Beyond Ledgers: The Theoretical Framework of Blockchain Technology in Enhancing Sustainability Reporting

Dahlia Fernandez¹*, Nor Amirah Idris²

¹Faculty of Economics and Management, Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor, Malaysia.
Email: dahlia@ukm.edu.my

²Faculty of Economics and Management, Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor, Malaysia.
Email: p110445@ukm.edu.my

ABSTRACT

This paper is to examine the extent to which quality of non-financial information presented in sustainability reporting can be improved by blockchain, and the extent to which organization’s level of understanding and commitment on the utilization of blockchain technology for sustainability reporting. Data will be collected through semi-structured interview with the top management and accountants of public organization who already utilized blockchain in reporting their sustainability information. Thematic analysis will be used in analysing the collected interview data. The findings may prompt more public organisations to provide training and enhance the skills of their managers and employees in utilising blockchain technology for a more comprehensive and meaningful disclosure of non-financial information. Additionally, it may encourage organisations, particularly those in the public sector, to prioritise and focus on specific qualities that enable managers to be more attentive and meticulous in structuring the completeness of non-financial information before it is recorded in the blockchain. This includes ensuring that relevant stakeholders have access to the appropriate information and exploring the adoption of standardised blockchain protocols.

Contribution/Originality: This study enhances the existing understanding of blockchain technology and its application in sustainability reporting. The adoption model of blockchain technology would provide significant benefits as a framework for researchers, public organisations, and relevant stakeholders, rendering this study highly valuable to them.

1. Introduction

Delivery of sustainable development has been a real growing global concern. The 2030 Agenda for Sustainable Development with its 17 Sustainable Development Goals (SDGs) and 169 targets released in 2015 by United Nation (UN) has called for global
commitment to deliver integrated and balanced development of social, economic and environmental (Rasche, 2020). While integrating sustainable practices into organizational planning and operating, organizations are also demanded to transparently disclose and communicate their integrated sustainability impacts to all their stakeholders (Fonseca & Carvalho, 2019; Parl, Paemuru, Paemuru & Kivisoo, 2020). In response to this call, sustainability reporting has been one of crucial corporate channel to publicly inform their stakeholders if the organization is being managed and operated in responsible way particularly in delivering an integrate and balance development of social, economic and environmental (Di Vaio et al., 2021). All these hopefully may draw small picture of how relevance and importance of sustainability reporting to be given attention on especially in improving organization accountability and reputation. However, quality of sustainability information that presented in the report are still being criticized and doubted among literature, including on how the information are gathered and verified, and also the content and type of information disclosed (Bakarich, 2020; Michelon, Pilonato & Ricceri, 2015). Thus, the quality of information presented in sustainability reporting will be the main issue in the study research model development.

In line with sustainable development, technology revolution playing an important role in presenting new opportunities for organizations to enhance productivity and efficiency of their business functions, including accounting function. Advancement in information technology has shifted manual accounting system to computerized accounting information system (AIS) with great improvement in accuracy, functionality, process, and reporting (Ghasemi et al., 2011; Dalci & Tanis, 2004). Before going any further, it is great to have a clear mind that Accounting Information System (AIS) is a mechanism used by organizations to support their accounting function in gathering, recordkeeping and processing financial and non-financial data of organization’s activities into useful information report for effective various decision making (Belfo & Trigo, 2013). Furthermore, Jans et al., (2022) findings revealed that AIS has been received broad discussion among literature as a mechanism for information disclosure, network technologies as well as for audit and control. This hopefully may give small view of understanding that information technology advancement in accounting system is not just a mechanism that function to increase the speed and accuracy of preparation and presentation of accounting information, but it also functions to monitor and control transparency of the presented accounting information. In addition, as stressing by Neogy (2014) that AIS is not just a trend for being in this digital era, but it is an essential mechanism in getting a true and better quality of information of organization activities to satisfy different stakeholders needs for decision making. For this reason, it is interesting to dive in a bit deeper into one of the latest technologies that has been emerged in AIS, called blockchain.

Blockchain technology has been among other latest information technology of AIS, that has been growing discussed among literature to be widely demanded by organizations including in public sector (Sung & Park, 2021; Ojo & Adebayo, 2017). Blockchain is a digital network in which digital information of transaction (the Block) is recorded and kept in a public database (the Chain) that accessible among all appointed nodes (participants) in the network. Blockchain serve as a database which required validation and verification of all participants in the network for having any new information of transaction, but none of them is controlling it. Therefore, blockchain characterised as distributed ledger, more decentralized, transparent and chronological technology (Treiblmaier, 2020; Ducas & Wilner, 2017). Due to these characteristics, blockchain offered more traceable digital recordkeeping of organization transaction and a more
proper governance across organization activities (Shahaab et al., 2023; Ojo & Adebayo, 2017). This is in line with De Filippi, Mannan and Reijers (2020) findings blockchain is a confidence-produced machine by solving governance challenges and trust problem. Blockchain therefore is seen to be a great demanded platform for more transparent disclosure of both financial and non-financial information as it may able to reduce risk of information asymmetry or any manipulation of information disclosure (Benedetti, et al., 2021; Roszkowska, 2020). It is clear revealed blockchain provided confidence in information for supporting organizations enhancing their accountability and reputation in order to gain stakeholders trust and satisfy stakeholders’ information needs for decision making. Thus, organizations started to explore and demand blockchain as a support mechanism in preparing and presenting their non-financial information particularly for sustainability reporting (Pizzi, et al., 2022; Bakarich, 2020; Radhakrishnan et al., 2019).

Some literature (Bakarich, 2020; Pizzi, et al., 2022; Radhakrishnan, Sinha, & Uhlig, 2019) demonstrated some approaches of blockchain, like Block as a Service (BaaS) or data notarisation could provide better quality sustainability information for reporting. However, utilization of blockchain technology in improving the assurance and quality of sustainability reporting are still underexplored (Pizzi et al., 2022; Bakarich, 2020; Radhakrishnan et al., 2019; Ojo & Adebayo, 2017). Most studies (Kuruppu, et al., 2022; Borhani et al., 2021; Roszkowska, 2020) are highlighting the implication of blockchain on enhancement of information quality in financial reporting, despite non-financial information are growing demanded in ensuring organization sustainability development, (Turzo et al., 2022; Hoffmann et al., 2018). For this reason, non-financial information in sustainability reporting demanded to achieve high quality as financial information. Wu et al. (2019) discussed some of criteria of accounting information quality that have been significantly improved by blockchain and they are including relevance of completeness, truthful representation, neutrality, timeliness, comparability, verifiability, as well as cost-benefit principle of accounting information. On the other hand, Bonsón and Bednárová, (2019) highlighted different main measurement of accounting information quality which are completeness, interpretability and clarity, relevancy, and comparability. But they are much explored on financial reporting context, which contributed exploration in sustainability reporting remained scarce. Therefore, this study interest to examine the extent to which quality of non-financial information presented in sustainability reporting can be improved by blockchain.

While consuming number of benefits, successful utilization of blockchain also should be main focus of organizations. Literature highlighted that leadership, support from the top management, knowledge and expertise of blockchain are among of the crucial factors for successful utilization of blockchain, besides sufficient of technical network and external support or collaboration (Alam et al., 2021; Yadav & Singh, 2020; Hastig & Sodhi, 2020; Hamdan et al., 2016). This is showing besides of having sufficient of technical support, involvement of managers is needed. But, since blockchain are still in developing adoption (Spano et al., 2022), not all organizations are truly prepared to the demand of blockchain particularly in sustainability reporting. Therefore, it draws interest for this study to also examine the extent to which organization’s level of understanding and commitment on the utilization of blockchain technology for sustainability reporting.

As such, the entire theoretical paper discusses in depth of the model development in order to understand to which quality of non-financial information presented in sustainability reporting can be improved by blockchain and the extent to which
organization’s level of understanding and commitment on the utilization of blockchain technology for sustainability reporting. This model will be focusing on eight (8) dimensions of information quality (Completeness, Interpretability and clarity, Relevancy, Comparability, Authority, Accuracy, Timeliness, Manipulation) which adapted from prior studies (Bons & Bednárová, 2019). Meanwhile, there are three (3) dimension regards to organizational barriers (Maintenance and management, Participation of top management, Comprehensive understanding of the technology) which adapted from Caldarelli, Zardini and Rossignoli (2021). This study hopefully may provide organizations some insight of opportunity to enhance their accountability and reputation in sustainability reporting towards sustainable development through the latest technology of AIS. Besides, it may also provide a signal to managers or top management the needs of maintenance and management, participation of top management, comprehensive understanding of the blockchain, as well as standardized protocol is crucial in order to really benefited the improvement in non-information qualities including Completeness, Interpretability and clarity, Relevancy, Comparability, Authority, Accuracy, Timeliness, Manipulation. Overall, this study hopefully might contribute to the scarcity of literature in shedding light on blockchain demand as crucial mechanism in improving non-financial information quality presented in sustainability reporting.

2. Underpinning Theory: Agent Theory and Stakeholder Theory

Two theories are used to develop the research model which are agent theory and stakeholder theory. Agent theory is used in this study as it provided enlightenment on the needs of information improvement in transparency and reduction of information asymmetry to solve agency-principal problem (Cole, Stevenson & Aitken, 2019; Treiblmaier, 2018). Previous study like Han et al. (2022) emphasized on the needs of improvement in transparency and accountability in reducing the information asymmetry and agency problem, which can be controlled and monitored through new technologies like blockchain. This helps to understand on the improvement in non-financial information quality in sustainability reporting by demanding one of the latest advancement technologies that is blockchain which ultimately help organizations in enhancing their accountability and reputation to their different stakeholders in moving towards sustainability development. Meanwhile, through its distributed, decentralized, transparent and chronological technology network, study of Han et al. (2022) revealed that literature demonstrated blockchain as crucial platform in fostering an open and inclusive collaboration and interaction across organization with its stakeholders, but at the same time organization needs to aware on the successful of blockchain adoption. Therefore, using the stakeholder theory helped this study in regards to the level of organization’s understanding and commitment on blockchain utilization.

2.1. Information Quality

In examining the extent to which quality of non-financial information presented in sustainability reporting can be improved by blockchain (study objective 1), this study will use eight (8) dimension of information quality namely completeness, interpretability and clarity, relevancy, comparability, authority, accuracy, timeliness, and manipulation which adapted from previous study Bonson and Bednarova (2019) as the research framework (Table 1).
Table 1: Dimension used for information quality measurement

<table>
<thead>
<tr>
<th>Dimensions Of Information Quality</th>
<th>Description of Information Quality Gained From Blockchain Adoption</th>
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<tbody>
<tr>
<td>Completeness</td>
<td>Information supposed to be complete in order for it to be validated and the appointed nodes are who responsible to predefine the term of required completeness.</td>
</tr>
<tr>
<td>Interpretability and clarity</td>
<td>By fulfilling the required completeness, the information able to provide better interpretation and clarification. Blockchain technology will required predefine of information completeness for every new entry of transaction in order to safeguard the information interpretability. In particular, XBRL blockchain has been developed in enhancing information interpretability and clarity.</td>
</tr>
<tr>
<td>Relevancy</td>
<td>Blockchain enable each node (CEO, auditors, stakeholders) accessing to the relevant information only. It means, while CEO and auditors widely accessible to most of organization information, only limited information could be accessed by some stakeholders depends on their key role</td>
</tr>
<tr>
<td>Comparability</td>
<td>By fulfilling the particular defined standard for entry, blockchain enabling information with identical character to be more comparable.</td>
</tr>
<tr>
<td>Authority</td>
<td>Blockchain enabling recognition of information source, by which information insertion can only be done by trusted nodes, and its modification is traceable and identifiable.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Blockchain safeguarding the accuracy of information by requiring verification of various nodes for any new or additional of information to be recorded in the block.</td>
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<tr>
<td>Timeliness</td>
<td>Blockchain provide on-time information reporting continuously as blockchain enabling the immediate information update.</td>
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<tr>
<td>Manipulation</td>
<td>Blockchain enabling restriction in permitting the information to be read and write to particular parties, as it offered cryptographic lock and unchangeable block of information.</td>
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Source: Adapted from Bonson and Bednarova (2019)

2.2. Organizational Factors of Successful Blockchain Utilization

Meanwhile, in order to examine the extent to which organization's level of understanding and commitment on the utilization of blockchain technology for sustainability reporting, this research propose to incorporate four (4) organizational factors of successful blockchain utilization namely, maintenance and management, engagement of organization members, comprehensive understanding on the technology, and standardized protocol which all adapted from Caldarelli et al. (2021). The four (4) of organizational factors of successful blockchain utilization are described in Table 2.

Table 2: Dimension used in organizational factors of successful blockchain utilization

<table>
<thead>
<tr>
<th>Organizational Factors of Successful Blockchain Utilization</th>
<th>Descriptions</th>
</tr>
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<tbody>
<tr>
<td>Maintenance and management</td>
<td>Appointing experts in maintaining and managing blockchain technology.</td>
</tr>
<tr>
<td>Engagement of organization</td>
<td>Including blockchain as one of the agenda in</td>
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members
organization’s annual meeting with managers and employees to promote active collaboration, communications and coordination on the data gathering for blockchain adoption.

Comprehensive understanding on the technology
Despite delegated to expert, managers and employees supposed to have knowledge and ability on the function of blockchain in order to oversee if the process work in right manner.

Standardized protocol
Existence of official procedure to be practiced in adopting blockchain.

Source: Adapted from Caldarelli et al. (2021)

3. Demand of Blockchain in Sustainability Reporting

Blockchain technology was known to be initially used to develop cryptocurrencies, due to its characteristics of transparency, security and certainty of the system transactions (Tandon et al., 2021). Literatures showed the blockchain technology then has been explored in other fields such as supply chain and logistics, as well as in the field of finance, accounting and auditing. There is many research highlighted the blockchain adoption for organizations’ sustainability performance or developments, and also discussed on its adoption in operation management, operational performance for operational excellence (Shahaab et al., 2022), as well as in supply chain management (Bai, Quayson & Sarkis, 2022) for improving their sustainable supply chain transparency. Scholars have also started discussing on the integration of blockchain with other existing technology on sustainable corporate performance. This is showing that blockchain technology has been widely benefited by organizations in achieving sustainability developments, but the focus is more regards to Corporate Sustainable Responsibility (CSR) performance, instead of sustainable reporting.

Blockchain suitability in reporting sustainability information or also known as corporate social responsibility (CSR) has been explored. In particular, Sarajoti et al. (2022) suggested public blockchain provide more proper platform for reporting organization’s CSR as its accessibility opened to any participants through which enabling crowdsourcing on organization’s CSR performance from a direct observation. Similar with Pizzi et al. (2022) that stressed public blockchain is more appropriate to be implemented for sustainability reporting through which asymmetry information issue can be reduced. The reason is, despite private blockchain is possible to be utilized in sustainability reporting, but Smith and Castonguay (2020) and Bakarich et al. (2020) agreed that private blockchain without execution of strong governance and internal control policies may still lead organization to the issue of data trust in reporting. Therefore, so far public blockchain is seen to be more appropriate in enhancing transparency and accountability in reporting sustainability. In addition, while Sarajoti et al. (2022) also demonstrated the possibility of any database in existence to be transform to blockchain database, previous study like Spano et al. (2022) demonstrated the needs of more research studying on the integration of blockchain with other developing technologies (e.g. virtual reality & metaverse) particularly in addressing issue of accountability and assurance in accounting field.

However, while many studies focused on the main implication of blockchain adoption on the enhancement of transparency and trust in corporate financial reporting as well as sustainability operational performance, there is still few of recent studies stressing on
blockchain utilization in improving the assurance of sustainability reporting, and this is what this study intends to fill the gap.

Despite increasing attention given on non-financial information disclosure through some sustainable reporting standards such as the Global Reporting Initiative (GRI), Integrated Reporting (IR), and Environmental, Social and Governance (ESG) Report, but Bakarich et al. (2020) has highlighted that issues regard to gathering and verifying the data presented in these reports is continue to arise. In addition, EY survey (2016) found the most challenges regard to sustainability reporting is (1) availability of data, and (2) accuracy or completeness of data. So, Torres (2021) emphasized that technologies are called for providing consistent information, analysing organizations’ sustainability development, and supporting system by which may guarantee the origin and traceability of data, harmonize non-financial information to achieve the same level of trust, transparency and commitment as provided by financial reporting statements. As stressing by Farooq and De Villiers (2017), assurance procedures for sustainability reporting played a crucial role in supporting the credibility of non-financial disclosure information. Therefore, there is need for this study to fill the gap of scarce literatures on blockchain utilization in sustainability reporting by examining the extent to which blockchain adoption playing its role in improving the quality of sustainability reporting which will then fulfil the stakeholders’ information need and eventually provide accountability to public. Figure 1 shows the model of information quality, organizational factors, and demand of blockchain in sustainability reporting.

Figure 1: Information Quality, Organizational Factors, and Demand of Blockchain in Sustainability Reporting Model
4. Conclusion

This study provides a theoretical framework to examine various dimensions of information quality in response to the need for blockchain technology to ensure high-quality disclosure of non-financial information in sustainability reporting. Additionally, this study includes the factor in the organization’s comprehension and dedication to the utilization of blockchain as a key factor in ensuring successful implementation of blockchain technology, leading to significant enhancements in information quality. Blockchain offers a transparent and secure recordkeeping system, as well as effective governance for organisational activities. There is a requirement to enhance the quality of non-financial information, as it is increasingly demanded by the Global Reporting Initiative to be included in sustainability reporting. This is done to meet the diverse needs of stakeholders for various decision-making purposes. Besides that, in order for organisations to achieve genuine enhancement in the quality of non-financial information through blockchain, it is crucial for them to possess a thorough comprehension and strong dedication to the successful implementation of blockchain technology. Nevertheless, due to the ongoing development and implementation of blockchain technology, not all organisations are adequately equipped to meet the specific requirements of blockchain, especially in the context of sustainability reporting. Therefore, this study aims to assess the organization’s comprehension and dedication towards the implementation of blockchain technology for sustainability reporting, by providing a theoretical framework as a guideline to other researchers. In addition, it can also serve as an indicator for managers or top executives regarding the requirements for maintenance and management. The involvement of top management, a thorough understanding of the blockchain, and adherence to standardised protocols are essential in order to truly enhance non-information qualities such as Completeness, Interpretability and clarity, Relevancy, Comparability, Authority, Accuracy, Timeliness, and Manipulation.

On the other hand, this study may present some limitations which are first, this study has focused only on the dimension of information qualities in evaluating the blockchain for sustainability reporting, despite previous studies like Almeshal and Alhogail (2021) revealed of some framework availability in evaluating the suitability of blockchain. Therefore, it would be interesting for future studies to explore blockchain utilization in sustainability reporting by extending the frameworks, so that more empirical evidence with broader dimensions would be brought to the table in promoting the blockchain technology utilization for sustainability reporting. Secondly, this study focused merely on the blockchain despite previous study like Sarajoti et al. (2022) demonstrated that blockchain is possible to be structured with smart contract by which more diverse automation tasks could be done. Therefore, it would be interesting for future studies to explore and incorporate the utilization of blockchain and smart contract in enhancing the transparency and accountability of non-financial information for sustainability reporting.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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