commonly accepted legal frameworks [89]. The challenge of globally distributed nodes and their operation requires ex-ante research to construct a global governance framework.

### 3.5. Public governance

The usage of BCT in corporate governance, business decision makings and global governance systems has been discussed in earlier sections. Apart from the latter, literature is highly focused on the usage of blockchain in enhancing public governance systems. There are numerous recommendations for the usage of BCT in the voting process [108,118] to encourage digital trust. Digital trust refers to the confidence and reliability that individuals and entities place in digital technologies, systems, and processes. Digital trust acts as a bridge or mediator between the strategies for managing information, the use of blockchain technology, and ensuring the security of democratic processes. Velpanur recommends a voting process by taking into consideration the privilege index and incorporating that into the voting process of blockchain [118]. In this system, each citizen is assigned a vote token based on their Privilege Index score, with lower scores resulting in higher token values. These ideas will have a major uptake in the governance of smart cities (smart governance), making the cities more inclusive, democratic, and transparent [116].

Technically, blockchain provides a central authority to the code, ensuring that maximum benefit is achieved. This system resembles Bentham's utilitarian concept [151]. According to utilitarianism, the benefit of the majority will benefit society. From this, it can also be concluded that blockchain, rather than decentralising, re-centralises the governance mechanism. Some argue that BCT will not change the power relations between the public, corporates and the state. It just shifts the old actors with the new, which is centralisation of power but not decentralisation [105].

Circling back to the concept of trust, it is proposed that a multi-stakeholder approach to policymaking would be feasible using blockchain. This includes public-private partnership, governance by non-state actors, and autonomous self-governance in particular sectors [150]. It essentially enables the New Public Governance system to have inter-organisational governance, trust-based management and co-production[1] of services as its fundamentals [96]. An example of showcasing the usage of blockchain in public governance by replacing interpersonal trust with machine-based systemic confidence is the movement of excise goods [94]. In such a system, the government will only frame the rules of the smart contract and leave the functioning to a blockchain platform.

Decentralised systems anchor their decision-making on the user community and the contextual rules [152]. As communities are different, even within a country, blockchain-based governance should be based on the macro-level acceptances that construct an initial framework for blockchain-based public governance [152].

It is found that the public blockchain is vulnerable without an overseeing organisation [59]. Sandbox regulatory experiments should be conducted before launching the governance systems [153]. Apart from this, if DAO architectures are used to establish decision-making frameworks in public governance, it is recommended to have a coded rule to upgrade or change protocols when loopholes are identified [74]. In addition, it is discouraged to allow substantial public participation in decision-making [57].

### 3.6. Judicature

Blockchain is immutable! That means it cannot be erased or edited once data is stored. How does an individual enforce the right to data erasure in this case? This is the dilemma between blockchain implementation and General Data Protection Regulation (GDPR) provisions [66]. The same problem exists for other countries and respective data protection legislations. The blockchain ledger can be designed so that anyone who satisfies certain rules can execute a certain command or view the ledger. If it is coded in such a way that the usage of information within a node can be used if it complies with GDPR, then the problem is solved. With its transparency and immutability, GDPR compliance will become more effective.

Another major legal tussle for using blockchain is the absence of a common currency system worldwide. If no currency is involved in the exchange, then there is no need for monetary regulatory approvals [153]. As of writing this paper, cryptocurrencies are bought using exchanged currency such as the dollar and rupee. They are then further used for the exchange of goods and services. This usage requires approvals from the regulatory authorities of states. The difficulty in the current code of law is that the roles of node maintainers are changing. Not just the people who mine, but their geographic locations also makes it difficult to accommodate different jurisdictions. As of now, international law is not enforceable. If blockchain systems are to be used globally, there must be an enforceable international law.

### 3.7. Governance of blockchain technology

The specificity of BCT governance is understood in three layers - off-chain community, off-chain development, and on-chain protocol [58]. The on-chain governance layer includes changes to blockchain protocols through a voting process without discrimination [47]. Off-chain development involves developers, miners, users, and other stakeholders. Each of these would have a seat at any meetings where a decision to change protocols or re-coding is made [47]. This is where the integration of norms, culture, laws, and people can define a given organisation [48]. Off-chain development governance pertains to the management and coordination of

[1] Simultaneous design and consumption of a service.

software development efforts related to blockchain protocol, associated tools and applications.

Blockchain's initial rules establish hierarchies of membership and allocation of decision-making responsibilities. These can define the club committees and sub-committees, with founding members allocated to different roles [50]. This structure is similar to that of the off-chain community. Within this structure, technology governance can be conducted on three levels - macro, meso and micro [115]. At the macro level, governance decisions encompass overarching principles, policies, and strategies that guide the entire blockchain network. This includes fundamental rules and protocols that shape the network's architecture, consensus mechanisms, and economic incentives. Meso-level governance focuses on intermediate-level decision-making processes that govern specific segments or sectors within the blockchain network. This may include governance structures and mechanisms tailored to address the needs and challenges of particular communities, applications or use cases. Micro-level governance deals with granular, day-to-day operational matters and technical details within the blockchain ecosystem. This includes governance mechanisms related to software development, protocol upgrades, transaction validation, and network maintenance.

Amidst all the back and forth debates regarding the effectiveness of blockchain technology in designing governance frameworks, there are some papers that provide governance designs. Laatikainen et al. provide a peripheral governance model which is laden with principles but has no concrete model that can be implemented [154]. The proposed model also works only when the context and sector in which the BCT governance model is being implemented are pre-defined. It cannot be generalised. Li et al. [155], and Basile et al. [64] assert that blockchain-based governance systems will ensure data privacy and preserve the data rights of consumers. They recommend data be stored in a separate server and that data requests should be processed in a separate server. All the transactions from various IP addresses are to be verified using smart contracts.

There are methods to evaluate the best suitable methods of governance models. Zhang et al. argue that a configurational approach would benefit as it examines how various features and combinations thereof explain specific outcomes [60]. The process encourages de-agentising the governance process, emphasizing five key elements: access to decision rights, process visibility, protocol automation, incentives for developers/miners, and incentives for other stakeholders.

From literature, it is clear that there is an established structural understanding of how BCT works and the principles on which technology governance has to be anchored. The layered structures will make governance easier when followed by the accommodation of Zhang's five elements of governance. However, discussions or propositions on building governance frameworks with 'trust' as a vantage point are not found. Where BCT is considered to be a technology that replaces trust between agencies [5], lacking discussion on the same aspect when it comes to governance is worth exploring. This is one of the major areas where future research is necessary.

## 4. Discussion

From the review of 155 articles, eight themes emerge. The previous section details the thematic analysis. All themes emphasise the efficiency of governance when BCT is used. This section delves into the aspects raised by RQ2.

The literature's focus areas are studied to evaluate the aspect of 'trust.' This evaluation is made by categorising all the relevant literature into four questions. The article distribution as per these four questions is shown in Table 4.

1. Does the article talk about the aspect of trust.
2. Does the article talk about the governance of blockchain technology.
3. Does the article discuss governance in any sector using blockchain technology?
4. Does the article discuss the governance mechanisms based on trust.

The first and fourth questions directly search for the existence of discussion on the aspect of trust in the papers. The second and fourth questions talk about governance. Questions regarding governance and trust become interrelated for RQ2. As the question is whether the reviewed papers discuss the concept of trust when discussing governance, they become complementary. The first question exclusively looks at whether the literature focuses on trust. The second and third binarily evaluate whether they discuss governance. Finally, the fourth question combines all three and binarily checks whether the identified literature discusses governance based on trust.

This categorisation (Table 4) shows that not enough papers provide blockchain governance models based on trust. This is the case even though the technology is considered as technology without trust.

Blockchain usage is strongly advocated in those areas where traditional governance structures fail to build trust among people [156]. With the pervasive usage of BCT, the public will decide the value of goods using the immutable ledger. The confidence factor will shift from a human-managed system to a machine-managed ledger. It is not a stretch of imagination to say that blockchain will have an agency status in shaping the socio-economic life of the public, if it becomes as common as the internet.

Though it is dubbed a confidence machine [156], there are sceptical opinions about the public governance of blockchain. The main reason is that if blockchain governance is given public access, stakeholders can form a conglomeration offline and damage the rule-based authentication. If this happens, then it cannot build systemic trust. From the understanding of BCT workings, it is clear that the controllers will be the miners for those platforms with proof of work as their consensus mechanism. Those with higher computational power and an extensive network of miners will have more power to control the BCT system. This means it creates an oligopoly of decision-makers. In the proof of stake consensus mechanism, the nodes will be elected. They will get to validate the next/new block. However, to be chosen as a validator, they must invest in the blockchain platform. Even in the 'proof of stake' governance system, the more money one invests, the more oligopolistic the platform becomes [46]. Moreover, even the public access blockchain will eventually form power clusters leading to oligarchical powers [92].

The governance structures of BCT might be partially controlled [120]. However, in usage cases such as supply chains or any private company-controlled blockchain, permissioned access with global technical standards is suggested [129]. As observed in earlier themes, permissioned blockchains are advised for regulating the supply chain and exploiting natural resources. In order to maintain trust in the decentralised blockchains, tokenisation for nodes is advised [92]. Tokenisation provides society with a means of decentralisation. As observed in the section on corporate governance, there are methods to offer tokens, such as reputation index.

The idea that BCT is an alternative to centralised governance is debateable. Some argue that if the blockchain's design, deployment and maintenance are understood, it can be concluded that BCT does not provide a decentralised governance model [102]. However, even in the centralised blockchain, the mining pools created by the aggregation of miners will have a greater say in validating the contracts [46]. Here, the central authority is not constant. Any new pool can emerge and replace the existing one, making it a new type of governance system. This may possibly enhance user trust in the system.

Table 5 provides a distribution of the selected papers into eight themes along with their major arguments. Most of the papers fall into BCT governance, business and corporate governance, and public governance. It is noted that papers explaining the confluence of trust and governance are absent. From the 155 research papers, it is evident that blockchain is considered to invariably provide a systemic trust among users. As a consequence, this provides two outcomes. One is that the combined efforts of off-chain and on-chain communities should draft the governance structure using blockchain for any institution. The other is that a foundational construct of governance is yet to be developed to use blockchain in governance.

Though some papers discuss the concept 'trust,' a dedicated paper on trust and governance regarding blockchain is absent. This shows that further research based on governance and trust is required.

### 4.2. Future research directions

So far, the review thematically discusses the major arguments of the papers. Apart from the thematic discussion, this paper also identifies certain future research gaps; this is further discussed in this section. This identification should not be considered a result of an exhaustive review. As the literature is selected using the software 'Publish and Perish,' its results will be restricted. However, the questions extracted from the review provide a peripheral direction where further research is necessary. The research questions presented in Table 10 are derived from the themes and from the literature. Further, they are to be answered by future research and are not attempted by any of the papers selected for the conducted review.

In the category of sector-wise governance using blockchain technology, the literature identifies a dichotomous approach regarding blockchain replacing the necessity of trust between two parties in any transactions. This dichotomy appears to be skewed towards the argument that BCT enables a systemic trust. This means that it creates a platform where transactions (social and financial) are made without personally knowing the other party, while trusting that the outcome will be as expected. However, there is no information on how to build a system that enables systemic trust in any institution. Future research questions that are centred on this theme are more focused on designing basic frameworks that create systemic confidence. All four questions focus on providing systemic confidence in various sectors, and on similar lines, multidisciplinary research is required to understand and adopt BCT in governance [88,157]. This shows that BCT is ready to be adopted but needs to have a sectoral governance framework.

Under the theme business and corporate governance, peripheral assertions are made regarding blockchain based governance systems. However, an in-depth analysis or design frameworks are not identified. BCT is considered to provide supply chain traceability applications which enhance trust and also help in compliance [158]. An example of a 'block' company is provided by the authors supporting the argument that BCT enhances supply chain efficiency. However, more examples of how to integrate physical properties into the digital ledger are not to be seen in the literature. Along with BCT, there is research that proposes the usage of IoT to increase supply chain visibility [159]. However, further research is required that provides a framework to adopt the latest IoT technologies and BCT in tracing the supply chain. Questions 3, 4, 5 address the issues in corporate governance using BCT. The lack of BCT governance architectures that provide answers to the issues of geographically displaced blockchain nodes in the case of decentralised governance requires a more nuanced understanding of BCT within management teams of corporates [160]. Future research may explore the potential of integrating DAOs into existing organizational structures, creating a hybrid of hierarchy and DAO autonomy. A joint effort by scholars and technology experts needs to be directed towards understanding how organisations handle increased transaction volumes as they adopt blockchain solutions and evaluate the scalability limits of existing blockchain platforms.

Future research areas identified under the theme data governance, surveillance and IT, also emphasise constructing frameworks for proper data governance both for private companies and public institutions. The literature identifies that BCT can solve the problem of data ownership, regulate the undue advantage of data hoarders and some governments, and decouple data from digital services. When it comes to government transactions, the usage of BCT ensures that data entered by the data producer is not tampered with, thus providing data integrity. Since there is an understanding that this technology provides solutions to various problems within data governance, further research is required to elaborate on sector specific solutions. As mentioned earlier, future research should be directed towards building frameworks that enable all the latter possibilities.

International institutions operate on mutual trust. There is no enforcement authority. Countries act according to their own interests and international cooperation is anchored on norms and peace-building. BCT promises to provide institutional enforcement. Some examples found are the provision of international aid without middle men. BCT features can be aligned to Ostrom's principles for efficient cluster governance to provide efficient usage of resources to MSMEs. Similarly, a comprehensive theoretical framework should be developed for global governance on the principle of Ostrom's global commons. The future research direction that will strengthen blockchain adoption is on global data legislation, global blockchain regulations, and identification of enablers that encourage the usage of BCT in global institutions.

Under the theme public governance, with concepts such as domestic social contracts, imagined communities are identified to be associated with the adoption of blockchain governance. It will be interesting and worthwhile to conduct causal analysis of the implementation of blockchain-based governance systems and the mentioned social concepts. As governments are already piloting BCT applications, further research can be carried out to highlight the practical frameworks and consensus algorithms among various ministries/departments [107]. The micro-foundations of blockchain governance, and how different dimensions of blockchain governance influence the outcome of governance, are not adequately understood [60]. Micro foundations are underlying principles, mechanisms, and processes at the individual level that contribute to the overall governance of blockchain networks. This involves understanding how decisions are made, incentives are aligned, and behaviours are influenced by the design and operation of blockchain systems. Question 7 within this section provides the research question that engages micro foundations and its causal relation with aspects of governance. Under the theme judicature, BCT is found to contradict GDPR. Irrespective of its contradictions, blockchain can be designed to uphold global data legislation. Future research can be made in the latter direction. Some BCT applications are floated in the market asserting that they help companies to comply with GDPR [66]. Designing a blockchain solution that complies with information governance requirements, such as GDPR, necessitates careful planning from the start. This design should consider various factors, including how data and records move, system structures, and how these elements affect data protection and adherence to regulations. Finally, existing literature hardly explores the interaction of trust and governance. Accordingly, some of the future research themes identified are blockchain and its agency status in providing a systemic trust, and how blockchain is alleged to bring oligopoly worldwide. Table 10 exclusively provides future research questions that are extracted from the literature review. It is hoped that this will serve as an initial step for the academic community to conduct further research on enabling governance structures using blockchain technology.

### 4.1. Distribution of publications as per the questions

Tables 6–9 present the distribution of the literature based on each categorical question.

From Tables 6 and it can be asserted that the trust factor is discussed more in the category of public governance. Social governance is one such aspect where public trust in the system becomes a desideratum for the complete adoption of blockchain in all digital services. The next categories that emphasise trust are corporate governance and blockchain technology governance. The rest of the categories have a limited distribution of literature. The three categories under which the trust aspect is discussed are those where blockchain technology is tested and implemented. In Japan, as per the new additions to Japan's Payment Services Act, PSA [161] and the Financial Instruments and Exchange Act (FIEA), cryptocurrencies are legal and treated as property in Japan [162]. They are regarded as miscellaneous income and taxed accordingly. El Salvador became the first country, in 2021, to declare bitcoin as a legal tender. The usage of DAOs in corporate governance is another example of proven blockchain usage in governance. The mapping between the above examples and Table 6 shows that BCT once tested requires trust to be adopted entirely. Once trust is established among all stakeholders, the technology will be adopted ubiquitously with the only drawback being high capital investments. It appears that the rest of the areas mentioned in Table 6 are still grappling with the debate on how to introduce the technology.

When it comes to governance of the technology itself, Table 7 shows that 24 articles directly discuss the aspect of governance. In the category of 'blockchain technology governance' only those articles that directly address the governance of technology are considered. It is found that there is a lack of contextual discussion regarding technology governance, or perhaps the contextual discussion is not necessary when the governance of the technology itself is discussed. In order to bring blockchain into various sectors and encourage transparent and immutable services, contextual research on technology governance would prove to be helpful. It will be interesting to conduct separate research on the possibility of having sector-wise governance models designed for the functioning of blockchain. Usage of the technology for governance will be useful only if the technology is trusted. Trust would be increased if the blockchain is unbiased. Further, if the latter is to be true, the governance of blockchain becomes paramount. Necessary steps are to be considered to ensure that stakeholders are not overpowered and forking should be enabled only in dire needs.

Governance using blockchain is found to be the favourite within the analysed literature from Table 8. The themes, business and corporate governance, public governance, and sector wise governance, extensively discuss enhancing existing governance mechanisms

**Table 7**
Article distribution under the question
'***Does the article talk about the governance of BCT?***'

| Theme | Governance of the BCT | Count |
|---|---|---|
| Blockchain Technology Governance | No | 8 |
| | Yes | 24 |
| Business And Corporate Governance | No | 37 |
| | Yes | 2 |
| Data Governance, Surveillance, and IT | No | 6 |
| | Yes | 2 |
| Global Governance | No | 6 |
| Public Governance | No | 43 |
| Judicature | No | 5 |
| | Yes | 2 |
| Sector-wise Governance Using Blockchain Technology | No | 19 |
| Trust | No | 1 |

using blockchain. This shows confidence on the blockchain to provide a systemic trust in these areas and to eliminate the long existing problems like corruption, middle men intervention, and delays in government services to name a few. However, literature is also found not to be discussing about governance when it comes to designing the technical aspects of the blockchain. Interestingly, the literature is distributed almost equally when it comes to the business and corporate governance sector and public governance sector. This distribution is because some of the articles are found to be review articles that assess the impacts of the governances rather than describing the governance models.

The distribution in Table 9 shows that there is only one article that discusses designing blockchain with trust as its foundation. There are 38 papers that do not talk about governance with trust as an anchor in the sector business and corporate governance; this is highest among the papers. The same goes with the sector public governance and blockchain technology governance.

## 5. Framework to enhance trust for blockchain based governance models

For blockchain technology to gain widespread acceptance across diverse sectors, both users and creators must have confidence in the system. Rather than solely relying on stakeholders, the governance model of blockchain should be constructed on the bedrock principle of trust, with rules governing the ledger serving as the ultimate authority. This approach is fundamental to fostering trust in blockchain technology and maximizing its potential across multiple domains. The literature identifies six principal agents using BCT platform governance models. Using the various trust-enabling paths, trust will be inculcated among agents or by these agents while conducting their businesses. Here, business is a generic term indicating activities carried out by the mentioned agents. 'Trust enabling paths' mentioned in Fig. 3 is the means to attain the solutions that enhance 'trust' among users. From the SLR, it is found that each use case has one or more than one 'trust enabling paths.' The solutions mentioned on the right side of Fig. 3 are not a result of an exhaustive literature review. Thus, they must be considered as one of the many solutions available. Irrespective of the latter, these solutions will enhance systemic trust among the platform users governed by BCT. While undergoing the trial, developers of the blockchain system should revisit the rules to ensure that there are no gaps that will strengthen or promote monopoly or oligopoly. In that way, the power to control the lecture should not be wasted in a single authority. Of course, this is feasible only for public blockchains. However, even for a private blockchain, measures must be taken to ensure that rules formulated by the governing body will be the paramount authority, not the stakeholders of the chain.

From the SLR, it is evident that blockchain governance has merits and demerits. Further, there are difficulties in adopting BCT-based governance models owing to the need for uniform blockchain functionaries across different service providers. The lack of uniform data legislation worldwide is also an impediment to the adoption of blockchain technology. Other barriers include the capital-intensive nature of blockchain mining and blockchain's contribution to e-waste. In order to avoid all these difficulties, the above framework (Fig. 3) is recommended for blockchain trials. This research does not imply that this is the best framework. It is derived from the SLR, and there can be alternative models to the proposed framework. The framework presented in Fig. 3 simplifies how various actors use particular aspects of blockchain governance. It also shows that the identified outcomes will enhance trust, while lowering the difficulties faced to sustain that trust.

Finally, while conducting BCT trials, government agencies and private companies should focus on the blockchain governance difficulties identified. Firstly, government agencies should focus on bringing in globally recognised legislation on blockchain usage and data. Private companies should at least lobby for the same. With global legislation, data portability becomes easier. Further, in the case of auditing, each node that verifies new entries into the block would be situated in different countries. Having different systems of blockchain legislation would hamper auditing and diminish an extremely important facet - transparency and accountability. It is also noted that becoming miners is capital intensive. This means that those firms with large capital can acquire more computing power and become miners. If they can establish maximum mining power, the blockchain ledger becomes centralised. This opposes another facet - distributiveness. Finally, extensive investments in storage and computation is increasing electronic system usage [166]. Encouraging proof of stake algorithms would reduce the amount of blockchain mining-based e-waste [166]. Conversely, BCT is also used to track the

**Table 8**
Article distribution under the question
'***Does the article talk about the governance using BCT?***'

| Theme | Governance using BCT | Count |
|---|---|---|
| Blockchain Technology Governance | Yes | 6 |
| | No | 26 |
| Business And Corporate Governance | Yes | 27 |
| | No | 12 |
| Data Governance, Surveillance, and ITIT | Yes | 6 |
| | No | 2 |
| Global Governance | Yes | 6 |
| Public Governance | Yes | 35 |
| | No | 8 |
| Judicature | No | 6 |
| | Yes | 1 |
| Sector-wise Governance Using Blockchain Technology | Yes | 17 |
| | No | 2 |
| Trust | No | 1 |

**Table 9**
Article distribution under the question
'***Does the article discuss governance based on trust?***'

| Theme | Governance based on Trust? | Count |
|---|---|---|
| Blockchain Technology Governance | No | 31 |
| | Yes | 1 |
| Business and Corporate Governance | No | 38 |
| | Yes | 1 |
| Data Governance, Surveillance, and IT | No | 8 |
| Global Governance | No | 6 |
| Public Governance | No | 40 |
| | Yes | 3 |
| Judicature | No | 7 |
| Sector-wise Governance using Blockchain Technology | No | 19 |
| Trust | No | 1 |

ageing of batteries to assist in recycling [167]. Thus, the message that can be derived from this is that the usage of blockchain does not provide a blanket path for a sustainable economy. While adopting BCT in governance models, governments should be careful regarding the type of proofing algorithms that the platforms are using. Otherwise, they would be the cause of the large volume of e-waste. These difficulties must be addressed before introducing any BCT platforms and while undergoing trials.

## 6. Implications for business, government, and society

The analysis conducted suggests that blockchain has the potential to revolutionize the way that businesses operate. By improving transparency, efficiency, and security, blockchain can help businesses to reduce costs, improve customer satisfaction, and make better decisions. Here are some specific examples showing how businesses are already using blockchain to improve governance in the broad themes as highlighted above [168].

### *6.1. Transparency and accountability*

- Walmart is using blockchain to track the movement of food products through its supply chain. This helps Walmart to ensure that its products are safe and that they meet all relevant regulations.
- Maersk is using blockchain to streamline its shipping operations. This has helped Maersk to reduce costs and improve efficiency.
- VotingWorks is using blockchain to develop a more secure and efficient voting system. This could help to increase voter turnout and reduce the risk of fraud.

### *6.2. Efficiency and security*

- ConsenSys is developing new governance models for businesses, including decentralised autonomous organisations (DAOs). DAOs are organisations that are governed by smart contracts, which are self-executing contracts that are stored on a blockchain. DAOs have the potential to revolutionize the way that businesses are organized and operated.
- Microsoft is developing a new blockchain-based identity management system that will allow businesses to manage their employees' identities and access resources more securely and efficiently.
- IBM is working with a number of businesses to develop and implement blockchain-based governance solutions. For example, IBM is working with the Australian government to develop a new blockchain-based land registry system. This system will help to improve the efficiency and transparency of land transactions in Australia.

### *6.3. Participation and engagement*

- The Aragon project is developing a set of open-source tools that allow anyone to create and manage a DAO. This makes it easier for businesses and organisations to experiment with blockchain-based governance models.
- The Decentralised Autonomous Organization Stack (DAOStack) is another open-source platform that allows users to create and manage DAOs. DAOStack provides a variety of features and tools to help users create and manage successful DAOs.
- The DAOStarter platform helps businesses to launch their own DAOs. DAOStarter provides a variety of services and support to help businesses launch their DAOs successfully.

These are just a few examples of how businesses are using blockchain to improve governance. As technology continues to develop, even more innovative and transformative applications will emerge. Apart from the corporates, governments have many use cases for BCT, and countries worldwide are actively exploring this technology [169]. The fundamental characteristics of technology enable implementation in a wide range of processes for asset registry, inventory, and information exchange, both hard assets such as physical property and intangible assets such as votes, patents, ideas, reputation, intention, health data, information, etc. [170]. It brings more

**Table 10**
Future research questions.

| Theme | Key Future Research Questions |
|---|---|
| Sector-wise Governance using Blockchain Technology | 1. How does blockchain replace interpersonal trust between bureaucrats and contractors while creating systemic confidence? [117].<br>2. How does blockchain technology-enabled academic journal platforms strengthen the Kuhnian idea of 'expansion of scientific knowledge'? [141,142].<br>3. What are the trust enablers that blockchain technology replaces in providing systemic confidence? [101].<br>4. Though some believe that BCT can replace the necessity of trust between two parties [53,122], some believe that trust cannot be replaced [53]. What are the major factors for the above dichotomous conclusions? |
| Business and Corporate Governance | 1. How is blockchain technology integrated with the physical properties of goods to ensure an untampered supply chain? [124,82].<br>2. What is the governance structure to integrate IoT with supply chain systems built on blockchain? [103].<br>3. How does BCT resolve the agency problem in corporate governance? [163].<br>4. What are the probable governance architectures that establish confidence between the decision-makers and shareholders? [69].<br>5. How can the issue of nodes present in different geographic locations be solved in blockchain corporate governance? [69,71,146].<br>6. What is the potential of integrating DAOs into existing organizational structures, creating a hybrid of hierarchy and DAO autonomy? [87]. |
| Data Governance, Surveillance, IT | 1. How is the problem of data ownership solved using BCT systems? [55,148].<br>2. How can undue access of data by government agencies be regulated using blockchain? [103].<br>3. What are the data management structures that can be adopted to decouple data from the applications? [55] |
| Global Governance | 1. What are the enablers of blockchain-based international organisations' governance structures with international enforcement? [92,150]<br>2. How does blockchain eliminate middle men in providing international aid? [90].<br>3. How can countries achieve legal consensus for global blockchain governance? [89].<br>4. Usage of BCT to structure the workings of international organisations might lead to a hierarchical world order [98, 164]. How can we implement BCT based decision making in international organisations that eliminate the hierarchy?<br>5. What are the implementable governance structures that would realise Ostrom's principles of global commons? [91, 93] |
| Governance of BCT | 1. When BCT governance is similar to open-source software governance, what are the best practices that can be adopted? [58]<br>2. Among macro, meso, and micro governance structures, which level should be concentrated on by state authorities and which levels should be left to the developers? [15].<br>3. How is the aspect of 'trust' understood in making the broad rules for blockchain technology governance? [15,165] |
| Public Governance | 1. How does the usage of blockchain strengthen the 'domestic social contract' between state and citizens? [96,150]<br>2. How does liberalism and anarchism support the usage of BCT in public governance systems? [113]<br>3. What are the various imagined communities that the cross-country usage of BCT would bring? [113]<br>4. If the general rule of 51 % consensus is followed in implementing BCT in public governance, how does this actuate Bentham's Utilitarian concept of governance? [151]<br>5. What is the structure of an organisation that would oversee the public governance using BCT? [59].<br>6. What are the various attributes of '*New Public Governance (NPG)*' that are enabled by BCT? [153].<br>7. Given the complexity of blockchain governance and its multi-faceted nature, what are the micro-foundations underlying governance mechanisms within blockchain networks, and how do different dimensions of blockchain governance interact to influence governance outcomes such as network security, scalability, decentralisation, community engagement, and adaptability to technological and regulatory changes? [60]. |
| Judicature | 1. How does an individual enforce the 'right to data erasure' and 'right to be forgotten' if BCT is used to store data? [16, 66]<br>2. How and which judicial codes should be added to blockchain rules that will help reverse the smart contracts as per the external dispute resolution tribunals or judicial decisions? [120]<br>3. How do we solve the tussle between GDPR and BCT adoption? [66]<br>4. How do we solve the issue of the absence of a common currency in enabling global usage of BCT? [153] |
| Trust | 1. Does the BCT system acquire the agency status in enabling trustless transactions? [74]<br>2. Does the usage of BCT create a word-wide oligopoly? [92]<br>3. How can we enable a partially controlled BCT system to build systemic confidence among the public? [120]<br>4. Does blockchain-enabled tokenisation lead to more stable socio-economic conditions? [92] |

efficiency and robustness to any government institution [20], with its fair share of data protection and transparency. Is blockchain the solution to the long and tiring debates on privacy, authenticity, and intangibility? Perhaps it is one.

Corporations such as Deloitte have released reports highlighting the requirement of governance frameworks for the adoption of BCT [171]. PWC also asserts that a country requires a Distributed Ledger Technology (DLT) policy anchoring technology standards, identity and data security, and industry consortium formation [172]. Liu et al., in their literature review analysis, assert that research on blockchain governance principles, ensuring accountability, and structures for evaluation of the BCT governance is required [28]. In lieu of the Deloitte report, this research provides a governance framework for the adoption of BCT.

In India, Niti Aayog, a think tank of the government of India released a blockchain strategy with a greater emphasis on 'trust.' The paper highlights the potential of BCT to become the technology mediator to enable trust between two parties [173]. It has identified potential use cases and also provides a framework to evaluate the adoption of BCT. However, it highlights the absence of legal and

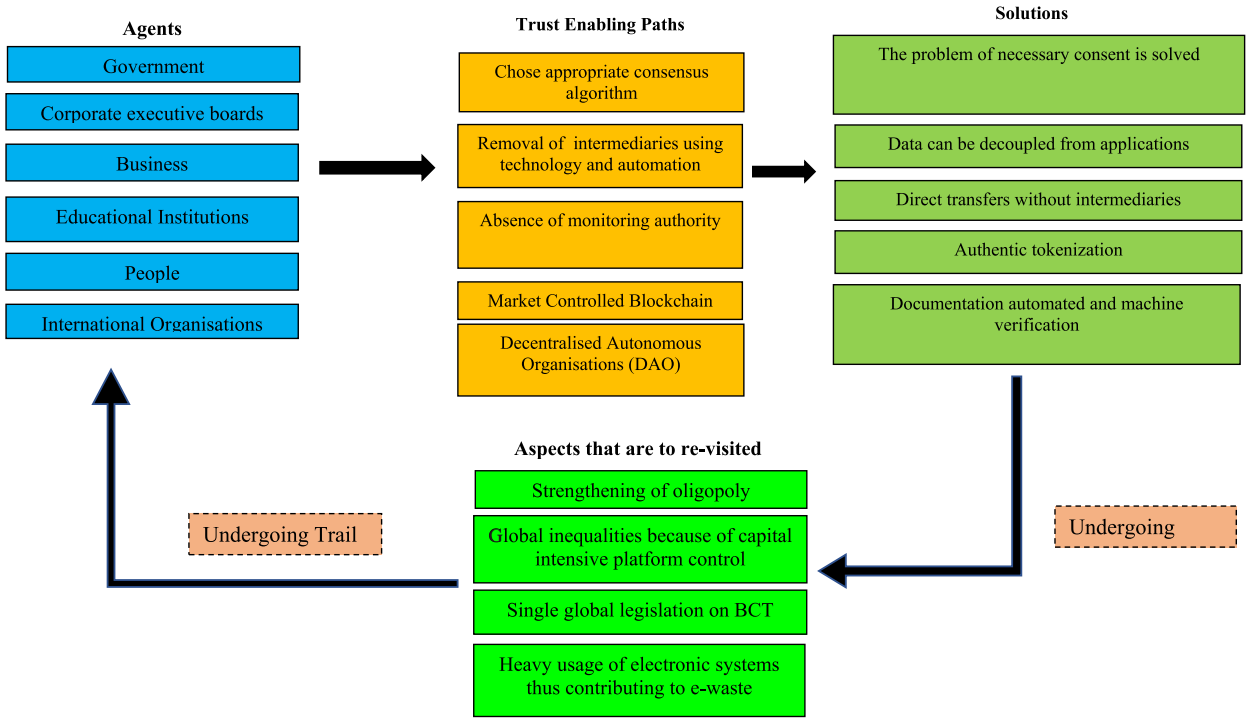


**Fig. 3.** Framework to Enhance Trust during BCT trials.

judicial frameworks that recognise BCT as the trust-enabling technology between two parties. Following the latter, the Ministry of Electronics and Information Technology (MeitY) of India released a Blockchain National Strategy asserting the usefulness of BCT in e-governance and contracts which enhance the necessary trust [174]. Even the national strategy accepts that governance frameworks, proper identification of use cases and technology capabilities of the government should be strengthened for the adoption of BCT. PWC's recommendation that a country needs a blockchain policy is in line with government reports. This shows that the government of India is keen to adopt BCT but lacks a clear picture regarding the trust enhancing governance frameworks which assist in its adoption. The proposed governance framework provides a base of sound principles; this can be a foundation for the development of sectoral frameworks.

The usage of BCT in governance promises decentralised decision-making. Such decentralisation can be used in public governance, corporate governance and also in the governance of the blockchain itself. For public governance, blockchain can create shelling points so that a consensus is arrived at regarding an issue [8]. A shelling point is a solution that the participants choose when they are not able to communicate. When participants are incentivised to choose the correct solution (solution proposed by the average of the participants), they will be forced to prioritise the group requirements rather than any individual requirements. This is an example of how decentralised governance might work in public governance. Decentralised Autonomous Organisations (DAOs) are being advocated for corporate governance. However, there are issues when it comes to the usage of blockchain in defining governance systems or using BCT for governance. Events of hard forking the code mean that there needs to be a systematisation for the BCT to adopt. Realising the importance of BCT, the Organisation for Economic Cooperation and Development (OECD) has advocated for the development of compliance procedures and governance frameworks for the adoption of blockchain [9]. This review paper can add an academic input to the formulation of governance frameworks.

## 7. Limitations

Some of the limitations identified in the review are the additions of new research, usage of a single search platform, and not capturing pluri-perspectives of the analysis. As research on blockchain and trust is emerging very quickly, it becomes difficult to incorporate the latest research in the review. However, the method adopted paves the way to add an analysis to this paper by following the same steps which are elaborated in the initial sections. In this review, Publish and Perish uses Google Scholar, Cross Ref, and Scopus platforms to understand the research discourses.

Finally, regarding the analysis conducted, the results may appear to be generalised findings based on selected literature without considering contextual factors. Examples of these factors are regional differences, industry-specific nuances, or variations in blockchain implementation. The analysis has not been contextualised as the results are directly discussed as per the literature used.

## 8. Conclusion

In conclusion of this paper, revisiting Latour's seminal paper would be befitting. Latour, in his seminal paper 'Where are the Missing Masses?" explains how the agency is being increasingly devolved to artefacts. Further, humans are bound to the rules set for the artefacts as if the agency itself is transferred. Similar is the case with blockchain. When blockchain is used in any governance system, the initial coding team has written a certain code and released blockchain to the public. Now, as no one can change the original code, all the people who accept the blockchain platform have to abide by the rules of the artefact (here blockchain). Does this mean that the agency itself has been transferred to the platform by the coders and those who accepted the platform? It appears so.

As observed from the review, it is found that trust as a foundational aspect of blockchain governance has yet to be fully explored. Many articles talk about the frameworks regarding governance using blockchain technology. Risk theory, the performativity of blockchain and society (which can be a corporate entity) can be combined to gain an effective theoretical framework to explain the social aspects of blockchain [103]. Methods such as homeostatic interactions [49] and using regulatory sandboxes [52] are also recommended in achieving an efficient framework for blockchain governance. If even part of human agency is being delegated to the machine, it becomes important to understand how such devolution will build systemic 'trust.' This work urges further research on the confluence of trust, governance, and blockchain.

## Data availability

No data was used for the research described in the article.

## CRediT authorship contribution statement

**Arun Teja Polcumpally:** Writing – original draft, Software, Methodology, Formal analysis, Data curation, Conceptualization. **Krishan Kumar Pandey:** Writing – review & editing, Supervision, Investigation, Conceptualization. **Anil Kumar:** Writing – review & editing, Investigation, Conceptualization. **Ashutosh Samadhiya:** Writing – review & editing, Supervision, Project administration, Data curation.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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