




Enhancing governance through blockchain technology in the South African public sector

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Background: Blockchain technology can potentially enhance the efficiency and governing of the public sector. The study explored how blockchain could be instrumental in effectively governing the public sector using the Technology Acceptance Model and Diffusions of Innovations Theory as explanatory lenses.

Aim: To determine if blockchain could lead to effective governance by reporting the views of those charged with public sector governance.

Setting: The sample consisted of those charged with governance in four Gauteng provincial departments in the positions of Head of Department, Chief Financial Officer, and Chief Director of Finance.

Methods: A qualitative research approach using semi-structured in-depth interviews and purposive sampling was used.

Results: Blockchain could be instrumental in curbing the current governance challenges in the South African public sector. The rapid growth in the use of blockchain by other countries, and the leveraged results thereof prompt South Africa to align. Although blockchain can potentially improve governance, the study's findings suggest that the South African public sector may not be ready to embrace it.

Conclusion: Effective governance is critical for public sector performance. The ongoing governance challenges in the South African public sector urgently require a solution. The article suggests that blockchain technology could potentially improve the governance of the public sector evidenced by data from in-depth personal interviews despite the low willingness to accept it.

Contribution: The study contributes to the body of knowledge by provoking an intellectual debate and research on the use of blockchain technology in the public sector, which remains an under-researched topic.

Keywords: governance; blockchain technology; Auditor-General of South Africa; change management; technology acceptance model; diffusion of innovation theory.

Introduction

Good governance is crucial for public sector performance. Over the years, the South African public sector has experienced an upsurge in governance challenges resulting in poor public sector performance (Masuku 2019; Moloi 2015). The increased transgressions by the public sector in managing state funds and the lack of transparency call for innovative ways of addressing these problems (Auditor-General of South Africa [AGSA] Integrated Report 2021).

Previous research proposed that transparency in the public sector could be enhanced by accounting systems that allow for the timely publication of data in open and central platforms, such as blockchain technology (Brennan, Subramaniam & Van Staden 2019). Although the South African public sector may not have adopted blockchain technology (Nemer, Jihad & Róbert 2020), its adoption is urgent for curbing governance challenges. Prior studies have focussed on blockchain as a trading platform for cryptocurrencies, leaving an open research area on how it could be used in other contexts outside cryptocurrencies, including public sector governance (Pedro et al. 2019). For the public sector, blockchain could be instrumental in several ways, including enhancing financial reporting through improved transparency and trustworthiness of

the financial statements in recording and storing information in a system that cannot be altered (Brennan et al. 2019).

Globally, governments are swiftly adopting blockchain to control public sector funds, enhance efficiency, and purge corruption (Fourie 2018). In Africa, the socio-economic growth is rapidly advancing with several countries improving financial governance through blockchain technology, while South Africa lags. The United Kingdom (UK), Estonia, Honduras, Denmark, Australia, and Singapore are examples of governments that have taken steps to realise the leverage of blockchain technology (Alketbi, Nasir & Talib 2018). Dubai is the global leader in the world's smart cities, maximising the potential blockchain technology on their cities (Bishr 2019). Similarly, Brazil, consequently, adopted blockchain technology in their Public Digital Bookkeeping system, while Kenya is one of the few African countries that has embraced blockchain in the verification of transactions and records (Shava & Mhlanga 2023).

At present, South African banks have pioneered the blockchain space. For example the South African Reserve Bank implemented blockchain in its Khokha project (South African Reserve Bank 2019). Although success stories have been reported for the implementation of blockchain in areas such as banking and finance, health sector, and supply chain, these are not within the scope of this study and will not be discussed.

The use of blockchain technology in the public sector could enable the development of governance models that could improve the sharing of data based on blockchain's distributed systems, promoting flexible government regulatory systems, while improving transparency (Raymundo Prux, Da Silva Momo & Melati 2021). Government buy-in would accelerate the adoption of blockchain technology. Low government participation and an unfriendly regulatory framework limit the adoption of blockchain technology despite growth in the blockchain ecosystem (Fourie 2018).

Blockchain technology can potentially enhance the effectiveness and efficiency of operations in government departments (Pedro et al. 2019). Furthermore, it could enhance quality and reliability in handling government data (Frick de Moura et al. 2020). However, an extensive analysis of its applications from a governance perspective is still limited (Ziolkowski, Miscione & Schwabe 2020). The limited analysis prompts researchers to investigate the potential for blockchain technology to enhance governance in the South African public sector. Since blockchain technology is emerging particularly in South Africa, it would be worthwhile to investigate the factors that would determine its adoption, and how it could lead to effective governance in turn. To achieve this, the following section provides an overview of governance and reviews the overall state of governance in South Africa to identify gaps that could be filled by blockchain technology.

Literature review

Overview of governance

Governance refers to a set of processes aimed at directing and controlling the behaviour of managers or those charged with governance to ensure the alignment of their actions to shareholders' interests (Gro Holst & Bjorn 2018; Zoubida 2020). In the public sector, governance encompasses a set of institutions and actors drawing from and beyond the government which challenge the authority of the State by maintaining that the government is not the only power centre of a State (Keping 2018). Governance in the public sector could also be viewed as processes for exerting power in managing public resources, making important decisions, resolving conflict, and incorporating the various stakeholders into the system (Brennan et al. 2019).

Literature on governance does not define effective governance (Redondo & Bilbao 2018). This lack of definition stems from the fact that scholars are yet to agree on the best measure of a company's financial performance (Gleißner, Günther & Walkshäusl 2022). Additionally, the history of business management provides various governance measures that cannot be applied uniformly to all company settings (Aguilera & Jackson 2010). This leaves the definition of 'effective governance' a subjective issue. In layman's language, effective governance refers to having the right people with the right skills in the correct positions to ensure transparency and accountability in managing an organisation's affairs.

The literature on corporate governance rather defines good governance, which refers to establishing legislation and frameworks used in implementing strategic policies, effective regulation, monitoring, system design, and social accountability (Sarah, Alan & Jean 2020). Good governance requires maintaining a strategic direction in policy development and implementation, monitoring the reporting systems, and detecting adverse trends in efficiency, and establishing effective and transparent social accountability mechanisms. These definitions suggest that good governance is based on legislative frameworks. On the contrary, as posited by Masuku (2019), effective governance rests on the balance between internal and external mechanisms, by warranting the efficiency of governance and solving natural problems and potential conflicts arising from corporate structures (Masuku 2019). The efficiency of governance structures could be instrumental in aiding sustainable economic development, which could be achieved by the extent to which enterprises publicly adhere to good governance practices (Chigudu 2020). The results of this could lead to sound corporate governance practices which are critical for any country to enhance sustainable economic development (Van Zyl & Mans-Kemp 2001). Thus, this calls for governments to create innovative ways to govern the public sector.

Creative ways for governing the public sector prompts governments to explore different possibilities for improving transparency, accountability, and operational efficiency while

also minimising costs (Robert, Paweł & Joanna 2021). Public sector governance could be improved by adopting innovative strategies that align with technological developments (Janssen et al. 2020). Furthermore, Ashok et al. (2021) supported this view by reiterating how public organisations could improve their governance by embracing new technologies and innovations. Likewise, the public sector could benefit from urgently adopting innovative strategies in financial reporting that enhance transparency and accountability (Brennan et al. 2019; Fofie 2016). As Keping (2018) observed, it would be beneficial for South Africa to adopt technology that enhances transparency, integrity, and accountability. Furthermore, this could promote the recording of transactions in a transparent, reliable, and secure manner that fosters accountability (Brennan et al. 2019). Enhanced transparency and accountability in the public sector through blockchain technology would ensure that governance is not only excellent but also effective in all spheres of government, and to achieve this, there is need to situate the role of technology. The following section provides a brief overview of blockchain technology and its role in governance.

The concept of blockchain technology

Blockchain technology emerged with the advances in the digital era and the Fourth Industrial Revolution (4IR) and refers to a distributed records ledger or a public ledger of transactions executed by an entity and shared among parties (Crosby et al. 2016). The technology uses consensus protocols and innovative nodes to record data seamlessly rather than relying on a central authority to handle this function (Mijoska & Ristevski 2021). Blockchain technology is similar to the traditional ledger for record keeping, although researchers perceive blockchains could be beneficial when compared to the traditional ledger (Maden, Alptekin & Kahraman 2020). As opposed to the traditional ledgers for record keeping which store data in a central location, blockchain duplicates and stores data across many platforms. Once data are captured on the blockchain platform, it cannot be deleted, creating a permanent audit trail. Data in a blockchain are stored in blocks that are connected in a chronological order, to make chains of blocks called blockchains (Idrees et al. 2021), and data cannot be deleted once captured. Blockchain technology uses peer-to-peer nodes which aid participants in the blockchain platform to interact directly within the network (Maden et al. 2020). Each node in the blockchain validates and stores a record of transactions while the consensus protocol harmonises transactions to maintain the shared record of transactions in the blockchain (Hariguna et al. 2021). The advantage of blockchain technology has potential to replace the centralised decision-making power model with a decentralised accountability system, where decision-making powers would be directly delegated to blockchain users (Casallas, Lovelle & Molano 2020). In promoting good governance, advocates of decentralisation believe blockchains could improve the quality of a nation's

governance by taking the government closer to the people (Faguet & Pöschl 2015).

There are several types of blockchains, for example, public, private and hybrid blockchains; and each function according to its unique characteristics. The public blockchain is decentralised in nature and self-regulated, with no interference of a central authority (AlShamsi, Al-Emran & Shaalan 2022) and provides records of current and past transactions (Paul, Aithal & Saavedra 2021). The advantage of a public blockchain is that it ensures openness and trust for all parties involved in the blockchain network. A private blockchain, on the contrary, operates in a closed network by verifying and authenticating transactions from selected parties only (Idrees et al. 2021), while a hybrid blockchain contains characteristics of both public and private blockchains. The authentication of transactions in a private blockchain may limit transparency as users may not authorise transactions they do not approve. Thus, public blockchains would be beneficial for the public sector as they are secured by the larger number of participants and the unavailability of a centralised authority to control them. The large number of participants in a public blockchain platform eliminates dominancy and opportunities to manipulate the transactions on the blockchain platform (Liu, A Wu & A Xu 2019).

Several advantages are envisaged from blockchain technology such as improved record keeping when contrasted to the traditional methods of keeping and auditing government's transactions (Shava & Mhlanga 2023). The most significant advantages being transparency and anonymity in the recording of transactions. Transparency refers to the permanent recording and availability of transactions to anyone within the network, while anonymity refers to the non-identifiability of sending and receiving transactions as the identity of parties is recorded in nodes which are only known to the parties of the transactions (Liang et al. 2021). Anonymity allows a direct interaction among participants without intermediaries through pseudonyms and public key cryptography (Nemer et al. 2020). Another advantage is that real-time accounting could be achieved, eliminating the need to constantly update accounting records and in turn improving the trustworthiness of financial information (Brennan et al. 2019). Although blockchain is perceived as safe and secure, Shava and Mhlanga (2023) reported blockchain's susceptibility to manipulation and cyber-attacks which could compromise the anonymity and privacy of government employees. However, this could be mitigated by establishing proper controls and response strategies prior to adoption.

Accordingly, this article explores the adoption of blockchain technology for effective governance in the South African public sector. The Technology Acceptance Model (TAM) and the Diffusion of Innovations (DOI) theory guided the study. Although there are several theories, not all would apply in all studies contexts. For example, the unified theory of acceptance aims to explain the intentions of users to adopt an information system and the subsequent usage behaviour even though uncertainties still exist over its capability to

describe individuals' technology acceptance (Chao 2019). The Task-Technology Fit (TTF) theory suggests quantifying technology's effectiveness in a system by evaluating the relationship between the technology and the tasks the technology aims to support (Spies et al. 2020). However, the theory is most suitable for measuring technological applications already in the marketplace, thus not suitable for adopting blockchain technology which is currently not in use within government departments. It is for this reason that this study used the TAM for guidance, and it is discussed below.

Technology acceptance model

The TAM assumes that the behavioural intention to adopt new technology depends upon blockchain's perceived usefulness and ease of use (Guych et al. 2020). The user's attitude towards adopting new technology is influenced by the perceived usefulness and ease of use (Kamble, Gunasekaran & Arha 2019). In the adoption of blockchain technology, several studies have used TAM (Harjit et al. 2019; Li 2020; Liu & Ye 2021). For example, Borhani et al. (2021) posited that TAM was appropriate in examining blockchain technology as it is primarily end user oriented. Liu and Ye (2021) combined the technical characteristics of blockchain with TAM to gain a better understanding of the factors that influenced user acceptance for this new technology. Other studies have criticised the model as limited in theoretical assumption and practical effectiveness, regarding it as lacking the necessary attributes for a good theory for technology adoption (Opuku & Francis, 2019). Li (2020) questioned the connection between attitude towards using a technology and the actual use, arguing that these could be affected by factors beyond the potential user's control. To strengthen the power of TAM, researchers recommend integration with other theories to enhance the quality and explanatory power of the theory (Lou & Li 2017), hence the integration with DOI in this study.

The diffusion of innovations theory

Diffusion of innovations theory prescribes a framework for studying innovation adoption processes through the lens of change and describes why and how quickly change may occur (Trahan 2019). This theory suggests that the decision to adopt blockchain technology would be influenced, firstly, by compatibility, which refers to the consistency of blockchain technology to an individual's current settings, secondly, trialability, which refers to the ability for blockchain technology to be tried before adoption, followed by observability, and relative advantage that comes with the use of technology (Nordhoff et al. 2021). Thus, the decision to adopt blockchain would be guided by how the public sector perceives it to be compatible, trialable, and expected to yield results for the departments.

Methodology

The study followed a qualitative research approach which studies the nature of phenomena by analysing their quality, different manifestations, and the context in which they appear (Lorraine, Wolfgang & Christoph 2020). Data were collected using key informant semi-structured in-depth

interviews. An interview guide with semi-structured questions was used to collect data through these in-depth interviews conducted on the Zoom platform. Table 1 is an extract from the interview guide.

The in-depth interviews were conducted individually and produced rich information from the respondents, allowing the researcher to ask questions about the phenomenon being studied (Bezuidenhout, Davis & Du Plooy-Cilliers 2014). Atlas.ti software and thematic analysis were used to analyse the data. Thematic analysis is a process of coding data without trying to fit it into an established coding frame using seven steps: transcription; reading and familiarisation; coding; searching for themes; reviewing; defining and naming themes; and finalising the analysis (Bryman & Bell 2014). This enhanced the sense-making process and helped to give the respondents a voice in the research.

The sample comprised personnel charged with governance in directorship positions within seven Gauteng departments. According to the 2019–2020 findings of the AGSA, out of the nine provinces, Gauteng reported a stagnant outcome in audit results; only 3 departments improved, 1 regressed, and 11 remained the same. The departments selected for this study comprised the 3 that had improved. For comparison, an equal number of 3 from the 11 remaining unchanged were randomly selected, plus the 1 which had regressed, bringing the total to 7 departments. Participants were in the category of heads of department, chief directors, directors, and deputy directors. These respondents were purposely selected based on their ability to explain the phenomenon best (Bezuidenhout et al. 2014; Michalos 2013).

Since blockchain is still a new concept, selecting participants who understood how it could fit as an administrative and financial reporting tool within government departments was imperative. Before the sampling, potential respondents were asked to indicate their knowledge of the financial reporting

TABLE 1: Interview guide: Factors affecting the adoption of blockchain technology.

No.	Question
1	What is your knowledge of blockchain technology?
2	What is your perception of or attitude towards adopting blockchain technology within the department?
3	What is the process within the department to migrate from one financial reporting system to another?
4	What would be required for the department to adopt blockchain technology?
5	Does the department have a framework in place for the adoption of new technology?
6	Will blockchain technology be compatible with the systems of the department?
7	What factors do you think would hinder the adoption of blockchain technology?

Source: Author's interview guide (Appendix 1)

TABLE 2: Total number of respondents.

Department	Position	No. of respondents
Department A	Chief Financial Officer and Chief Director Finance	2
Department B	Head of Department	1
Department C	Chief Financial Officer and Chief Director Finance	2
Department D	Chief Financial Officer and Chief Director Finance	2
Total number of respondents		7

systems and the overall governance procedures of the department. Based on the results, respondents were purposefully selected for the study. The objective was to interview one participant per department in the positions of heads of department, chief directors, directors, and deputy directors. However, only four departments consented to partake in the study. Only four of the seven departments selected for the study agreed to participate. The researcher increased the sample to two participants per department to maintain the original sample size. The details of the respondents are shown in Table 2.

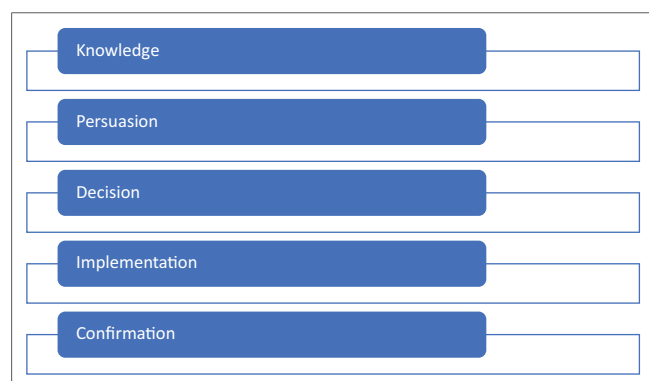
A total of seven interviews were conducted. The interviews stopped at seven as the saturation point reached, and no new data emerged. Thematic analysis with the aid of Atlas.ti software was used to analyse data. The thematic analysis enables a researcher to compare data from various sources and identify patterns in the meanings to derive common themes (Eriksson & Kovalainen 2015). The interpretation of the data is subject to the researcher's understanding of the data. The advantage of thematic analysis is that it does not tie the researcher to a specific theoretical framework (Nowell et al. 2017), allowing for flexibility in the analysis process. Thus, this allowed the researcher flexibility in interpreting the results, allowing new perspectives to emerge from the analysis.

Findings

Blockchain could be instrumental in curbing the current governance challenges in the South African public sector. The rapid growth in the use of blockchain by other countries, and the leveraged results thereof prompt South Africa to align. The study revealed that blockchain technology could be a relevant financial reporting tool in the public sector. Although the study revealed potential for blockchain, the results from the qualitative interviews suggest that the South African public sector may not be ready to embrace it as illustrated below.

Lack of knowledge of blockchain technology

The lack of knowledge was identified as one of the major hindrances to adopting blockchain technology. However, some respondents understood blockchain technology, but



Source: Adapted from Rogers, E.M., 2003, *Diffusion of innovations*, 5th edn., Free Press, New York, NY

FIGURE 1: Stages of diffusion of innovation.

most needed more knowledge, which would pose a challenge in the adoption process. As Rogers (2003) noted, knowledge is the first step in the diffusion of innovation (see Figure 1). With this knowledge, technology can be diffused into an ecosystem (Trahan 2019). The lack of blockchain technology knowledge leads to hesitancy to adopt it (Dowelani, Okoro & Olaleye 2022). The public sector needs to create awareness and invest in equipping their employees with the necessary knowledge and skills to adopt blockchain technology.

Resistance to change and fear of the unknown

Although respondents reported positive attitudes towards adopting blockchain technology, resistance was noted based on government officials being challenged out of their 'comfort zone'. One response serves as an example:

'Change, remember, as human beings, we fear change, fear of the unknown. You're taking me to an environment that I have never been to. It's new to me. That might be one of the limitations. With government employees, you've got people with different educational levels. And that might be a threat to the implementation of that.' (R1, CFO)

The human element plays a significant role in the successful implementation of change. Organisational change has commonly been defined as a shift from the known to the unknown (Dent & Goldberg 1999), and often, it has been observed that employees do not accept change unless there are significant and well-communicated reasons for change (Adams et al. 2009; Lorenzi & Riley 2000). Resistance to change and fear of the unknown were frequently mentioned by respondents as significant barriers to the adoption of blockchain technology. Such fears may have emerged because of insecurities regarding their jobs, influenced by educational background and skills ability. Thus, acceptance of blockchain technology would be low where there is limited knowledge, as suggested by the DOI theory. It was also noted that employees from the younger generation might threaten the older generation as it is often assumed that the younger generation has more excellent technological knowledge than the older generation (Apergis 2019; Becker, Keijsers & Fleming 2012).

In addition to fearing the unknown, change management emerged as another prominent theme that may hinder the adoption of blockchain technology and confirmed the findings of Dowelani et al. (2022). Respondents regarded it as part of 'human nature' to fear change which would impede the change management process. This fear is even more significant in government departments where officials are threatened by their educational backgrounds and limited knowledge of blockchain technology. Persuasion becomes easier when little understanding of technology affects the decision to adopt that technology (Rogers 2003). Thus, any system that challenges their educational background is improbable to be accepted, as the perceived ease of use is challenging. It is also interesting to note how respondents characterised the resistance to change as related to older generation employees as this sample quote shows:

'It's a skills issue and a people's issue. We are bringing in new people, younger generation type people who easily accept this. It is the old guard; that's where the challenge lies. We might have to retire them.' (R2, CFO)

Such views suggest that the skills gap between the younger and older generation, particularly in using technology, threatens the older generation. The change would require persuasion, as indicated by the second stage of the diffusion of the innovation process and upskilling potential users. Persuasion would entail convincing the system's users of the potential benefits of blockchain technology. This process could be futile where there is limited knowledge of the system.

Before implementing change, government departments must consider their population demographics and how individuals might be impacted by new ways of working and new technologies such as blockchain technology. Younger generations view change as an opportunity and may manage it better than their older peers (Tapscott 2017). According to TAM, users would only accept a system if the perceived ease of use is high. As evidenced in the responses, the threat of acquiring new skills would suggest that acceptance of blockchain technology would be low as employees may need to perceive it as a user-friendly technology. Government employees must be trained to boost their confidence and acceptance of blockchain technology to overcome this challenge.

Migration from one system to another

Furthermore, respondents highlighted the importance of having the proper infrastructure supporting the new system. Diffusion of Innovations theory (Trahan 2019) requires that systems be compatible to support the diffusion of new technology; thus, government systems would have to be compatible with blockchain technology. It was noted that although migration could be feasible, it was only partially a decision at the departmental level but would have to involve higher authorities such as the provincial and national treasury. The following quote from an interview serves as an example of this view:

'And from there, again, interacting with the users, those people who are using the system daily, and getting what their frustrations are. Again, you analyse the infrastructure that you have and that you need to utilise the systems. That becomes imperative. And the involvement of the Provincial and National Treasury. It's also required. So that we migrate, we need to have the support of those two institutions.' (R1, CFO)

Considering DOI theory in conjunction with TAM points towards a better understanding of the following two themes, which also emerged.

Adoption of new technology and update of systems

Whether departments had frameworks for adopting new technology seemed unclear, as respondents reacted positively and negatively to such questions. It was, however, noted that this function was not entirely a departmental issue but that a

dedicated department needs to be assigned that role. For instance, the department of E-gov is the department that is tasked with all the information and communications technology solutions of the departments and is responsible for frameworks in that regard.

The data revealed that the current systems used in government departments need to be updated and have an impact on financial reporting. Financial reporting is essential for government departments as this information is crucial for the AGSA to report on government spending to Parliament and the public. Fofie (2016) and Brennan et al. (2019) emphasised the importance of financial reporting and indicated a vital need to develop innovative strategies that enhance accountability and transparency in financial reporting within government departments. Thus, a system like a blockchain technology would improve financial reporting, as the following quote illustrates:

'So, we're still using outdated technology because there needs to be more willingness to implement or enhance new systems. And that's across the board from either Provincial Treasury, and the Auditor-General should have much input. Because when the Auditor-General speaks, generally, leadership listens. But also, the Auditor-General has not been assisted in providing those leading technology solutions to improve service delivery and enhance compliance within the department.' (R4, CFO)

While the above statement confirms the challenge of outdated technology, it also points to departments' trust in the AGSA to solve their challenge of outdated technology. Future studies could focus on the role played by the AGSA in influencing technological choices within the public sector. The response further points to dissatisfaction among departmental heads with the current systems and this may influence the way they view any new system, which may raise scepticism towards adopting blockchain technology.

Privacy issues

Although blockchain is considered to enhance privacy, respondents reported concerns in this regard as they feared that the decentralised nature of the system could compromise government data. This implies that privacy measures should be strictly enhanced should the government consider adopting such a system. The following two quotes well illustrate this issue:

'They also use the same system to ensure that whatever information we receive or have cannot be hacked. And are also using the system to ensure that our information is protected from viruses or other people who can steal information.' (R3, Chief director: Finance)

'[...G]overnment's fear of exposing our data to other, outside company, outside source. The safety of data poses a concern. And that is quite evident in terms of our limited access.' (R4, CFO)

Raising privacy and security issues related to adopting new technology is common. Although some researchers have advocated for blockchain technology as a system that

enhances privacy and improves the storing of information (Idrees et al. 2021; Mohanta et al. 2019), some researchers are still concerned about privacy. Akgiray (2019) indicated that blockchain could compromise people's identities and activities, while Dowelani et al. (2022) suggested that transparency of identities could comprise the *Protection of Personal Information Act*. Thus, departments would need adequate training to understand how privacy could be enhanced through blockchain technology and legislation promoting the parties' privacy.

Training of personnel

Technology acceptance model suggests that recipients would accept a technology they perceive as easy to use and helpful in performing their duties. Staff training is essential before any new system is adopted or implemented to foster this acceptance. While blockchain may be perceived to have benefits for the department, literature revealed that understanding the underlying capabilities and technological requirements to implement blockchain remains a significant downfall in the adoption process (Clavin et al. 2020).

Respondents to the present inquiry strongly believed that implementing a system without the necessary training would be futile as it limits the system from leveraging its full potential. When training is provided, people can avoid being stuck in old ways of doing things. Respondents further emphasised that the training should be an ongoing process. Implementing blockchain technology requires a shift in operations, and government departments would have to hire experienced personnel with blockchain knowledge to collaborate with the staff or train staff to broaden their technical skills in using this technology (Tiron-Tudor et al. 2021). The need for training emerged as a theme, as illustrated by the quotes below:

'[...] It must be communicated, and the users must be adequately trained so that they can be able to use the system effectively.' (R2, CFO)

'[...] The department should also ensure they train the staff to use it. And then if they have been trained, and you've been taken through the system, it is much easier for you to use it.' (R3, Chief director: Finance)

'[...] Retraining them, or bringing in new people with proper skills to work the system.' (R4, CFO)

The themes that emerged from the qualitative data on viewing and implementing blockchain in governance and financial reporting highlighted several implications, especially at the level of practice.

Practical implications

Governance is at the core of an enduring debate that has for years occupied financial accountability scholarship (Brennan et al. 2019; Pedro et al. 2019). Although several challenges and issues emerged concerning adopting blockchain technology, this article highlights the potential blockchain technology could enhance effective governance. Given the

increase in governance challenges in the South African public sector, this research could be helpful for policymakers. The study contributes to the body of knowledge by revealing the level of readiness of the South African public sector to adopt blockchain technology. It also encourages an intellectual debate and research on the use of blockchain technology in the public sector, which remains an under-researched topic. For South African public sector to adopt blockchain technology, extensive skills development is required, and it is recommended that this be incorporated into educational curriculums. There is a need to significantly increase public educational initiatives on blockchain technology and its relevance in this information age.

Limitations

The study focussed mainly on the determinants of blockchain technology and did not delve deeply into the feasibility of adopting blockchain technology. Furthermore, the focus was only on government departments in the province of Gauteng because of institutional ethical requirements and accessibility issues beyond the researcher's control, limiting the generalisation of the results. Although seven departments were selected, only four consented to participate in the study, thus limiting the responses and results. Furthermore, the interviews targeted only departmental heads which may provide a one-sided perspective. Future studies could employ a larger sample and extend beyond departmental heads and one province.

Conclusion

Effective governance is crucial for public sector performance. The research reported in this article highlighted the determinants of adopting blockchain technology as suggested by data from in-depth personal interviews with key public service personnel. It revealed that significant governance challenges remained in public service departments and that a transformative technological solution towards effective governance required much preparatory work on technical and staff development levels. As a starting point, the study identified the critical factors in adopting blockchain technology towards effective governance in the South African public sector.

The findings in this study revealed that knowledge of blockchain technology, the need to update the current financial reporting systems, change management, and personnel training should be considered prior to adopting blockchain technology. Results from this study report that there may be limited knowledge of blockchain technology in public sector environments, and its possible adoption could pose a threat because of limited knowledge and skills.

Fear of change was identified as a significant hindrance, as people prefer to avoid being challenged to move out of their comfort zone. This fear appeared because of job insecurities and was influenced by inadequate educational background and skills. The study points to the blockchain technology as a possible tool to address governance challenges. The identified adoption determinants could guide the

South African public sector towards the readiness to adopt blockchain technology. Furthermore, the identified limitations could aid the development of frameworks for adopting blockchain technology.

Future studies could employ a quantitative research approach to cover a more significant sample and focus on the feasibility of adopting blockchain within government departments by assessing whether departments have the physical, human, and financial resources for its adoption.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

The two co-authors, B.B. and J.V.R., are B.S.'s PhD supervisors and have played a supervisory role in assisting B.S. to develop the manuscript by providing feedback and advising on how to improve.

Ethical considerations

Ethical clearance to conduct this study was obtained from the North-West University Economic and Management Sciences Research Ethics Committee (EMS-REC). (No. NWU-00625-22-A4).

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Data availability

Data are publicly available as public reports were used.

Disclaimer

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Appendix starts on the next page →

Appendix 1: Interview guide

Perceived usefulness and perceived ease of use

1. How would you describe your knowledge of blockchain technology?
2. Do you think blockchain technology would be a system that is easy to use within your department?
3. How useful do you think blockchain technology would be in governing the department?
4. In what areas do you think blockchain could be used in your department?
5. Do you think blockchain technology would have any relative advantage for the department?

Essential factors required for the adoption of blockchain technology

6. What factors do you think would hinder the adoption of blockchain technology?
7. What is your perception or attitude towards the adoption of a new technology within the department?
8. What is the process within the department to migrate from one financial reporting system to another?
9. What would be required for the department to adopt blockchain technology?
10. Does the department have a framework in place for the adoption of new technology?
11. Do you think blockchain technology will be compatible with the systems of the department?
12. Do you think the department can phase in blockchain technology on a trial basis before fully adopting it?
13. Do you think the department has the physical and financial resources for the adoption of blockchain technology?

Effective governance

14. What is management's perception on the adoption of new technology?
15. Do you think those charged with governance would be keen to adopt blockchain technology?
16. What would you consider to be effective governance in your department?
17. How satisfied are you with the level of transparency and accountability in your department?
18. What effect do the current financial reporting systems used by the department have on transparency and accountability?
19. Does the current financial reporting system provide transparency for all the parties that have an interest in the department?
20. In what ways do you think blockchain technology could improve governance in your department?