ASSESSING THE FACTORS HINDERING THE EARLY ADOPTION OF BLOCKCHAIN TECHNOLOGY, A CASE OF MINISTRY OF ENERGY – TANZANIA

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Abstract
In Tanzania, the adoption and use of blockchain technology in supply chains is still early and requires more time to fully realize this breakthrough. This study intends to analyse factors hindering the early adoption of blockchain technology, A case of Ministry of Energy – Tanzania. In this study, a descriptive research design was used. The study's target population was workers from the Ministry of Energy's Dodoma Offices from all departments. The study found that to the large extent organization barriers are the most leading factors that hinder the early adoption of blockchain. This was attributed by the resistance and lack of management commitment support, lack of expertise and technical knowledge priority, lack of policies, cultural differences and perceived effort in collaboration and communication in the early adoption of blockchain technology. The study unveiled that to the moderate extent technological barriers hinder the early adoption of blockchain technology. This was accredited by the complexity, security and vulnerability, network as a nature of technology, scalability and cost of implementation of the early adoption of blockchain technology. The study designated that to the moderate extent environmental factors hinder the early adoption of blockchain technology. The study revealed that the perceived constraint on encouragement program, government support, proper regulations and legal framework within blockchain hinder the early adoption of blockchain technology. The study recommends that, further research on the same issue should be undertaken on other government and private organizations for comparison results.

Keywords: Blockchain, Technology, Supply Chain

1.0 Introduction
In information technology and all industries, the Blockchain technology has garnered considerable interest, and is frequently referred to like one of the most promising developing information technologies (Hackett, 2017). Their development led to considerable public anxiety, with a provision for cryptocurrencies estimated at USD 255 billion in market capitalisation (Saberi et al., 2019). Companies and researchers are currently studying whether the new blockchain technology can address this gap.

In developed countries, firms which have adopted the blockchain technology, the blockchain operated at its very essential core like a decentralized leader. A record of transactions on a specific blockchain common to all participants means that each member retains an updated copy of each participant's blockchain (ledger). Cryptographic methods guarantee integrity between the copy, tie each blockchain transaction to any previous transactions and allow the recording of a transaction only if the parties of the transaction have a right to do so. All parties can review digital records of the transaction and not only the sending, receiving or approving party. Thus, information on the transaction submitter is irreversible and unequivocal (Peck, 2017). As a copy is maintained by each blockchain participant, it can only be recorded to be available to everybody, individual members or particular members. Every transaction information is preserved and cannot be disputed on every system, in all situations (Tapscott and Tapscott 2019). The blockchain's digital nature allows it to even be programmed to automatically implement smart contracts when specific requirements are met (e.g., the conclusion of a certain operation). Again, these smart contracts may be blocked, making the contracts irrefutable. Blockchain technology therefore enables trust-based collaboration, i.e. the elimination of the hazards and distrust of transaction parties not following the same standards (Casey & Wong, 2017).

This basic blockchain design contributes to its flexibility and resilience. Flexibility means that a blockchain constructed doesn't depend on whether or not participants are identified or changed over time so that the network is flexible and independent of one central authority. Resilience means the redundancy of the stored information (because there are many copies of a blockchain that has the same content store) (Peck, 2017). Although other element of a blockchain depends on a particular setup and protocol, the above features include confidence, shared access, low friction due to trusts, peer checks, underlying cryptography, immutability, decentralization, redundancy, versatility, and the share of all blockchain's automation potential (Seebacher and Schüritz, 2019).

While the organizations are acquainted to blockchain and the supply chain, the integration of these two differs, which is both academic and business fascinating. Many big corporations and organisations, while others plan future investments, have openly acknowledged their involvement in Blockchain. These phenomena make blockchain integration and the supply chain seem ideal. For all supply chain problems, Blockchain is often called panacea (Arha 2020). Businesses and researchers are using this new technology on the basis of their specific goals, but the difficulties and conditions for acceptance in the supply chain are still being examined systematically (Kwiat and Njilla 2019).

The adoption rate is slow and might be delayed by hidden reasons that inhibit company decisions, notwithstanding the effectiveness of the technology. As proposed by (Roriz and Pereira 2019) it is a difficult and long method of introducing new technologies to an industry. Some firms may want to take the first step as early adopters, while others may prefer to play it safe. Others may question their decisions either because they have limited resources or because they are not sufficiently persuasive about the purported advantages (Tapscott andTapscott 2020). The adoption of blockchain technology in Tanzania will allow the country and ministries to works without intermediary and all participants of this Blockchain make the decision, keep record of data which cannot be changed or delated and increase trust. Also, the blockchain technology is high secured system, traceability, transparent and unalterable as well as indestructible technology.

In Tanzania, the adoption and use of blockchain technology in supply chains is still early and requires more time to fully realize this breakthrough. Sander, et al. (2018) notified companies in 2017 that they are addressing the problem and reviewing measures for the use of blockchain technology. Although pilot projects are in place for some years (Shetri, 2018; White, 2018), the use of blockchain technology does not have clear consequences. The aforementioned are evident and ultimately economical technological and organizational consequences (Stahlbock, Heilig & Voss, 2018). Since the number of companies that use blockchain technology is currently very low (Seebacher & Schüritz 2019).

Further research on implementing hurdles (Saberi et al. 2019) and the identification of causal links between these obstacles is necessary despite the research currently conducted. (Francisco & Swanson, 2018). Consequently, empirical research is needed to provide the basis for the successful use of blockchain technology. The effective use of the Blockchain technology in international business is not obvious since it depends on the wishes of parties (Van der Elst & Lafarre, 2019).

The blockchain is particularly affected by obstacles from network contexts to adoption inside corporate networks, which require more research in the area (Seebacher & Schüritz 2019). The key concern with regard to business management is how it delivers long-term financial advantages. The adoption blockchain of innovation is nevertheless not just accompanied with advantages that do not ignore the challenges. In particular, research to identify factors hindering the early adoption of blockchain technology in Tanzania Ministry of Energy was thus took place in this area. A complete survey and understanding were carried out to enable the Ministry of Energy understand and steer block chains

technology adoption problems in an effective manner. The aim of the study was to give insights about the necessity for blockchain technology adoption in the Ministry of Energy.

2.0 Literature Review

2.1 Technology Organization Environment Framework Model

The theoretic framework of Technology Organization Environment (TOE) Framework serveed as the foundation for this study. The Organizational Technology Environment Tornatzky and Fleischer's (1990) theoretical framework model highlights three factors of an organization that impact technology adoption: the environmental context, the organizational context, and the technical context. The term "technology context" refers to both existing and possible new technologies important to the company. The organizational context specifies the features of the organization, such as its size and breadth. The environmental context includes the surrounds in which a firm operates, such as the industry, rivals, or legal framework. This section reviews relevant literature on the three aspects of TOE in order to synthesize factors hindering the early adoption of blockchain technology in the Tanzanian Ministry of Energy.

Technology context: Any relevant and available IT solutions are included in the technology context. This covers both innovative technologies that are available on the market but have yet to be deployed and technologies that are currently in use (Tornatzky et al., 1990). Tushman and Nadler (1986) defined technical advancements accessible to businesses as either gradual, synthetic, or discontinuous developments. While incremental innovations are new or improved aspects of a current product, synthetic alterations are a novel mix of existing technology. Discontinuous changes (also referred to as radical changes) imply a major alteration to current processes or technologies (Ettlie, Bridges, & O'keefe, 1984). Whereas incremental innovations have low risks, synthetic or discontinuous innovations have more operational and financial risks. Organizations must carefully assess the consequences and organizational changes associated with each technology breakthrough accessible to the company or industry (Tornatzky et al., 1990). Several empirical investigations have demonstrated that a lack of technological preparedness and security is a barrier to IT adoption ((Al-Saqaf and Seidler, 2017; Alketbi et al., 2018; Atlam et al., 2018; Boulos et al., 2018).

Organizational Context: Attempts to implement innovations need organizational competence, as well as financial investments. The necessary financial resources correspond to the costs of installation, implementation, further enhancement, and continuous expenses while in use (Iacovou et al., 1995). The deciding variables of technological readiness, according to Zhu et al. (2006), are a mix of the supplied technology infrastructure (the technology context) and IT people resources (the organization context). IT human resources include the knowledge and skills needed to create and implement future innovations (Lacovou et al., 1995). Tornatzky et al. (1990) provided a more comprehensive knowledge of enterprise organizational capacities and found the following deciding factors: interdepartmental collaboration and communication, organizational structure, company size, and available resources. However, lack of organization capability hinders organization ability to adopt and utilize technological innovations.

Environmental context: The environmental context consists of the structure of the industry, the regulatory environment, and the availability of technological service providers (Tornatzky et al., 1990). The TEO framework does not clearly identify external pressure, thus it is included to the external task environment. This represents the involvement of trade partners and rivals, as well as the overall competitive pressure in the adoption process (Iacovou et al., 1995). Mansfield (1968) emphasized the need of fierce rivalry in the processes of corporate innovation adoption. As more rivals in an industry begin to investigate an invention, others may feel compelled to do the same in order to retain a competitive position. Innovations driven by competitive motives, on the other hand, might be aided or hampered by industry or government restrictions. Such laws are seen to have both positive and

negative impacts on innovation. For example, new limitations or laws may compel businesses to invest in innovation; similarly, obligations to conform with, say, specific standards may stymie the development of unique goods or methods.

2.2 Empirical Literature Review

Choi and Chung (2020) discovered that a variety of reasons, including technological hurdles, restrictions based in organizations and the environment, and system-related governmental barriers, hamper the adoption of blockchain technology. Furthermore, numerous elements in the technological, organizational, and environmental dimensions are important predictors of blockchain resistance.

Kosmarski (2020) asserted that blockchain has progressed beyond cryptocurrencies, and has been hailed as a disruptive technology for a score of industries. The study contributes to the increasing range of studies in many areas like transport, banking and education on blockchain adoption and blockchain-driven innovation. However, it is not yet extensively examined how distributed ledger technology (DLT) affects the management of science.

Odongo (2017) has been researching the impact of the blockchain in the counties of Kisumu. The study found that blockchain technology is beneficial in tracking headlines and reports from many departments and is difficult to modify transactions so that information is kept open, safe and stored in a high manner. A research in the finance and operations divisions in Kajiado County Government on the implications of blockchain technology has shown that when erroneous data is entered, the administration requires logging into the system and making adjustments.

Rana et al. (2021) on the study titled “Analysis of Challenges for Blockchain Adoption within the Indian Public Sector” suggested that lowest level consists issues such as lack of standards and lack of validation form the basis of blockchain Hierarchical Structure. The highest level, however, consists of a highly reliant "police blockchain adoption" problem. The selected research filters five challenges for developing a parsimonious model and formulates six proposals to examine the impact of "lack of standard," "lack of validation" on "problems of security" and "privacy" in order to eventually determine the reluctance of individuals to apply the technology of the blockchain.

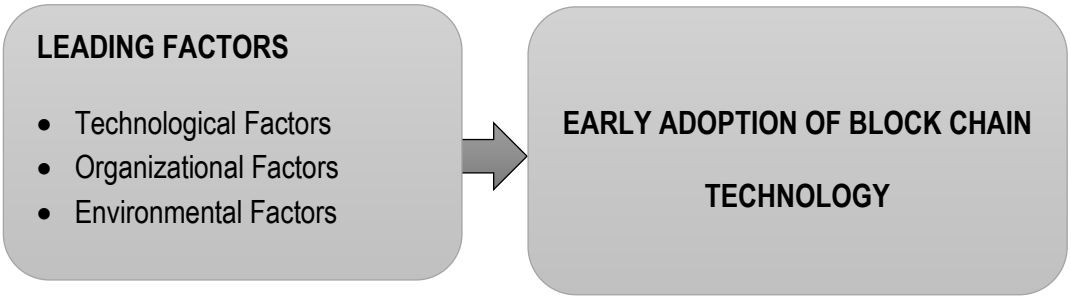
Taufiq (2018) assessed the influence factors of blockchain technology adoption of payments system in obtaining large-scale implementation in Indonesia. Blockchain researchers in payment systems have been working in key nations including the United Kingdom, the United States of America, Australia, Scotland, Germany, Japan, France, Italy and China all this time. The researchers found that indicated that immaturity, incompatibility, and shortcomings related to the size and speed of transactions are the main problems that prevent blockchain technology from obtaining large-scale implementation.

Wang et al. (2017) argued that blockchain is still in the early stage of development and faces a number of technical, sector related and human-related challenges. The technological obstacles include performance, latency, compatibility and scalability (that means that the optimum current is seven transactions per second). The study showed that organizations are usually used to keeping their business operations in their own manuals and, thus, theoretically their processes can hardly be changed by utilizing a distributed manual. In recent decades, many organizations have created and deployed the company resource planning (ERP) systems and are making substantial investment in order to move to blockchain-based systems. Moreover, human barriers like lack of expertise, technical knowledge and comprehension of this technology impede wider dissemination inside organizations.

In the fields of scalability, performance and interoperability, Lacity (2018) outlines the problems of blockchain technology. The author also emphasized the obstacles in managing blockchain applications including standards, regulations, shared governance and the creation of a sustainable and progressive ecosystem. A series of technology problems blockchain confronts have been highlighted by Mendling et al. (2018) includes transmission, latency, bandwidth and size, restricted usefulness, privacy and flow of communication. A variety of blockchain implementing problems, including storage capacity and scalability, security, coordination and collaboration, data privacy and policy issues also explored by Reyna et al. (2018).

The absence of standards and interoperability within the public sector has posed Al-Saqaf and Seidler (2017) as a major barrier that limits the broad use of blockchain technology. Alketbi et al. (2018) claim that technological problems such as safe data share and integration, pose hurdles into blockchain adoption. Atlam et al. (2018) emphasized organizational barriers to adopting blockchains, including skills, legal and compliance, as well as the absence of appropriate competences. Boulos et al, (2018) claimed that blockchain is confronted with comparable difficulties as other technologies which threaten to disrupt established processes, including investments costs, management issues, security and confidentiality, as well as the necessity for an adequate and sustainable business model to be explored.

Figure 1: Conceptual Framework



Source: Researcher (2021).

Methodology

In this study, a descriptive research design was used. Descriptive studies explain the characteristics of the subject population. The study was carried out in the Ministry of Energy - Dodoma Offices for the following reasons: first, the Ministry of Energy is one of Tanzania's ministries in charge of Energy and Petroleum Resource Management. With the study's aims in mind, researchers sought to analyse issues impeding the early adoption of blockchain technology in order to guarantee that the ministry can adopt blockchain technology in an effective manner.

In this investigation, a quantitative method was employed. The study's target population was 210 workers from the Ministry of Energy's Dodoma Offices from all departments. The simple random sample technique was appropriate for this study because of its benefits such as reduced bias in results, increased liability and validity of data from respondents who reflect the population. Cochran (1963) indicated that for large populations, the following formula was used to determine a sample size:

$$\mathrm{n} = \frac{\mathrm{N}}{1 + N.e^2}$$

$$\mathrm{n} = \frac{210}{1+210.0.05^2} = 137$$

Where n is the sample size, N represents the population size, and e represents the level of accuracy. The study will utilize a precision level of 5%, therefore the calculated sample size is 137 respondents from the Ministry of Energy – Dodoma Offices, who was chosen at random to provide relevant information for the study. A systematic questionnaire was used to obtain primary data. Closed-ended questions was used to ensure that the answers provided are relevant. The quantitative data gathered via questionnaire was analysed using descriptive statistics.

Findings

Respondents in this research were given 137 questionnaires, but only 120, representing 94%, were returned and analysed. A response rate of greater than 50%, according to Kumar (2019), is adequate

to provide relevant information. The objective was to identify leading factors that hinder the early adoption of blockchain technology. The responses of the participants are shown in Table 1 below:

Table 1: Leading Factors that Hinder the Early Adoption of Blockchain Technology

		Mean	Std. Deviation
Technological Barriers	Complexity (black box effect) (interoperability)	2.9750	1.42877
	Absence of standardization of programming languages - Java, C++	2.8667	.57880
	Security and vulnerability	3.1000	.80335
	Immaturity	3.2250	.76105
	Compatibility	2.5333	.88814
	Intensive energy consumption	3.4500	1.34007
	Negative perspective due to Bitcoin	4.0167	1.20212
	Network as a nature of technology	3.1667	1.41025
	Scalability	3.9750	1.19848
	Technology attributes: trial and reversibility	3.4333	1.10715
	Cost of implementation	3.4750	1.30005
	COMPOSITE MEAN	**3.2924**	
Organizational Barriers	Technological familiarity of the management team	3.7583	1.28988
	Resistance and lack of management commitment and support	3.9667	1.18061
	Lack of expertise and technical knowledge priority	3.6500	1.13204
	Need for close coordination and collaboration	3.6583	1.29314
	Lack of policies for blockchain	4.1583	.69809
	Other technology investments are taking priority	4.2417	.68594
	Cultural differences	3.9143	.40799
	Privacy and information disclosure concerns	3.2571	.73594
	Perceived effort in collaboration and communication	3.1857	.39168
	COMPOSITE MEAN	**3.7545**	
Environmental Barriers	Perceived constraint on encouragement program	2.9500	.95134
	Perceived constraint on government support	3.0083	1.21956
	Perceived constraint on proper regulations and legal framework within blockchain	3.2667	1.29468
	Perceived constraint on efficient technological infrastructure	2.9917	1.37502
	Perceived constraint on governance	3.5583	.96837
	Lack of successful examples	3.1917	1.14713
	COMPOSITE MEAN	**3.1611**	

Source: Field Data (2022).

On the Technological barriers: From the table 4.1 above, majority of the respondents indicated that, to the moderate extent complexity (black box effect) (interoperability) (Mean = 2.9750, SD = 1.42877) and absence of standardization of programming languages - Java, C++ (Mean = 2.8667, SD =.57880) hinder the early adoption of blockchain technology. Tanzania's Ministry of Energy must either adopt blockchain-based solutions that are compatible with their legacy systems, or adapt their current systems to be blockchain-compliant. Because supply chains are interconnected, it is necessary to reengineer the business process. It is possible that incorporating blockchain will necessitate changes to an existing system.

Findings designated that security and vulnerability (Mean = 3.1000, SD =.80335) and immaturity (Mean = 3.2250, SD =.76105) to the moderate extent they hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania. Study finding uncovered that, compatibility (Mean = 2.5333, SD

=.88814), intensive energy consumption (Mean = 3.4500, SD = 1.34007) and negative perspective due to Bitcoin (Mean = 4.0167, SD = 1.20212) as well as network as a nature of technology (Mean = 3.1667, SD = 1.41025) to the moderate extent they hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania. Because of Bitcoin, negative impressions of blockchain technology persist. The phrases blockchain and Bitcoin continue to be used interchangeably. It may take some time to spread the understanding that blockchain and Bitcoin are not the same thing. This technology was only recently made public, and its uniqueness remains an unsolved issue that creates barriers.

To the moderate extent, findings showed that the scalability (Mean = 3.9750, SD = 1.19848), technology attributes: trial and reversibility (Mean = 3.4333, SD = 1.10715) and cost of implementation (Mean = 3.4750, SD = 1.30005) hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania. The cost of integrating blockchain is unknown, which may jeopardize the management team's support and commitment. Implementation costs can vary according to a variety of essential aspects such as hardware, software, recruiting, and in-house training, and can include both opportunity and accounting expenses. Blockchain is thought to be a technology with significant initial investment costs, despite its cost-cutting benefits.

On the Organizational barriers: technological familiarity of the management team (Mean = 3.7583, SD = 1.28988), resistance and lack of management commitment and support (Mean = 3.9667, SD = 1.18061) and lack of expertise and technical knowledge priority (Mean = 3.6500, SD = 1.13204) hinder the early adoption of blockchain technology to the large extent. The delayed adoption of blockchain technology is due to a lack of competence and technical understanding, as well as senior management hesitation and resistance to change due to their fear of transparency or past substantial investments in old infrastructure. Also, to the large extent, respondents indicated that the need for close coordination and collaboration (Mean = 3.6583, SD = 1.29314), lack of policies for blockchain (Mean = 4.1583, SD =.69809), other technology investments are taking priority (Mean = 4.2417, SD =.68594) and cultural differences (Mean = 3.9143, SD =.40799) hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania.

To the moderate extent, respondent decreed that privacy and information disclosure concerns (Mean = 3.2571, SD =.73594) and perceived effort in collaboration and communication (Mean = 3.1857, SD =.39168) hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania. Catalysts such as political and economic as well as governmental assistance and encouragement are necessary to expedite the participation of external parties. Prioritizing enterprises and ministries with blockchain initiatives, as well as offering legal assistance, financial assistance, seminars, and training programs, among other things, could reduce opposition to early blockchain adoption.

Environmental Barriers: To the moderate extent, respondents indicated that perceived constraint on encouragement program (Mean = 2.9500, SD =.95134), perceived constraint on government support (Mean = 3.0083, SD = 1.21956) and perceived constraint on proper regulations and legal framework within blockchain (Mean = 3.2667, SD = 1.29468) hinder the early adoption of blockchain technology. Either, respondents designated that perceived constraint on efficient technological infrastructure (Mean = 2.9917, SD = 1.37502), perceived constraint on governance (Mean = 3.5583, SD =.96837) and lack of successful examples (Mean = 3.1917, SD = 1.14713) hinder the early adoption of blockchain technology to the moderate extent. Blockchain in the supply chain area requires positive perception, efficient technological infrastructure and good governance must be provided to put this technology into practice.
To the large extent, the findings indicated that the organization barriers (Composite Mean = 3.7545) hinder the early adoption of blockchain technology while to the moderate extent the technological

barriers (Composite Mean = 3.2924) and environmental barriers (Composite Mean = 3.1611) hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania.

On ranking barriers, this study found that to the large extent organization barriers (Composite Mean = 3.7545) are the leading factors that hinder the early adoption of blockchain technology in the Ministry of Energy – Tanzania followed by the technological barriers (Composite Mean = 3.2924) and lastly the environmental factors which scored the composite mean of 3.1611.

Discussion of Findings

Blockchain is a crucial new technology that has the potential to alter many facets of industry and society. However, it faces numerous severe technological, organizational, and environmental difficulties that will make its adoption difficult inside the Tanzanian Ministry of Energy. On the Technological barriers, findings indicated that, complexity and absence of standardization of programming languages hinder the early adoption of blockchain. On the same line, Rana et al. (2021) found that lack of standard, lack of validation on problems of security and "privacy in order to eventually determine the reluctance of individuals to apply the technology of the blockchain. Also, the absence of standards and interoperability within the public sector has posed Al-Saqaf and Seidler (2017) as a major barrier that limits the broad use of blockchain technology. The lack of acknowledged uniformity by regulators is a hurdle to adoption ambitions, whilst the lack of a standardized computer language is a disincentive to IT departments when they learn that platforms cannot communicate without help. In practice, blockchains are difficult to comprehend from the standpoint of adopters. Algorithms may make mistakes that people do not see until it is too late to correct. Potential adopters' hesitancy due to worries about blockchain's complexity may raise opposition, outweighing implementation intentions.

Findings of this study affirmed that the security and vulnerability to the moderate extent they hinder the early adoption of blockchain technology. This is in line with TOE framework which postulated that a lack of technological preparedness and security is a barrier to IT adoption. Similarly, Kosmarski (2020) indicated that problems and obstacles to blockchain adoption are outlined in academia: usability and security difficulties, legal concerns, moral conflicts, and criticism of blockchain governance's political elements. On the contrary, Odongo (2017) found that blockchain technology is beneficial in tracking headlines and reports from many departments and is difficult to modify transactions so that information is kept open, safe and stored in a high manner. Security and privacy are critical components of nascent blockchain technology since it exists without a third party, implying that there is no trustworthy individual or organization in control of this system. As a result, in order for this technology to be adopted successfully, public sector organizations must offer improved privacy and security mechanisms.

Findings affirmed that system immaturity to the moderate extent they hinder the early adoption of blockchain technology. Of course, blockchain adoption in supply chains is still young and innovative, including numerous complex algorithms; hence, it is difficult to grasp it adequately to recognize its potential for applications. Study finding uncovered that, compatibility, intensive energy consumption and negative perspective due to Bitcoin as well as network as a nature of technology to the moderate extent they hinder the early adoption of blockchain technology in the Ministry of Energy - Tanzania. Similarly, Taufiq (2018) indicated that immaturity, incompatibility, and shortcomings related to the size and speed of transactions are the main problems that prevent blockchain technology from obtaining large-scale implementation.

Scalability represents the capability of an information system to maintain its equilibrium condition with increased storage volume. To the moderate extent, findings showed that the scalability, technology attributes, trial and reversibility and cost of implementation hinder the early adoption of blockchain

technology in the Ministry of Energy - Tanzania. This is in line with Wang et al. (2017) who found that technological obstacles like performance, latency, compatibility and scalability impede adoption of blockchain technology in organizations.

In this study, findings designated that technological familiarity of the management team, lack of management commitment and support hinder the early adoption of blockchain technology to the large extent. These barriers make sense, since the management team's lack of technological expertise, resistance, and lack of management commitment and support for blockchain technology can make adoption difficult and result in their unwillingness to employ such technology. The Tanzanian Ministry of Energy should guarantee that the management team is technologically savvy, as well as that management is committed to and supportive of this growing technology. The TOE framework indicated that the lack of organization capability hinders organization ability to adopt and utilize technological innovations. Also, Kumar (2019) affirmed that blockchain also faces significant organizational obstacles before wide-ranging integration can occur.

Findings indicated that the lack of expertise and technical knowledge priority hinder the early adoption of blockchain technology to the large extent. These findings correlate with Wang et al. (2017) that human barriers like lack of expertise, technical knowledge and comprehension of this technology impede adoption of blockchain technology inside organizations. This is because recent technological advancements and complexity have exacerbated the gap between the demand and supply of competent human resources and experience. To fully realize the potential of this technology, one must be well-versed in both IT and daily procedures. As a result, it is costly to either hire or educate human resources to use blockchain. Without enough trained people, the Ministry of Energy - Tanzania may not get the full benefits of blockchain and may be unwilling to use it.

Also, to the large extent, respondents indicated that the need for close coordination and collaboration and lack of policies for blockchain hinder the early adoption of blockchain technology. This is in line with Reyna et al. (2018) that storage capacity and scalability, security, coordination and collaboration, data privacy and policy issues are blockchain implementing problems. Management must develop mitigation strategies and policies to increase close coordination and collaboration in order to ensure the successful adoption of blockchain technology and transparent, secure, and fast systems capable of solving increasingly complex problems within the Tanzanian Ministry of Energy.

Findings of this revealed that other technology investments are taking priority and cultural differences hinder the early adoption of blockchain technology. These findings agree with Boulos et al, (2018) who claimed that blockchain is confronted with comparable difficulties as other technologies which threaten to disrupt established processes, including investments costs, management issues, security and confidentiality, as well as the necessity for an adequate and sustainable business model to be explored. This is because change may be a difficult process, resulting in opposition from some department members. Not everyone agrees on the importance of change. Adoption of a new technology may alter the existing organizational culture, necessitating the development of new jobs, obligations, knowledge, or aptitudes to manage and help diverse characteristics.

To the moderate extent, respondent decreed that privacy and information disclosure concerns and perceived effort in collaboration and communication hinder the early adoption of blockchain technology. This was also postulated by Mendling et al. (2018) that transmission, latency, bandwidth and size, restricted usefulness, privacy and flow of communication are problems that hinder the adoption of blockchain. Tanzania's Ministry of Energy must move at a steady and controlled pace toward blockchain technology if it is to serve its residents better and safer, with transactions that are decentralized, publicly viewable, and resilient enough to withstand hacking.

Environmental Barriers: To the moderate extent, respondents indicated that perceived constraint on encouragement program, perceived constraint on government support and perceived constraint on proper regulations and legal framework within blockchain hinder the early adoption of blockchain technology. Correspondingly, Lacity (2018) emphasized the obstacles in managing blockchain applications including standards, regulations, shared governance and the creation of a sustainable and progressive ecosystem. The Ministry of Energy - Tanzania understands the legal issues that arise from the use of common blockchain applications such as cryptocurrencies, smart contracts, and data storage, and should be able to explain how such applications can cause industry disruptions as well as the roadmap to successful early blockchain adoption. Either, respondents designated that perceived constraint on efficient technological infrastructure, perceived constraint on governance and lack of successful examples hinder the early adoption of blockchain technology to the moderate extent. Efficient infrastructure and excellent governance are required and should take precedence in new technology changes. The present technological infrastructure is inefficient. In this case, uninterrupted, high-speed Internet and energy are important aspects that promote usability for the Ministry of Energy - Tanzania's early deployment of blockchain technology.

The study sought to examine the relationship between identified factors and the early adoption of blockchain technology. Results of the Pearson correlation indicated that there was a significant negative correlation technological, organizational, environmental barriers and early adoption of blockchain technology. This implied that technological barriers, organizational barriers and environmental barriers significant hamper the early adoption of blockchain technology in the Ministry of Energy – Tanzania. These results are match with results of Choi and Chung (2020) that technological hurdles, restrictions based in organizations and the environment, and system-related governmental barriers, hamper the adoption of blockchain technology. Alketbi et al. (2018) claim that technological problems such as safe data share and integration, pose hurdles into blockchain adoption. Likewise, Atlam et al. (2018) emphasized several barriers to adopting blockchains, including skills, legal and compliance, as well as the absence of appropriate competences.

Conclusion and Recommendations

This study has attempted to analyse factors hindering the early adoption of blockchain technology, A case of Ministry of Energy - Tanzania. The study concludes that to the large extent organization barriers are the most leading factors that hinder the early adoption of blockchain technology in the Ministry of Energy – Tanzania. This was attributed by the resistance and lack of management commitment support, lack of expertise and technical knowledge priority, lack of policies, cultural differences and perceived effort in collaboration and communication in the early adoption of blockchain technology.

The study concludes that to the moderate extent technological barriers hinder the early adoption of blockchain technology in the Ministry of Energy – Tanzania. This was highly attributed by the complexity, security and vulnerability, network as a nature of technology, scalability and cost of implementation of the early adoption of blockchain technology.

The study concludes that to the moderate extent environmental factors hinder the early adoption of blockchain technology in the Ministry of Energy – Tanzania. The study inferred that the perceived constraint on encouragement program, government support, proper regulations and legal framework within blockchain hinder the early adoption of blockchain technology. It is further concluded perceived constraint on efficient technological infrastructure, perceived constraint on governance and lack of successful examples hinder the early adoption of blockchain technology to the moderate extent.

Nonetheless, senior management at Tanzania's Ministry of Energy can act as catalysts for these difficulties. Increasing staff understanding at all levels through seminars and training may substantially aid in blockchain's early adoption. Furthermore, senior management is strongly pushed to learn more about blockchain technology. Tanzania's Ministry of Energy may promote knowledge through collaborating with educational institutions and proposing future needs. It is also suggested that management rearrange their ministry's data structure to guarantee that information sharing does not jeopardize the organization's competitive advantages.

Based on the findings and conclusion, the study had the following recommendations;

i. From the findings of the study, under the technological barriers, before making an appropriate adoption decision, the Ministry of Energy - Tanzania needs consider blockchain technology as a new technology that has the potential to boost their competitive edge. Furthermore, in order to increase blockchain technology adoption, the ministry must verify that blockchain technology services are compatible with the ministry's systems. Furthermore, blockchain technology services must be consistent with regulatory regulations. Furthermore, the technical and procedural requirements of the innovation must be compatible with and consistent with the values and technological standards of the adopting company. This is obvious from the examined literature and the conclusions of this study, which show that security, network, and implementation cost are significant technological considerations.

ii. As a result, the Ministry of Energy - Tanzania must ensure that the new innovation is consistent with their existing values and needs. The study found that management commitment and support are critical to the effective integration of blockchain technology in the Tanzanian Ministry of Energy. Close coordination and collaboration are so critical since they ensure that adequate resources are given for the early implementation of blockchain technology. Furthermore, the Ministry of Energy - Tanzania will need to engage highly qualified or educated individuals for blockchain technology. There is also a need to design rules and dedicate adequate technological resources in order to utilize blockchain technology.

iii. Environmental barriers play a role in blockchain technology's early adoption. Tanzanian Ministry of Energy is recommended to practice good governance and provide appropriate policies and legal frameworks for blockchain technology. Employees should take the lead in implementing blockchain technology by understanding and applying blockchain technology. The ministry must create circumstances that encourage the use of blockchain technology via education.

This study should be expanded to include all ministries in Tanzania, since the researcher believes that adoption issues with blockchain technology may differ amongst ministries. The sample and context were seen as limitations from a methodological standpoint. This survey only included responders from Tanzania's Ministry of Energy. This leaves a gap that must be addressed based on the research field. As a consequence, further research on the same issue should be undertaken on other government and private organizations for comparison results. Furthermore, because the study was quantitative in nature, other researchers can conduct a comparable study utilizing qualitative analytic approaches.

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