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Corruption-Transparency-Promoting Blockchain-Based Governance Models: A Comprehensive Literature Analysis

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Abstract: - Integrity and a lack of disclosure continue to be key concerns in global governance systems. These problems are frequently exacerbated by cluster structure and their exploitation by system controller. In addition, the absence of data authorities and internet companies' exploit of user data raises questions about transparency. In light of these issues, the purpose of this search is to analyze live "block chain-based governance" prototype and select best-practice governance prototype that prioritize corruption transparency, as well as their properties and elements. The research will also investigate how a token economy might assist address trusted third-party difficulties in asset ownership management. We also examine the influence of smart contracts, blockchain, decentralized autonomous organizations (DAO), Web 3.0, and multifaceted challenge set self-sovereign identification verification (MFSSIA) as current tools for preventing corruption and establishing transparency in government. To do this, we performed a systematic literature review (SLR) on peer-reviewed articles, conferences, and book sections published between 2012 and 2023. Using the SLR method, 45 primary and supporting studies were chosen for collection and analysis. Finally, we identified seven blockchain-based management simulations, alongside their characteristics and key components.

Keywords: Blockchain, ecosystem, transparency, tokenization, economy.

I. Introduction

The beginning Blockchain is a randomized circulated collection of entries connected by cryptography, called blocks, that are organized chronologically and shared among nodes in a computing networking for digital data retention [1]. Smart contracts are computer programs [2] that are stored on a blockchain and self-start without the involvement of independent go-betweens [3]. Smart contracts pave the way for automated business engagement by removing third-party intermediaries, making collaborative procedures more transparent and cost-effective [4]. The third generation of the Internet, or Web 3.0, is consumer-centered and uses blockchain technology to securely delegate user data, including opinions, money, and possessions., empowering people with total control instead of managing centralized institutions [5][6] Meanwhile, multifactor challenge set self-sovereign identity authentication (MF-SSIA) is an important part of establishing confidence between entities in the burgeoning machine-to-everything (M2X) ecosystem, including systems, devices, organizations, and individuals. It provides self-sovereign, adaptable, and configurable multifactor challenge set-based identity authentication for safe human and machine involvement in electronic market transactions [7][8][9].

According to some research [11][12], using blockchain technology is not required for an SSI solution. However, this innovation gives a solid basis owing to its various technological advantages and only functions as an enabler in SSI deployments. Yet it couldn't be seen as the definitive response to SSI. Blockchain technology, which serves as the technical underpinning for the SSI concept, enables informants to report wrongdoing, unusual conduct, fraud, and corrupt activities anonymously without revealing their identity to investigators [13]. As a result, the blockchain has the potential to empower consumers by asserting their self-sovereign opinions, which is a significant advantage of this technology in terms of enhancing governance systems and closing corruption [14].

The study in [15] looks at SSI solutions and categories them as blockchain-based, such uPort and Sovrin, other non-blockchain-based, like the initiative 'I disclose my attributes'. Although blockchain-based SSIs provide protection combating conspiracy, they have structural difficulties. Non-blockchain SSIs are faster to deploy, but they represent an opportunity of schema alteration if managed by only one entity.

Token communities are a new sort of autonomous digital economy powered by blockchain that stimulates involvement in blockchain networks and platform. This bridges the data usage gap between enterprises and participants, while simultaneously providing high security and privacy on blockchain data sharing platforms. Token markets may enable consumers by giving them internet access of their information, output from work, and assets. [16,17,18].

Other side, blockchain technology improves socioeconomic linkages, citizen involvement, and elected processes [19].

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Corruption exists in both the governmental and private sectors. Bribery is a common practice among individuals and commercial organizations to acquire desired services [20]. Therefore, the use of “smart-contract blockchain technology” is thought to be one of the main tools that emerging economies may use to reduce nepotism, advance accountability, and do away with authorities and middlemen in systems that are susceptible to human interference [21][22].

II. BACKGROUND RELATED WORK

The ideas of blockchain and governance are the initial discussed in Section 2.1 before going into detail on blockchain-based governance frameworks. In Part 2.2, we provide an overview of the blockchain's use in the general public arena along with an analysis of the obstacles that it faces. In Part 2.3, we talk about blockchain-based concepts. Tokenization, token economy, and tokens are covered in Section 2.4.

1.1. Blockchain & governance concepts

Blockchain, often referred to as the dispense ledger, is a randomized peer network and dispersed database that offers security, authenticity, clarity, and longevity [37][38][39]. A dispense ledger is one that is spited by all peers on the network, with a copy of the whole ledger on each blockchain held by each peer [40]. This technology displaces middlemen like banks and other reputable intermediaries by being safe, decentralised, and distributed via the Internet. [41][42][43].

Procedures that are controlled by the rules, regulations, or authority of a company, organisation, or network are referred to as governed processes. The rules that govern "the creation and maintenance of assets managed in the ledger" are outlined in blockchain governance models [45]. Governance guarantees that decisions are made according to established procedures and provide clearly defined roles and responsibilities [46].The topic of governance can be viewed from two angles: (1) at the corporate level, where managerial choices are subject to a system of rules and structures; and (2) at the governmental level, where businesses are subject to rules and structures that influence the nature and extent of these managerial choices [47]. A choice made at one level of blockchain governance is not isolated; rather, it is part of a network of linked levels of blockchain governance [48].

1.2 Blockchain application in the public sector and its relevant challenges

From state to local, corruption is used to misuse government power. It can take many forms, from small-scale bribery to large-scale corruption [43]. Governments everywhere are, nonetheless, putting a lot of effort into advancing social empowerment [34]. Consequently, governments and other public entities are investigating novel approaches to using blockchain technology globally in order to accomplish intelligent governance, save expenses, and enhance operational effectiveness.

Under some circumstances, blockchain can provide reduced infrastructure costs because it facilitates peer-to-peer transactions and does away with the need for middlemen. But blockchain technology comes with a price. Specifically, energy uses and the cost of buying gear and software to run a decentralized network are major expenses. Depending on the particular design decisions used, blockchain technology's energy demands might differ greatly. The cost reductions associated with a certain blockchain should be taken into account before implementing any changes that increase energy consumption [49][50]. Blockchain types and their consensus mechanisms have a direct impact on how much energy they use. For example, public blockchains tend to consume a lot of energy [51].

“Blockchain technology” enhances public transparency by protecting recorded data, expediting procedures, and encouraging citizen involvement in the public sector [28]. In order to accomplish effective governance and win over citizens' trust, governments need to be more transparent. In light of this, corrupt behaviors are made possible by the absence of effective governance [43]. the adoption of blockchain technology in enterprises will be impacted by cybersecurity threats and a deficiency in governance [41]. Likewise, Batubara et al. [52] distinguish between the three main types of barriers to blockchain adoption: organizational, technological, and environmental. Technological aspects include safety, expandability, and flexibility.

The accomplishment of predetermined objectives establishes the necessity of using blockchain technology widely or not. Blockchains provide special benefits that are not possible with other technologies, even if other technologies could be sufficient in other circumstances. For example, if the goal is only to automate a process, then using blockchain may not be essential if a trusted third party can accomplish this. Nonetheless, blockchain could be the best option for achieving objectives like building a decentralized, transparent, and tamper-proof system. Apart from the aforementioned advantages, the removal of reliable intermediaries may also result in lower expenses and decreased corruption. This is especially important in financial applications as parties there typically want to avoid taking on too much risk and rely too much on trust presumptions [53].

1.2. Token, tokenization, and token economy

The applications of blockchain go beyond cryptocurrency management. Specifically, the token economy is becoming more and more well-known, wherein tokenized assets are traded between several blockchain ledgers [67]. The token economy is the idea of utilizing digital tokens as ownership of assets [68]. A token economy is described as a sophisticated to exchange various products, services, or privileges [69, 70]. It also serves as a means of encouraging desirable behavior. Tokens, incentives, and desired behavior are the three main components of the token economy, which is an ecosystem (reward system). Within this ecosystem, the token—which functions as an incentive for network users—and the required behavior exchange concrete or intangible values [71].

1.2.1. Token

Smart contracts are closely connected to tokens and token economies, often known as crypto economies [72]. Within the token economy, a token is a coded unit of value that may be used on any blockchain [73]. In order to enable consumers to engage with the goods and facilitate the distribution and sharing of rewards and advantages to all stakeholders, Mougayar defines a token as "a unit of value that an organization creates" [74, para. 3]. Two categories exist for crypto tokens: (a) by usage, such as fungible or non-fungible tokens (NFT); and (b) by kind of implementation, such as platform, transactional, governance, security, payment (currency), utility, and soul-bound tokens (SBT) [78].

1. **Payment tokens** (often referred to as consensus or cryptocurrencies): In the heart of blockchain systems like Bitcoin and Ethereum, they function both a unit of measurement and a store of value [72][79]. The two most utilized cryptocurrency tokens that are traded and spent like regular fiat money are ETH and BTC [77].
2. **Utility tokens** (sometimes referred to as user coins or applications): They speak of tokens, like gift cards, that stand in for certain tokenized permission granted to a good on a “blockchain network” [77].
3. **Security tokens** (sometimes referred to as equity tokens): These tokens can be digital copies of traditional assets like stocks, options that grant the share holder the right to future corporate earnings, or they can show authority shares of a business or DAO platform [72][79].
4. **Governance tokens:** Recently, governance tokens—a kind of bitcoin that symbolizes voting power on a blockchain—have mostly been included in “decentralized finance” projects as a means of assigning rights to users. Moreover, governance tokens are exchanged on both “centralized and decentralized” exchanges and have economic worth [76]. However, governance tokens enable for the allocation of power among stakeholders by representing a share in a DAO [80].
5. **Platform tokens:** They enable a wide range of processes and use cases, as well as the operation of decentralized application stacks. These currencies are often employed to provide a range of functions throughout the blockchain architecture in smart contracts. The ability to reward platform users and, in some situations, pay transaction costs is a fundamental characteristic of platform tokens. Make Dao’s DAI token is an illustration of a platform token that has been classified as a stable coin.
6. **Transactional tokens:** These tokens serve as accounting units and resemble conventional money in most cases. Central authority like banks or clearinghouses are not necessary for transactions utilizing transactional tokens. Additionally, they help with transactions like money exchanges [77].
7. **SBTs:** They are unassailable tokens that are same as to NFTs in that they may not be convey to another account after they have been granted to one [78].

1.2.2. Tokens stand for ownership rights, stocks, certificates, the possession of a home, an individual's identity, the ability to use a service, the right to participate in organizational decision-making, an existing digital or physical asset, access rights to resources, and authorizations in both the digital and physical worlds [81, 82, 83]. Tokens also act as a means of payment in situations where money is transferred digitally, physically, virtually, or legally [84], and they offer extra functionality in contrast to conventional funding mechanisms [85]. As a result, they play important roles in enabling access to services, granting community members the ability to contribute, and regulating governance through voting rights [86].

1.2.3. Tokenization

Tokenization based on blockchain offers a number of benefits, including democratizing the investment market by enabling fractional investments at a reduced cost and enabling transactions to be executed on a blockchain without the need for middlemen, which results in quicker and less expensive transactions. By removing the time and calendar constraints from the global market and enabling the immediate and inexpensive trading of formerly illiquid assets (including real estate, vehicles, and residences), it also increases market efficiency [89]. Furthermore, decentralization, security, flexibility, and transparency are further benefits of tokenization, along with quicker and less expensive transaction processing. Tokenization has several drawbacks in addition to these benefits, such as legal and regulatory concerns, as well as technological difficulties brought on by the usage of DApps [88]. Physical assets undergo a beneficial transformation throughout the tokenization process, whereby they are divided into smaller pieces that may be owned, transferred, and exchanged without the need for a middleman [90]. Tokenization thereby eliminates the expenses associated with middlemen [91].

1.2.4. Token economy

The domains of psychology, pedagogy, clinical psychology, psychiatry, education, therapy, and psychiatry comprised the majority of the prior research on token economy [83][92][93]. The token economy is described as "a management system that uses tokens as an incentive to promote the positive behaviors of the target while devaluing the negative ones of the target" [94] in the domains of psychology and pedagogy.

Three key areas are the focus of current research on token economies based on blockchain technology. First, creating a valued token is the main goal of token system design. The creation of specific economic scenarios comes

in second. Thirdly, the integration of tokens into the real business model, such as the combined usage of tokens and initial coin offerings [70].
In cases of a DLT-based token economy, smart contracts or a DLT protocol are used to create and manage tokens. Native tokens, also known as tokens, are produced using the DLT protocol and are frequently used in DLT systems to compensate users that contribute computing resources to the system's functioning. Tokens that represent any assets on the DLT protocols are created and managed by actors through the implementation of specific business logic via smart contracts [68]. From a microeconomic point of view, several token economies are developed. Using new distributed ledger tokens or building tokens on an already-existing distributed ledger are the two primary ways to launch a DLT-based token economy [91]. There are two types of token economies: centralized and decentralized. In cases of centralized token economies, central actors often provide interoperability between themselves, allowing tokens to be exchanged across digital platforms. As a result, the following disadvantages need to be considered before establishing a decentralized token economy [68]:

1. It is necessary to stop token double-spending.
2. Transactions and account balances stored in a tamper-proof manner.
3. The parties' coordination to arrive at a consensus.

To increase the dependability of the transfer process, a trusted third party, such as a bank or notary, transfers ownership of assets, such as conventional cash, corporate shares, or use rights, between persons or organizations. There are a number of drawbacks to having such a party involved, including increased expenses, delayed processing, and the presence of a single point of failure (SPOF). When these disadvantages exist, services rendered by an outside authority become decentralized and automated. On a decentralized digital platform, agents may express and manage asset ownership digitally using tokens in a fraud-resistant manner without the need for middlemen thanks to emerging sophisticated technology. This makes the token economy possible by reducing issues like SPOF related to reliable third parties. The token economy offers more security, efficiency, and flexibility than conventional techniques, and it has the potential to completely transform the way we trade value and transfer ownership of things. Digital systems that are decentralized ought to avoid issues with double spending and guarantee that users are unable to utilize the same coins more than once at once [91]. In token economy scenarios, DLTs are utilized to decentralize digital platforms and handle asset ownership [68]. Comparably, the current blockchain token economy model has a number of shortcomings, including a lack of commercial applications, incentive systems, and virtual token value. These flaws reduce customers' and retailers' desire to turn a profit [70]. A novel method for integrating blockchains called Connection Chain is put out by Fujimoto et al. [67] and provides a better framework for the exchange of tokenized digital assets in token economy settings. The following issues are the focus of Connection Chain's solutions:

1. The variety of blockchain implementation options makes it difficult to programmatically manage these ledgers because of incompatibilities between transaction data formats and communication protocols.
2. Because a smart contract only manages assets on the same blockchain, it cannot be utilized as a trustworthy intermediary for trade that involves transactions on several blockchains. Financial institutions are being encouraged by legal regulators to adhere to the standards for "security tokens" in order to guarantee the safe issue and trading of tokens.

A token economy is an economic system that relies on cryptography rather than a reliable third party [85]. It is characterized by a token reinforcement system where tokens serve as a medium of exchange in place of legal cash and serve as a link between the real and virtual economies. This is accomplished by providing participants with worthwhile prizes, which enhance data processing, staff motivation, information sharing, and cooperation across many departments and businesses [16]. It is not necessary to share the original transaction data in a token economy. Rather, the data demander just has to add the smart contract to the data provider's initial transaction data set for analysis, after which they may extract the analysis's findings. The token economy incorporates aspects of consensus, such value transfer and smart contract execution, as well as fast information transmission, stringent regulations, and effective execution of economic activities. These characteristics lessen taxes, fees, and administrative authority while streamlining government operations and streamlining the approval procedure. These improvements greatly ease the burden on enterprises and help them regain their vibrancy [17].
A well-thought-out token economy also considers how many tokens are released, how participants are compensated, how wealth is redistributed, and how long users continue to use the services [96]. Token economies are seen to be a useful source of finance that allow for the decentralized administration of digital platforms. Multifaceted token functionality, such inter-party payments, long-term value storage, and funding for foundations, should be provided by a token economy [85]. Steem it is an online content publication platform that uses a unique form of token economy to reward promoters and content providers while penalizing careless or malevolent activity [92]. In the blockchain-based online social network ecosystem, Steemit is among the pioneering and most

prosperous platforms. It determines the worth of contributions using three native tokens, each serving a distinct function: (1) STEEM (short for "steem blockchain"), (2) “Steem Blockchain Dollar” (SBD), and (3) “Steem Power” (SP).

1. **The STEEM token:** Users of Steem transfer this liquid cryptocurrency to one another as a kind of payment at the heart of the token system. STEEM is exchanged by users as a means of payment, or it may be traded with other cryptocurrencies on various exchanges or against more conventional currencies like US dollars. The fundamental unit of account on the Steem blockchain, the STEEM token is where the value of the other tokens is derived.
2. **SBD:** It is intended to offer a cryptocurrency with a consistent value. Similar to convertible notes, which are short-term debt instruments that can be converted to ownership at a later date at a certain rate, SBDs are produced by a similar procedure. Steem allows content providers to monetize their work by rewarding donations with bitcoin. Because of the Delegated Proof of Stake (DPoS) consensus method on the Steem blockchain, users who have a larger stake have more influence over how tokens are distributed than those who have a lesser stake. Whereas STEEM is perceived as ownership. Similar to STEEM, SBD is purchased and sold using exchanges that are not part of the Steem it network.
3. **SP:**

It is an access token that gives its owners the ability to vote on Steem. By agreeing to a vesting timetable, or "powering up," users convert their STEEM to SP. The process of withdrawing SP, also known as powering down, involves changing it back into liquid STEEM in thirteen equal weekly installments. SP is not transferable. The equivalent of a Steem market share is called SP. Similar to common shares, the value of the users' shares rises in tandem with the company's worth. One significant distinction from the other currencies is that SP cannot be bought or sold. To put it briefly, the only ways to obtain SP are through rewards or by exchanging other tokens for SP. Users need to hold some SP since the quantity of SP influences how many social actions (posts, comments, and votes) a user completes, even if they are not obliged to utilize STEEM or SBD to participate in everyday activities (such as submitting content). Furthermore, SP affects network activity in a variety of ways. For instance, SP is important to the reward system; posts that receive a lot of votes from users who possess a lot of SP are more visible, and the top posts receive a bigger portion of the reward pool. The STEEM and SBD tokens can be traded for products and/or services with other users or on trading platforms if a user has no interest in social activities [97][98]. Moreover, Aistov et al. [85] create a token economy for the Share Charge foundation's Open Charging Network (OCN) in order to facilitate distributed governance inside the organization, supply sufficient funding, and encourage early engagement. Together with adhering to certain broad token economy design criteria, the proposed token economy should also satisfy a number of stakeholder requirements and corporate goals.

Therefore, the OCN's token economy model has to:
1. Provide funding to the operators of the platform.
2. Provide long-term investment options that are lucrative.
3. Offer early participants something of value.
4. Encourage a decentralized system of government.

Given that powerful oligopolies were established in key online service marketplaces by the existing centralized design of the digital economy, a token economy based on decentralized business logic and data layers presents itself as a viable substitute. It is doubtful that intermediaries' roles as reliable third parties would become obsolete as a result of tokenization permitting consumer participation since they develop business models to monetize their positions either directly or indirectly through fees or the monetization of acquired data. Therefore, consideration of technology, standards, and governance factors is necessary for the effective creation of a token economy [91]. The main issues that businesses in the token economy face in terms of business challenges and the intersection of law and business are a lack of exchange infrastructure, which leads to low liquidity and a volatile market, and unclear regulations, which seriously obstruct the expansion of business. As soon as the major participants in the crypto and traditional industries collaborate to provide the necessary infrastructure, the first issue will be resolved [68].

Token economies are used in virtual projects as incentive systems based on cryptocurrencies that promote and encourage desired behavior inside the blockchain network. Usually, these projects are based on open blockchain systems like Ethereum, Aeternity, and Tezos, and they raise money via initial coin offerings, or ICOs [99]. Lympo1 is a blockchain-based ecosystem that lets users track their sports and health data and awards them with LYM tokens for leading a better lifestyle. One of the first apps connected to the Samsung blockchain wallet was Lympo, which allows users to take out LYM tokens straight from the wallet. Users of the program may earn rewards in the form of LYM tokens, which can be redeemed for high-quality athletic products from the Lympo Shop online, by completing daily walking and running tasks. Because it enables individuals to own and profit from their personal data by supplying it to a business that uses it to create systems that encourage physical activity, token economies like Lympo have a lot going for them [100][101][102]. The design of a reward distribution scheme for nodes and the design of the currency issue mechanism are the two components of token economies. Token economy designers look for solutions to stop bad conduct that lowers the ecosystem's value in terms of expenses and profits. The value of the whole token ecosystem is not immediately impacted by a large or low reward in a token economy [71].

1.3. Blockchain technologies, smart-contract, DAOs, Web3.0, and MFSSIA

The cornerstones of a new digital era are blockchain technologies and its subsets, which include Web 3.0, DAOs, and smart contracts. With the use of these technologies, transactions will be safe, transparent, and decentralized in the future, enhancing user control and doing away with the need for middlemen. This idea is further strengthened by the MFSSIA concept, which offers a safe framework for people, companies, and systems to engage in e-Commerce activities. We will examine each of these technologies individually as we go deeper into our investigation, starting with the following:

1.3.1. Blockchain technologies and smart contracts

A distributed database called blockchain technology maintains track of every transaction that occurs inside a network. The capacity of blockchain technology to enable communication between untrusted parties without the need for an intermediary or other reliable third party to be present is one of its primary features [103]. Conventional systems include centralized transactions that necessitate the involvement of a reliable third party. This method has significant transaction fees and generates a SPOF, which raise security issues [104]. By using smart contracts and blockchain technology, fraud and mistakes in all network data will be reduced, improving the efficiency, transparency, and equity of public service delivery [105]. By doing away with in-person interactions with government agencies, blockchain technology, along with other decentralized digital technologies, removes paperwork and bureaucracy. Three primary blockchain features that are being tested by governments are workflow automation, shared databases, and notarization. While more innovative alternatives face implementation issues due to present administrative processes and regulatory non-compliance, blockchain-based nota- rization services are more established [106].

Transparency in blockchain transactions is crucial for identifying corrupt activities and, eventually, mitigating or eradicating them. Three key problems are addressed by blockchain design: Lack of transparency: Because the existing system is difficult for the general public and other parties involved to see, it is often not transparent. Slow process: After the title has been granted, it takes three to six months to secure a legally binding purchase contract. Complexity that results in inefficiencies: Because of the importance of the transaction, all parties engaged in the registration process—sellers, purchasers, banks, and real estate agents—want to make sure that everything goes well. As a result, the registration procedure becomes too complex and inefficient [90]. A number of essential characteristics of blockchain technology include decentralization, transparency, resilience, au- ditability, and security [107].

Applications built on the blockchain run independently and are very good at streamlining and easing transactions between individuals, businesses, governments, and even robots [108]. To lower tax fraud and improve dividend flow transparency, Hyvari-nen et al. (2017) design and assess a blockchain-based prototype system designed for the Danish tax authority's needs. Key components of blockchain-based solutions, such as automation, decentralization, transparency, and immutability, are all included into their system.

By providing visible and unchangeable information to all market players, blockchain technology lessens information asymmetry. As a result, there are savings and increases in market efficiency. Furthermore, blockchain can enhance cybersecurity, identification and data management, government operations, and citizen interactions. Blockchain has a significant influence on the public sector that goes beyond enhancing information sharing and record keeping; it even replaces many of the administrative positions that governments now hold [110].

A blockchain technology (BCT)-based infrastructure in the public sector is not meant to take the place of the existing infrastructure. Instead, it is intended to be developed by adding to already-existing systems and useful parts. Blockchain technology and conventional databases are currently being combined (off-chain) in a number of BCT-based applications that go beyond cryptocurrency systems [72]. Permissioned blockchains seem to offer a workable way around the centralization issue in the public sector as they allow governance norms to be effectively enforced yet remain under the jurisdiction of a single entity or group. Blockchain-based notarization services enhance data auditability and administrative procedure transparency. The unchangeable nature of ledger records has the potential to improve public and corporate confidence in government record-keeping, as well as boost the dependability of marketplaces where government agencies operate. Blockchain not only fosters trust and dependability but also improves financial efficiency through the simplification of property title transfers and mortgage handling. Nevertheless, because of their inherent technical and economic drawbacks, including the use of native currencies (a blockchain's intrinsic token that represents a value, like Bitcoin or Ether), network latency problems, and the possibility of unreliable users, public permission less blockchains are not very useful for governments. The unchangeable nature of ledger records has the potential to improve public and corporate confidence in government record-keeping, as well as boost the dependability of marketplaces where government agencies operate. Blockchain not only fosters trust and dependability but also improves financial efficiency through the simplification of property title transfers and mortgage handling. Nevertheless, because of their inherent

technical and economic drawbacks, including the use of native currencies (a blockchain's intrinsic token that represents a value, like Bitcoin or Ether), network latency problems, and the possibility of unreliable users, public permission less blockchains are not very useful for governments.
The blockchain maintains consistency along all connections by distributing digital data throughout networks of computers and servers and updating the data. This system guards against user corruption and ensures transparency. [110][112]. Three possible benefits of blockchain technology are that it can change current governance structures and lessen principal-agent issues. This happens when the government, acting as an agent, and the people, acting as the principal, agree that the agent would work for the latter in return for certain benefits [113], hence lowering the frequency of document fabrication. Nonetheless, it is thought that blockchain technology might enhance government processes by promoting more transparency, accountability, and security [114].
Cryptographer Nick Szabo originally introduced the idea of a smart contract in 1997 as a kind of digital vending machine [115][116]. Because once a smart contract is put on the blockchain, it cannot be changed, developers must make sure it is error-free when building one. Rather, a new smart contract takes the place of the problematic one [72]. Government regulations are formalized and automatically carried out via smart contracts, which lowers expenses for administration and storage, gets rid of paperwork, and minimizes human mistake. Additionally, the allocation of public payments to recipients is made more efficient via smart contracts [106]. Smart contracts use artificial intelligence to enhance workflows and decision-making procedures by utilizing a "Blockchain platform as a service." Significant gains in cost-effectiveness and service quality are brought about by this automation [117]. For smart contracts to function, data must come from the blockchain or sources outside of of it [103].
Ordinary contracts that are unreadable by computers are typically only symbolic and lead to problems like ambiguity, which makes them difficult to enforce and leads to disputes. By requiring more exact specifications from both parties, machine-readable smart contracts provide a solution and lessen disagreement at the enactment stage [118]. Because smart contracts do not require a central authority, company, or organization to resolve disputes between participants, they lower transaction costs and enable more transaction automation [119]. Conventional contracts, on the other hand, need a lot of documentation and rely on third parties, which drives up transaction costs [104].There are many applications for smart contracts, such as lotteries, voting, crowdsourcing, asset sharing, tracking, real estate, insurance, identity management, bidding, rating, gaming, and gambling [116–120]. Smart contracts are implemented in a distributed manner. Smart contracts are utilized by banks for loan issuance and payment automation, insurance firms for claim processing, and postal corporations for accepting payments upon delivery [115]. DApps like decentralized autonomous corporations (DACs), forecasting markets (Augur), decentralized cloud storage (Storj), and DAOs are also constructed using smart contracts [121]. There are three primary types of smart contracts: oracle-driven, dynamic, and static. Simple mathematical operations like addition, subtraction, multiplication, and division are carried out via static smart contracts. Using embedded rules, dynamic smart contracts perform a variety of tasks, such as monitoring particular circumstances and initiating predetermined actions. Lastly, dynamic oracle smart contracts, such as AI oracles, make use of data sources beyond the blockchain. Blockchain data is managed by both static and dynamic smart contracts [122].

DAO

A decentralized autonomous organization (DAO), often referred to as a smart contract (DAC) [123]. As a stand-in for DAOs, other systems like Colony4 and DAOhaus5 refer to them as "magic internet communities" and "colonies," respectively. A DAO's source code is made available on a blockchain that supports smart contracts, like Ethereum6, usually on a public blockchain [126].
DAOs leverage blockchain technology to make community-based decision-making inside enterprises transparent and trustworthy.
Ethereum is the most notable DAO example. It is based on blockchain technology and has enabled several uses, such as the launch and growth of Ether, which is presently the second-largest cryptocurrency behind Bitcoin. By encouraging decentralization and giving players inside a company more influence, DAOs enhance business strategy. Because DAO techniques lack monitoring and control, traditional companies may see them as risky or unmanageable. This poses a serious risk to stakeholders, income, and assets [127]. Because of their minimal barriers to collaboration, highly motivated members, and social consciousness, DAOs function both locally and internationally and adjust swiftly to changes [128]. The DAO, which was constructed on Ethereum, was the first example of decentralized government using blockchain and cryptocurrency to provide algorithmic power. The goal of the DAO was to create a distinctive social and economic framework. Every DAO should match the internal objectives being defined with its structure. Because of their openness and automated functioning, DAOs save a lot of money on legal fees. Smart contracts are used to make management choices in DAOs, which are independently operated utilizing blockchain technology and viewed as decentralized corporate ledgers for financial and technological collaboration [129]. Because DAOs remove complex and dangerous human control from the process of supplying public and private products, they may present a challenge to the traditional role that governments and businesses now play in this regard [72]. Hunhevicz et al. (2022) identify two primary categories of DAO: application-level and protocol-level. Permission less blockchains with code governing stakeholder cooperation are

known as protocol-level DAOs. Application-level DAOs, on the other hand, function on a blockchain where smart contracts are used to encode governance regulations. Launched on Ethereum, the first DAO application, known as "the DAO," met with disastrous failure following a serious security breach that saw millions of dollars pilfered. New application-level DAOs have evolved in response to these instances, frequently making use of frameworks like Aragon or The DAO Stack, which offer evaluated code building pieces constructed to reduce the chance of failure as noted in "The DAO" [125].

Human decision-making is required while creating a DAO in order to automate processes, assess demands, uncover opportunities, and locate partners. Off-chain activities including administration, arbitration, communication, governance, and contracting may call for human intervention in a DAO and must be done responsibly. A DAO and traditional organizations vary primarily in that a DAO uses computer program regulations that are immune to assaults. In a DAO, relationships between members are digitally codified, carried out, and recorded in a ledger enabling decision-making without the need for human involvement. A decentralized autonomous organization (DAO) is one that relies on automated rules in smart contracts to operate itself. Its governance is carried out autonomously by use of off-chain and on-chain processes that facilitate community decision making. Numerical DAOs, such DAOstack7, DAOhaus8, Moloch DAO9, Uniswap10, BitDAO11, Mango DAO12, Compound13, Radicle14, Maker DAO15, Decentraland16, and Aragon17, have surfaced in the wake of the DAO's first failure. Every DAO has a different goal. For example, DAO stack suggests creating a venture capital firm using the Ethereum blockchain, while Democracy Earth18 advocates for global democracy and encourages public discussion on the Internet as a planetary government. Contributors can build their own ecosystems and communities on the Ethereum blockchain with the help of the metaverse platform decentral [130].

A blockchain-based architecture called Go-chain, which is targeted at the government sector and makes use of smart contracts and DAO to guarantee system execution speed, is proposed by Meirobie et al. [114]. As a consequence, government services now have access to a cutting-edge, safe electronic document framework that promotes openness and boosts public confidence. To run DAOs, the framework makes use of tokens and governance rules specified in the application layer code. The framework stops third parties from interfering with the government's ability to benefit from the stored data and allows it to securely keep all document data without any single point of failure. Intelligent contracts are used to execute transactions, cash flows, regulations, and rights within a DAO, so enabling decentralized management of the organization. By use of open processes, DAO members make proposals, debate, and cast votes about organization management. In addition, members exchange tokens and communicate with one another using smart contracts [120].

Project conditions in a DAO are decided by all members via online proposals and voting, motivated by a common goal. Participants receive rewards when the project is finished, which encourages a continuous cycle of action. After reviewing each other's contributions and the project's development, the participants are effectively motivated. The DAO creates a reliable foundation by utilizing the immutability, traceability, and decentralized aspects of blockchain technology [131]. Decentralized Autonomous Citizen Participation Organizations (DACPOs) are introduced by Rikken et al. [132] in order to support participatory budgeting. Concerns of trust and transparency are common with participatory budgeting, which includes the community voting on budget distribution. These issues can be addressed by utilizing DAO apps, which provide openness, run independently, and allow for direct citizen control over the budget. By recording and carrying out data and activities in a decentralized manner, DACPOs improve trust and transparency while lowering the likelihood of fraud and corruption. Voting based on smart contracts guarantees impartial and independent decision-making without requiring centralized bureaucracy or intervention from the government. DACPOs provide shared authority over voting, transactions, and storage. Voting results are tracked and carried out independently, giving voters direct influence over the budget without the involvement of the government or any other party. Applications under the DACPO are therefore thought to be appropriate for improving public confidence and engagement.

For companies looking to implement transparent, reliable, and decentralized governance structures, DAOs are seen as a viable substitute. DAOs have therefore garnered a lot of interest from the scholarly research community. DAOs are being researched as a potential solution to help organizations in their efforts to enhance sharing, security, transparency, and auditability. This would enable their governance or business models to be genuinely global without the need for a central governing body or intermediary [133].

1.3.2. Web3.0

By altering the way government agencies offer cutting-edge and creative services for citizen interaction, the advent of ICT and Web 3.0 benefits the government sector [122]. Gavin Wood, a co-founder of the Ethereum blockchain, came up with the term "Web 3.0" [134][135]. According to Wood, Web 3.0 gives customers complete control over their data and offers Internet services without the need for third parties they can trust. Web 3.0 was made possible by a multitude of technologies, and the decentralized nature of the blockchain supports the back end [5].

Web 1.0 (read-only web), in which IT businesses could provide content to end users via static websites so they could read it without having to engage with it (think encyclopedias, for example). With the help of server-side scripting, users can create shared content on Web 2.0 (read-write web), also known as the participatory social web.

This increases online services and encourages users to interact with the platform more by offering opportunities for content creation, interaction, and information exchange (e.g., social media, Wikipedia). Two essential elements of Web 3.0 are the blockchain and semantic web technologies, which aim to link data in a decentralized manner [139]. Despite their frequent interchangeability, Web 3.0 and Web 3 refer to distinct ideas. Thus, Tim Berners-Lee introduced Web 3.0 (also called the Semantic Web or the read-write-execute Web) for a connected Web. However, Web3, also referred to as the read-write-own or decentralized web, was introduced by Ethereum co-founder Gavin Wood and uses blockchain to record public information, safeguard private information, and do away with the need for reliable third parties by implementing smart contracts [140].

Technological developments in fields like artificial intelligence and the semantic web are included in Web 3.0. On the other hand, Web3 refers expressly to the decentralized Web that creates "ownable" resources using blockchain technology. The integration of Web 3.0's Semantic Web technologies with Web 3.0's Blockchain technologies holds great promise for augmenting the Web's functionality and use [141]. Web3, in Wood's opinion, is about decentralization, transparency, and openness rather than token economies, blockchain technology, or cryptocurrencies [136].

DAOs, blockchain, cryptocurrencies, and other decentralized technologies are used in some of the initial Web 3.0 initiatives to exchange digital assets online. Web 3.0 addresses many of the problems with Web 2.0, including network vulnerability, misinformation, and information disorder; it makes information creation, sharing, and transfer more secure, private, scalable, and free; and it makes it possible to create, identify, contract, and exchange products (like digital assets).

Web 3.0 networks are compatible with multitermi- nal services, enabling information to be accessible anywhere, at any time, and giving the general public access to a customized government system via mobile devices like phones [147].

A Web 3.0-based architecture is proposed by Muthe et al. that eliminates centralized organizations and facilitates a fully decentralized, secure, and open Internet. P2P distributed hypermedia transfer protocol IPFS is used in the architecture to increase speed, persistence, and dependability. With Ethereum and smart contracts, a safe decentralized method for starting data-based payments is established. To improve network nodes, the suggested design makes use of proxy re-encryption and zero-knowledge proofs. In a Web 1.0 design, producers have all control over data access, while users are not allowed to generate any data. Because Web 2.0 design gives consumers restricted access to data generation, it reduces the distance between producers and users. In terms of access, sharing, and production, Web 3.0 architecture seeks to make producers and users indistinguishable from one another [148].

Blockchain technology supports the development of digital infrastructure known as Web 3.0. This removes the requirement for reliable third parties by enabling direct value exchange between users through protocol-enforced consensus processes. With the use of blockchain technology and distributed and decentralized protocols, Web 3.0 seeks to reconstruct the Internet. This enables the following transformations: (1) moving economic infrastructure into distributed protocols, therefore decentralizing the Internet; and (2) digitally constructing native commercial and economic infrastructure, including money, contracts, organizations, and governance [135].

Facebook's announcement in June 2019 to create a new infrastructure to oversee its own token, Libra19 (later called Diem), which incorporates price stability characteristics for its exchange with fiat currencies, is an illustration of how the Web is changing from Web 2.0 to Web 3.0 [83]. Everything will become more democratic with the arrival of Web 3.0, revolutionizing commerce, technology, and the arts. This will eliminate middlemen and give people greater direct control over their own lives. Because of its expansion, the Internet is becoming more participatory, which makes it easier for individuals to go from being passive consumers to actively involved creators [150].

Web 3.0 sets the stage for a "trustless" future where devices and people may interact to trade value, services, and data without the need for intermediaries. This will result in a user-centric, private computing framework for the Internet's next generation [137].

1.3.3. MFSSIA

When multifactor authentication (MFA) first emerged in the 1980s, customers were reluctant to carry extra authentication factors, therefore adoption of the concept was restricted. However, the broad acceptance of MFA may be attributed to the fact that billions of people now have access to cellphones, which allow users to transmit proof of possession, inherence [151].

There are dangers and problems in developing safe, secure identification and authentication systems that are not dependent on the government. Citizens are limited by systems that are managed by the government. Challenge set configuration versatility is lacking in current self-governing IA systems. A blockchain-based approach that allows safe data transfer between different smart contract blockchain systems is proposed by Norta et al. The administration of the challenge / answer life cycle and the construction of customized challenge sets are made easier by the MFSSIA system, which is made up of decentralized knowledge graphs (DKG) and oracles [7]. The MFSSIA system is advantageous in situations like cross-border commerce, lowering risk, time, and expenditures, even if it can have latency problems for rapid processing applications [153]. Consequently, MFSSIA facilitates safe engagement between persons, companies, and systems in e-commerce transactions through the use of blockchain technology and adaptable task sets.

III. METHODOLOGY

We employ the SLR technique in accordance with Kitchenham's recommendations for performing SLR in software engineering [36] and the methodical approach offered by Dwivedi et al. [154] to address the research topics in Section 1. The most recent scientific research and publications that are pertinent to the present topic may be found and categorized using SLR. The SLR is comprised of the following five steps:
Study Synthesis; Data Extraction; Quality Assessment; Study Identification; Study Selection;

1.4. Study identification

Following a preliminary comprehension of the relevant study via literature review, we extract keywords from research questions, which are subsequently integrated to generate the research string (refer to Table 2). We find pertinent research by searching academic databases and webpages.

1.4.1. Search keywords:

In order to locate pertinent material, we create search terms using the right synonyms derived from study queries. To find pertinent papers based on research topics, we employ e-participation along the governance model and blockchain, together with its synonyms, as our main search terms. Next, we create more focused secondary search terms based on the primary research questions. The terms "public sector," "public administration," "corruption," and "transparency" are secondary keywords. The search query is then executed by creating the search string using the Boolean operators "AND" and "OR" from the primary and secondary search terms.

1.4.2. Study sources:

In order to find pertinent material to serve as the foundation for this study's research questions and provide answers, we conduct searches using a number of scholarly search engines, including Google Scholar and Scopus. Regarding the blockchain idea, e-participation, governance model, blockchain-based model, corruption, and transparency, we identify relevant journal, conference, and background articles.

1.4.3. Search process:

We find pertinent material from a variety of research sources. We employ Mendeley reference management software to eliminate articles that are duplicates. We search for redundant articles using Mendeley Desktop's Check for Duplicates option in the Tool menu. We find 26 duplicate articles in all papers, which we manually delete. As a result, we have located 242 publications that were published between 2012 and 2023 and were obtained from the academic databases Scopus and Google Scholar (see Table 3 for details).

1.5. Study selection

We use inclusion and exclusion criteria as part of a two-phase research selection approach to identify relevant studies (see Tables 4 and 5). During the inclusion-exclusion process, we look for pertinent studies that address smart contracts and blockchain-based models, as well as how they are used in the public sector to achieve transparency and lessen corruption. In order to reduce the number of detected publications, we therefore separate relevant and non-related papers in this manner and eliminate pointless investigations. In order to do this, we first look at the titles and abstracts of the identified articles to make sure they all meet the inclusion and exclusion criteria. Just 154 of the 242 articles have been included for evaluation; the remaining papers have been excluded due to they do not meet criteria.

1.6. Quality assessment

We categorize every research and provide a relevance score to each article that is examined. Using Microsoft Excel, we use three-point Likert scales to classify and score the articles. These three points are defined as follows: 1 (somewhat pertinent), 2 (very pertinent), and 3 (quite pertinent). Important articles for addressing research problems are given a score. 3. Articles are assessed based on how well they cover the study topic and the state of the art. Lastly, papers that include a few simple definitions of the terms utilized in this study are rated as 1.

1.7. Data extraction

Using the Microsoft Excel program, we extract the required data from primary and supporting research in this phase of the SLR based on the quality evaluation. Studies yield two types of data extractions: (1) publishing quality data and (ii) data needed to address re-search queries (i.e., RQ1, RQ2, RQ3, and RQ4). Table 6 presents specifics of the data that was retrieved for the main and ancillary investigations. Section 4 provides specific information about RQs.

2. STUDYSYNTHESIS

In order to address the research questions, this part summarizes the findings from the SLR technique and synthesizes the information from the chosen and supporting studies. Table 7's RQ1 response is supported by data in Section 4.1, which also provides an overview of the current blockchain-based governance structures. The information in Tables 8 and 9 is included in Section 4.2, which provides an overview of the key elements and features of the current governance models, therefore supporting the response to RQ2. Section 4.3 contains the response to RQ3, and Section 4.4 has the response to RQ4.

2.1. RQ1: what are the existing blockchain-based governance models?

Many governance prototypes that are present in the survey are revealed by this investigation utilizing the SLR methodology. Table 7, which covers “blockchain-based governance models” with notification year, government through digital communications, sector type, content, utilization, and better technologies, finalize these prototypes and offers seven prototypes derived from chosen and helping research.

For instance, the G2B public sector is the target market for the "Neural blockchain technology for a new anticorruption token" concept, which aims to enhance procurement procedures. Targeting the public sector of G2C in India, the "Blockchain-Based Identity Verification Model" offers a more effective and safe method of document verification. The goal of Pakistan's G2C Education sector's DLT-Based “Immutable Authentication Credential System” is to enhance data checking for knowledge establishments. Finally, "A Conceptual Model for E-Participation by Omani Citizens Using Blockchain Technology" is aimed at enhancing citizenry and is targeted at Oman's G2C public sector.

IV. DISCUSSION

This study's findings imply that just 3 present “blockchain-based governance” prototypes are better suited to achieving clarity and combating misuse in the public sector. These prototypes are used in a variety of fields, including appropriation, documentation confirmation. The 1st prototype presented in [44] aims to reduce corruption in the top order, enhance possession procedures, and boost shareholder involvement. The other strategy presented in [37] is intended for the public sector to give a safer and better means to check papers with no requiring physical involvement with public officials, hence minimizing risk by abolishing the requirement for physical document verification. Likewise, the 3rd model [58] aims to enhance educational institutions' document verification processes. It employs a allocate ledger mechanism to secure the integrity of scholastic certificates. The final concept [59] aims to promote citizen involvement in voting by implementing a safe and clear voting process based on “blockchain technology”, therefore reducing wrong voting and enhancing public faith in the election procedure.

Token economies are established and managed by DLT protocols or smart contracts, and can be “centralized or decentralized” [68]. Many learning in [106][110] underline that “blockchain-based consequences” do not eliminate the function of higher bodies as middlemen, but rather act as complementing or minimum alternatives for existing public [132].

In order to tackle concerns related to trust and fairness, [132] designed a “decentralized autonomous citizen participation organization” to support participatory budgeting. This organization records and manages data and works on a decentralized manner, guaranteeing impartial self-decision-making with no requirement for government intervention [127]. This strategy seeks to reduce the likelihood of fraud and corruption while promoting openness and trust [72].

Web 3.0's decentralization and ownership features provide consumers total control over their data, guaranteeing security and privacy. According to Kuznetsov et al., Web 3.0 and the Semantic Web have different features, hence they shouldn't be combined.

Web 3.0 emphasizes openness more than before, and it makes it easier for different stakeholders to communicate and develop trust [146]. Web 3.0 represents a significant breakthrough in enabling decentralized transactions and encouraging openness in the public sector. Its capacity to offer cutting-edge services, foster trust, and change a number of industries, including banking, law, and education, highlights its potential to upend established bureaucratic procedures and enable face-to-face interactions between people and organizations.

The results show that security and confidence in the public sector are significantly improved by the deployment of MFSSIA. MFSSIA mitigates possible risks and vulnerabilities by utilizing blockchain technology and numerous authentication elements.

There are now a lot of e-participation models available that empower and promote public contact with the government, but they don't provide people ownership over their data. Users are therefore dissuaded from taking part in the formulation of policies. In light of this, future research should consider integrating a Web 3.0 and blockchain-based e-participation paradigm to empower citizens and enhance their independency by granting complete access to their own data via SSI.

Conclusion

Blockchains, together with its cluster advancements like Intelligent agreements, Web 3.0, and ‘DAOs’, have the ability to help authorities battle nepotism and promote openness by reducing physical contacts betwixt people and public workers. In this study, we look at current models that utilize blockchain, analyzing its essential elements and features. We also look at the function of token economies in removing middlemen and the impact of blockchains and related component technologies, as well as “multifactor self-sovereign identity verification”, in the public sector. We identified Seven oversight concepts founded on blockchain technology that focus on increasing in the public sector, accountability and democracy after conducting an extensive systematic analysis of the “literature, which included journals, conferences, and book chapters”.

Our results show that 3 of these blockchain-depended models provide ways to combat misconduct in the public sector. By removing direct interactions with public workers and intermediaries from the process, these models successfully involve stakeholders and encourage openness. Furthermore, our research emphasizes the potential of token economies to offer organizations with new paths for fundraising. Token economies eliminate the need for trusted third parties, allowing stakeholders to digitally express and manage asset ownership using fraud-resistant tokens that are independent of central actors and platforms. Furthermore, our findings show that blockchain technologies, including smart contracts, Web 3.0, and DAOs, have considerable promise for combating corruption and improving transparency in the public sector. These technologies fulfill these objectives by limiting systemic abuse, improving “traceability and auditability”, removing the need for middlemen, minimizing bureaucracy, and giving people sovereignty and power over their information.

This research has a disadvantage in that it relies heavily on previously published work, which raises the likelihood of publication bias. Furthermore, the scalability of blockchain-based governance models and the ethical implications of token economies have not been thoroughly investigated in this work. To solve these constraints, future research should investigate real-world deployments of blockchain-based governance frameworks. Furthermore, researching the effect of these models in specific sectors, such as public procurement and municipalities, particularly in the context of participatory budgeting initiatives, would contribute to a fuller knowledge of the possible advantages and limitations within specific contexts.

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