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BARRIERS TO THE ADOPTION OF BLOCKCHAIN FOR LAND ADMINISTRATION IN A DEVELOPING ECONOMY

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ABSTRACT

Technological advancements often disrupt the status quo and transform processes, potentially improving speed and transparency in processes. Blockchain technology (BCT) is one such emerging technology which is gaining industry and academic attention (Mintah et al., 2020). Use cases span multiple sectors ranging from finance, law, music, to land. Departing from the extant literature that investigates the various use cases of BCT, we examine the barriers that impede the adoption of BCT in Ghana. Adopting a qualitative approach, we conduct semi-structured interviews with 15 stakeholders in the public and private sectors of land administration in Ghana to flesh out the adoption barriers to BCT. Our results suggest that there are six categories of factors that impede the adoption of BCT in Ghana, like other developing countries: Political, Organisational, Economic, Legal and Regulatory, Socio-cultural, and Technical. We conclude by providing recommendations.

Keywords: Blockchain technology, land administration, barriers, PropTech, Developing Countries, Ghana

1.0 Introduction

Leaps in technological innovation have significantly contributed to the progress of society. Technology has influenced the way people transact business, communicate and process information (Goodwin and Stelelman, 2013). As observed by Tapscott and Tapscott (2016), markets are often, including currently, witnessing a new wave of technological change which disrupt the status quo and transform processes, often improving speed and transparency in market processes. Contrarily, extant literature captures instances where technologies that were expected to cause major disruption never actually did, leaving unmet expectations in its wake. As such, forecasting the impact of emerging technologies is laden with uncertainty (Dixon and Marston, 2002). Blockchain technology is one such emerging technology which is gaining industry and academic attention (Mintah et al., 2020).

Opinions on the impact of emerging technology in the real estate sector are particularly varied. Some studies suggest that the emergence of real estate technology will end, or at least lower, the need for many real estate practitioners (Baen and Guttery, 1997). Other researchers held a contrasting view about the extent to which new technologies impact real estate industry structures, space demand, usage, work practices and other key benchmarks. In the UK for example, the impact of ICT-enabled new working practices such as hot-desking and teleworking on office space demand was found to be subdued, gradual and overstated (Lizieri, 2003). Geroski (2000) observed that the common feature with most discussions on technology diffusion is the slow pace at which firms embrace new technologies. More recently, Baum (2017) described the real estate industry as the slowest to adapt to the change that technological innovation brings.

Currently, emerging digital technologies have been forecasted to cause disruptive impact in the industry (RICS, 2017). However, as highlighted above, the real estate sector is deemed to be traditional and resistant to change. A key question remains unanswered: what impedes the adoption of new technologies in the real estate sector? This paper seeks to address this gap. More specifically, the study is focused on discovering key barriers that

hinder the adoption of these new technologies, particularly in developing countries. While there is some investigation on the nexus between new technology and the real estate sector, these studies have been mainly conducted in developed countries (including Baen and Guttery, 1997; Hohenstatt et al., 2011; Baum, 2017).
With the explosion of interest in emerging digital technologies in recent years, the study aims to unearth insights from Ghana on potential barriers that could hinder the adoption of these technologies. Industry reports as well as academic literature indicate that countries such as Estonia, Georgia, UAE (Dubai), Sweden, USA, UK and Ghana have already begun pioneering blockchain technology applications in the government and private sectors (PwC, 2018; Mintah et al., 2020). In this limited strand of literature, sufficient attention has not been paid to the perspectives of land sector professionals on potential barriers to adoption. This research thus focuses on the perspective of land sector professionals, who constitute vital players in the real estate industry.
The rest of the paper is organised as follows: section 2 reviews the relevant literature, section 3 details the methodology adopted, section 4 discusses the findings of the study and section 5 concludes and provides recommendations.

2.0 Literature Review

We review the literature relating to the adoption of emerging technology in the real estate sector.

2.1 Historical Overview of Technology in Real Estate

The application of technology in the real estate industry dates to the early- to mid-nineteenth century. Baum (2017) investigates the paradigms of technological innovation in the industry, drawing on existing research including Baen and Guttery (1997), Benjamin et al. (2002), Kummerow and Chan (2005), Corluka and Lindh (2017), among others. They identify different waves of technological change in the history of the property industry under a phenomenon labelled 'PropTech'; namely PropTech 1.0 and PropTech 2.0.

2.1.1 PropTech 1.0

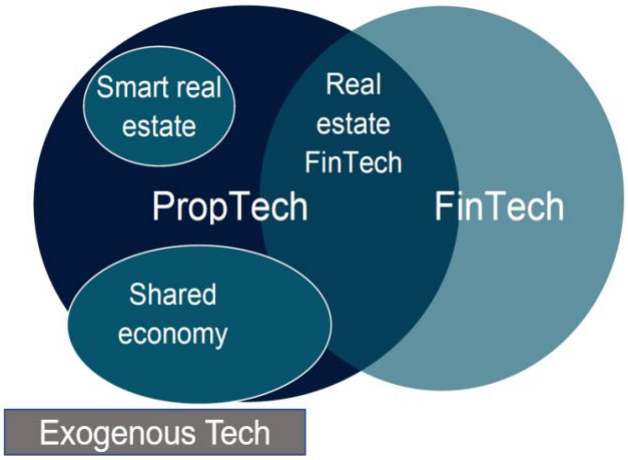
Baum (2017) classifies technological emergence in the industry in the period between 1980-2000 as the early stage of PropTech 1.0. Multiple studies refer to the early influence of technology on the industry driven by the emergence of computing technology. Although the introduction of computing was evident from the 1930s, this made little impact on the property industry until the mid-1980s occasioned by the advent of personal computers (Baum, 2017). This period was characterized by the use of research-led technological innovations such as spreadsheet packages for real estate data analysis and organization, quantitative modelling, valuation software, and portfolio and property management systems (ibid).
This was followed by effects of the introduction of the internet and email in the 1990s. At this point, researchers began examining the effects of evolving technology on the property industry. Seminal works include those of Baen and Guttery (1997) who examined the potential impact of the internet and information technology on the residential real estate industry.
The late stage of PropTech 1.0 was evident from 2000 through the impact of the internet on real estate agency, particularly in the residential sub-market. The founding of Rightmove (in 2000), Zoopla (2007), Trulia (2005) and Zillow (2006) signified the growing acceptance of online markets in the industry. Information and communication technologies revolutionized property transactions by providing clients and professionals with up-to-date market information throughout the transaction process (Crowston *et al.*, 2001; Tse and Web, 2002). Research efforts were directed towards assessing the impact of IT on the property industry in terms of incomes (Benjamin *et al*., 2002; Muhanna & Wolf, 2002), market size and efficiency (Kummerow & Chan, 2005), commercial real estate (Dixon, 2005) and market innovation (Li and Wang, 2006). Other studies examined specific applications of technology such as IT-enabled new working practices (Lizieri, 2003) and internet marketing.
In general, these studies find a positive influence of information technology usage on incomes and services provided.

2.1.2 PropTech 2.0

According to Baum (2017), the industry is currently witnessing a new wave of disruptive technological innovation described as 'PropTech 2.0'. The early stage of the new wave has been driven by limitations of a large and illiquid real estate stock, breakthroughs in technology such as cloud computing, leaner coding, sensors, mobile devices and connectivity via broadband, Wi-Fi and 4G (now 5G) telephony (Baum, 2017). These breakthroughs resulted in diverting significant commercial activity and market share from brick and mortar to e-commerce (Acharya *et al*, 2010).

Recent academic and industry research suggest a more disruptive wave of new technology, in what has been referred to as *The Fourth Industrial Revolution* (RICS, 2017). Baum (2017) suggests a broad taxonomy illustrated in Figure 1 below. Emerging technology is classified into two broad groups, based on their influence on the real estate sector: endogenous (Proptech) and exogenous technology.

Figure 1: Tech Classifications



Source: Baum (2017)

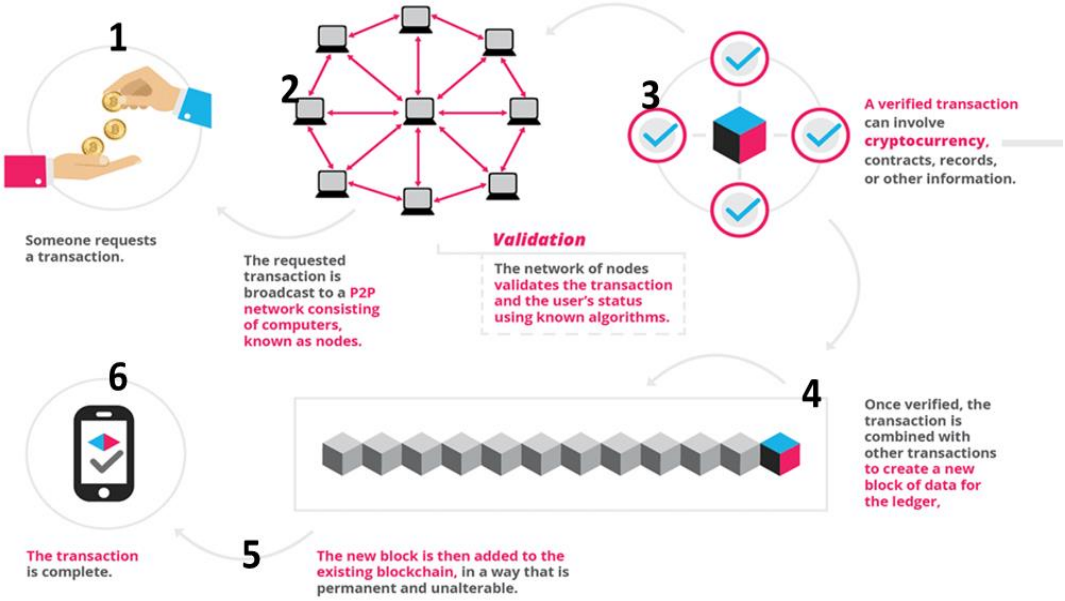
Endogenous technologies refer to technologies created by and for the property market such as Smart real estate, Shared economy and Real estate FinTech. Smart real estate technologies facilitate the operation and management of property. Smart real estate effectively means buildings that merge space with technology (Baum, 2017). Notable players employing such technology include *Nest* and *Digital Realty*. Shared economy technologies support the concept of 'collaborative consumption' of property using peer-to-peer services and technology (Baum, 2017). Industry examples include *WeWork*, *Stayz* and *Airbnb*. Real estate FinTech includes technology solutions which facilitate transactions of real property. Examples include *Zoopla*, *Trulia* and *OpenDoor*.

Exogenous technologies refer to those not created specifically for the property market, but which have potential applications for the market. RICS (2017) identified five key exogenous technologies to have significant impact on surveying, namely, The Internet of Things (IoT), 5G communications, Machine learning, Building data and Distributed ledger technology.

2.2 Distributed ledger technology (Blockchain)

Since its introduction in 2008, blockchain technology has enjoyed increasing attention from industry and academia (Yli-Huumo et al., 2016; Mintah et al., 2020). Introduced by the famous Satoshi Nakamoto white paper (Nakamoto, 2008), Blockchain technology (BCT) refers to a range of general-purpose technologies that exchange information and transact digital assets in distributed networks (Ølnes et al., 2017). Blockchain also goes by the name Distributed Ledger Technology, which describes the basic concept behind the technology in the sense that each participant has access to a shared ledger (ibid).

Figure 2: How Blockchain works



Source: Adapted from Tapscott & Tapscott (2016)

As noted in Mintah et al., (2020), BCT in its simplest form serves as a digital ledger containing transactions of a specific product such as money, cryptocurrency, property, etc. (Rijmenam and Ryan, 2019) in a process demonstrated by Figure 2 below. As shown, at the initiation of a transaction, the request is broadcasted to all nodes (a peer-to-peer network of computers) for validation. Once validated, a verified transaction, representing a new layer of information known as a block, is attached to a chain of existing blocks (hence the term blockchain) in the ledger. A notification of completion is sent to the transacting parties and the process is deemed complete.

The key features of BCT which make it attractive include decentralization, security, persistency, anonymity, auditability, data integrity and the real-time updates of transactions (Mintah et al. 2020).

2.2.1 Applications of Blockchain technology

According to Ølnes et al. (2017), BCT uses have expanded to include several applications such as governance, auditing, public registry amongst several other uses. Table 1 below summarizes key studies into the application of blockchain in several use cases.

Table 1: Summary of Blockchain Applications

Source	Application	Example/Description
Nakamoto (2008)	Crypto currencies	Networks and mediums of exchange using cryptography to secure transactions
Nofer et al (2017)	Securities issuance	Companies going public issue shares directly and without a bank syndicate. Private, less liquid shares can be traded in a blockchain-based secondary market.
Nofer et al (2017)	Insurance	Properties (e.g., real estate, automobiles, etc.) are registered using blockchain technology. Insurers can check the transaction history
Tapscott & Tapscott (2016); Nofer *et al* (2017)	Intellectual property e.g: Music	Determining music royalties and managing music rights ownership
Baum (2017); Ølnes *et al* (2017); Vos et al.(2017); Lemieux (2016); Bennett et al. (2019); Kshteri and	Land governance, Registries and Public Sector Information	Storing and validating lease agreements, land rights, public records

Voas (2018), Mintah et al. (2020)		
Corluka & Lindh (2017); Baum (2017)	Real estate transactions	ABN Amro and IBM have established a blockchain pilot for commercial real estate clients and services
Nofer et al (2017)	Decentralized internet of things	The blockchain reliably stores the communication of smart devices within the internet of things
Nofer et al (2017)	Anti-counterfeit solutions	Authenticity of products in electronic commerce is verified by the blockchain network

Authors, 2021

Rows 5 and 6 highlight some academic studies that have focused on the application of BCT in land administration or real estate, in general. In practice, some countries or states have proposed or adopted the use of blockchain technology. Examples include Georgia (Higgins, 2016), Kenya (Bennett, 2019), India (Bhattacharya), New South Wales in Australia (Bleby, 2018) and Kumasi, Ghana (Kshteri and Voas, 2018; Vos et al., 2017). These uses include registering land titles, facilitating land transactions, providing smart contracts and recording other land-related data.

2.3 Barriers to adoption of technology in the real estate sector

Majority of the existing literature reviewed so far highlights the drivers to technology adoption in the property industry. Only a few studies point out the barriers to emerging technology adoption. Of these, majority focus on the barriers in developed countries (Smullyan, 1994; Baen and Guttery, 1997; PwC, 2018). Some studies have also explored barriers to technology adoption in the African context (Karikari et al., 2005; Banadda, 2010; Ashaye, 2014). For instance, Ølnes et al. (2017) and PwC (2018) highlight barriers that border on the adoption of distributed ledger technology. These had to do with institutional, cultural and regulatory hindrances to Blockchain adoption. Although these works identify barriers impeding technology adoption in the land market, they were based on technologies that emerged in earlier paradigms and are silent on distributed ledger technology in Ghana's land market.

The literature reviewed above emphasizes that while there is previous research on BCT in Ghana and other developing markets, this is the first that takes the qualitative approach and assesses practitioners' perspectives on the barriers that impede the adoption of blockchain technology. The findings revealed here will be relevant for Ghana as well as in other developing countries with similar conditions where the technology is yet to be applied. We further provide recommendations for capitalizing on the potential of blockchain adoption in the land market.

3.0 Methodology

This paper adopts the interpretive philosophy, which is the basis of qualitative research. Interpretive research tends to produce "rich, subjective, qualitative data" with inductive processes (Collis and Hussey, 2003). Qualitative research is more suited to meet the objectives of the study as it focuses on participants' perspectives, meanings, and in-depth views about the research problem through a dynamic process rather than a tightly, pre-defined quantitative one (Hatch, 2002). According to Creswell (2013), qualitative studies are conducted when the researcher seeks a complex yet detailed understanding of the phenomenon or when the characteristics to be identified are not easily quantifiable. To gain a deeper understanding of the issue of concern here, the required level of detail could only be established by going to participants at their place of convenience and allowing them to tell their perspectives in an unencumbered manner (Creswell, 2013).

Primary data was thus collected through semi-structured interviews with 15 practitioners. The interviewee selection was conducted through purposive sampling. The target interviewees were sampled based on their role and expertise which have exposed them to the adoption of technology in the real estate sector in Ghana and uniquely positioned them to provide insight into the barriers to the adoption of the BCT. Three sub-groups of experts were targeted: state lands officers, academic researchers, and private BCT consultants. The state

lands officers comprised senior staff from the Lands Commission, the state agency responsible for registering land and land related transactions in Ghana. The academic researchers comprised two academics who have studied the adoption of blockchain technology in Ghana. The last group comprised private sector practitioners who are frontrunning the application of blockchain in Ghana's real estate market. Table 2 below provides details of the interviewees.

Table 2: Interviewee Details

Institution	Role	Years of Experience
Lands Commission	Snr. Officer, Client Services	14
Lands Commission	Snr. Reg. Officer, PVLMD	Undisclosed
Lands Commission	Land Administration Officer	7
Lands Commission	Sub Dept. Head, Cartography (SMD)	33
Lands Commission	Photogrammetry Staff (SMD)	5
Lands Commission	Processing Staff (LRD)	11
GHL Bank	Dep. Officer, Collateral Mgt. Unit	5
BenBen	C.E.O. & Govt. Tech Specialist	3.5
KNUST	Lecturer, Property	12
RMIT University	Lecturer, Property	13
Republic Bank	Client Officer, Collateral Department	12
Republic Bank	Dept. Head, Collateral Department	22
Assenta Property Consulting	Senior Valuer	7
Housing Afrique	Founder and Real Estate Consultant	8
Private Consultant	Land Acquisition Specialist	10

In Table 2 above, the interviewees are described in terms of their role and wealth of experience. It is evident from the table that the interviewees sampled were very diverse and highly experienced, with an average of approximately 12 years' relevant experience. The interviews were then conducted face-to-face in Accra between August to September 2018, subject to ethical considerations

The next section presents the results and discussion from the interviews. Then the paper closes with a conclusion that draws out the main findings and provides recommendations.

4.0 Results and Discussion

The main aim of this study is to discover the barriers to the adoption of BCT in Ghana, from the perspectives of the practitioners who play key roles in the land administration and real estate technology sectors. After the introductory set of questions which elicited information on years of experience and depth of awareness of BCT, the key set of interview questions basically asked: "what are the barriers that impede the adoption of Blockchain Technology in Land Administration in Ghana?". The analysis of the interviews yielded a host of factors. These are broadly categorised into six main themes emerged from the analysis. They are Political, Organizational, Economic, Legal and Regulatory, Socio-cultural, and Technical. Figure 3 is a diagrammatic representation of the barriers. The figure shows the six main sets of barriers that impede the adoption of BCT in Ghana, detailing some of the individual factors under each group. A detailed analysis of these determinants is provided in the sections below.

4.1 Political Barriers

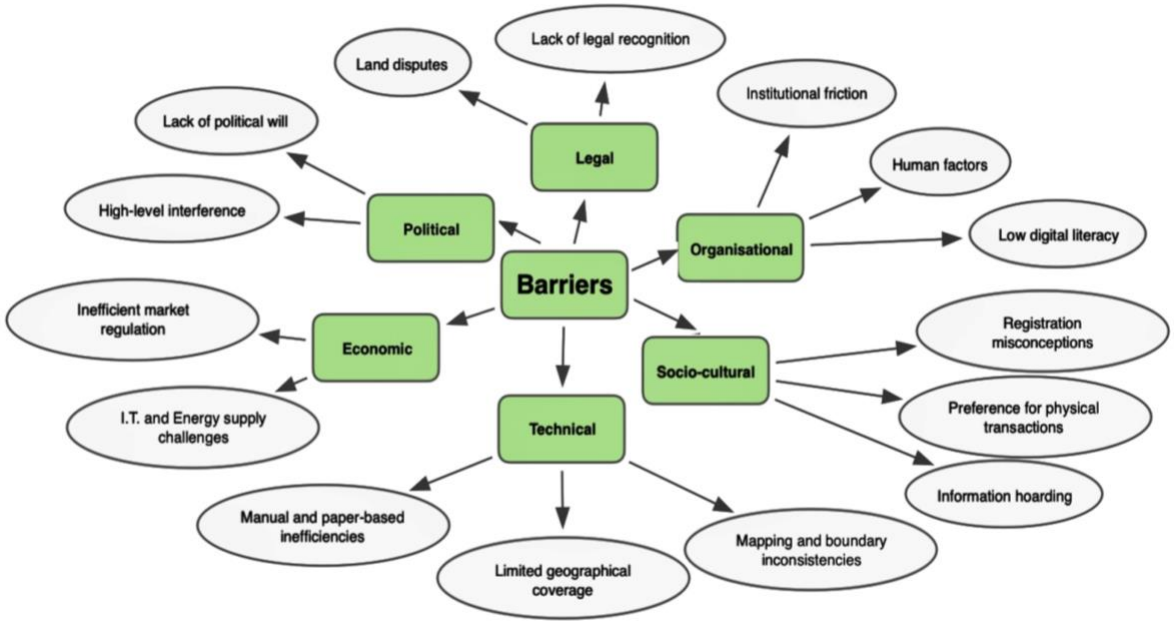
4.1.1 Lack of political will

A critical analysis of the interviews revealed that directives implemented by the Lands Commission are not exempt from the influence of the executive arm of government, which is formed, and often dominated, by the political party in power. Essentially, the adoption or non-adoption of emerging technologies, such as Blockchain, for land administration in Ghana could be heavily impacted by the agenda of the government of

the day, summed up in the concept of 'political will'. Where the political party that heads the government does not consider digitisation to be one of its priorities, the Lands Commission and other key sector agencies accordingly take a similar position. The following quote highlights this barrier.

> *"The will of the government of the day is crucial to adoption. Currently, the government in power has indicated its commitment and backing of digitisation. The Vice President has been strong on this a number of times. Assuming a different government comes into power tomorrow and has a different agenda, that might be problematic. In the past 8 years of the previous government, apart from the periodic contribution from LAP donor partners, there has not been any significant commitment to resolve the problem" (Officer, Lands Commission)*

Figure 3: Diagrammatic Representation of Barriers to Blockchain Adoption



4.1.2 High-level interference

Linked the impediment of lack of political will, another barrier that was common to most interviewees was the threat of interference in the strategic focus and business of the Commission. As contained in article 70 of the Constitution of Ghana, the Chief Administrator of the Lands Commission and other key executive members are appointed by the President and Minister of Lands respectively. This makes them accountable to directives from higher offices. Where newly formed governments are unwilling to pursue initiatives started by previous governments, this creates the likelihood of discontinuation. This quote, one of many, captures this barrier.

> *"The topmost official of the Commission is by political appointment and this can affect the agenda of digitization. The duopoly of parties in Ghana could affect sustainable adoption of Blockchain technology. Appointments are made or changed mainly due to the political objectives of alternating parties in government" (Surveyor, Lands Commission)*

In effect, for Blockchain technology to be adopted over the long term, the political barriers must be surmounted. Cooperation on the adoption and use of disruptive technologies such as Blockchain in Ghana's public land administration system typically lasts for as long as any political regime may accommodate. Similar studies by Khasawneh-Jalghoum and Wood-Harper (2011) recognise the existence of political barriers to the adoption of new technology.

4.2 Economic Barriers

4.2.1 Inefficient market regulation

Land administration in Ghana has been fraught with a myriad of challenges despite several interventions by authorities (Mintah et al. 2021). Quaye (2014) and Gyamera (2018) identified challenges such as multiple land sales, use of unverifiable documentation amongst others as critical issues persisting in the land sector. Many of the interviewees attributed the persistence of such problems to poor market regulation which further stifles attempts to introduce sustainable digital solutions. As captured by the quote below, the challenges that beset the land administration system will simply be transferred onto new technology, without being solved.

> *"The technology is not plug-and-play. We have off chain issues (referring to issues that take place outside the technology) in Ghana, the main one is accuracy of data in the Lands administration sector. Ghana does not have authoritative property market data. The market is somewhat a jungle, and we are operating with silos of information. There is no central knowledge, no form of monitoring and people are just being ripped off their properties" (Blockchain Consultant).*

4.2.2 Information Technology and Energy Supply challenges

A dominant concern raised by all respondents to the study was one of inadequate infrastructure to support the use of the technology. Erratic power supply coupled with limited cyber infrastructure and usage across the country featured significantly in the interview data. Respondents posited that unreliable power supply significantly disrupted economic activity hence the fortunes of Blockchain technology adoption remain similarly bleak. The quite below quote highlights this barrier.

> *"In my opinion, Ghana is far from ready for Blockchain. From a logistical point of view Ghana lacks reliable internet and power supply, even in prominent areas of the capital. The fact that most of these digital innovations rely heavily on good internet connectivity points to another barrier because we lack that. Internet service provision in the country is unstable and poor in most areas" (Land acquisition specialist, Private sector)*

4.3 Legal Barriers

4.3.1 Lack of legal recognition

Mireku et al. (2016) notes that a prominent feature of Ghana's land sector is the manual or paper-based approach to land transaction processes. As a result, these practices have been preserved in law much to the detriment of digital interventions. Such lack of recognition further enshrines manual processes along with their associated challenges. One respondent indicated:

> *"In terms of legislation, I am not of the view that the legislative body has awareness and understanding of Blockchain technology. I also do not think the laws in the country are proactive to govern the technology. A more decentralized system of administration is possible with the technology, but I do not think our relatively centralized system at the moment will support the idea (Officer, Lands Commission)"*

Indeed, the new Land Act, 2020 (Act 1036) makes provision for conveyancing by legal practitioners of land interests via an electronic information system; however, increased emphasis is still placed on paper-based transactions.

4.3.2 Land disputes

Results of the analysis further buttressed the views of Maha-Atma (2014) on the persistence of land disputes in Ghana. An interviewee was of the view:

> *"The choke in our court system is largely due to land disputes. Court cases could be long-standing for as long as 60 years, with the original claimants having passed on years ago." (Land acquisition specialist, Private sector)*

Respondents were of the view that the success or otherwise of Blockchain technology, even if adopted, depended largely on the pace of justice delivery amidst an ever-increasing backlog of land disputes and litigations.

4.4 Technical Barriers

4.4.1 Mapping and boundary inconsistencies

The analysis discovered barriers relating to the integrity of land sector data which would ultimately serve as a primary data source for digital technology. Majority of the respondents laid emphasis on historical and prevailing surveying and mapping challenges, which further exacerbate long-standing land disputes nationwide. This quote highlights this factor.

> *Over the years when survey records or boundaries were being taken, they were linked to different references and done in fragments and on adhoc basis. The focus was more on mines and natural resource areas without covering the whole of Ghana first and doing the apportioning later. Currently, there are different references across the various regions. There are overlaps of boundary interest (Surveyor, Lands Commission)*

4.4.2 Limited geographical coverage

The analysis further highlighted incomplete coverage of registration and digitalisation in the country. The Ghana Enterprise Land Information System (GELIS), which represents Ghana's prevailing effort towards digitalisation, covers circa 10% of all land data in the country. The following extract elaborates on the extent of coverage:

> *The first challenge is that we are talking about an entirely digital platform. We are not there yet. The current digital process being piloted; Ghana Enterprise Land Information System (GELIS), only covers 10% of land data from 5 out of 16 regions in the country. This gives you an idea of where we are in terms of digitalization. (Surveyor; CSAU, Lands Commission)*

Another pertinent challenge is the operation of dual land administration systems. Land Title Registration prevails only in the Greater Accra Region and Kumasi metropolis which had been declared registrable districts for the purposes of title registration to land, with the rest of the country administering Deed Registration. Previous and ongoing digitization efforts have focused on a small segment of the market, often Greater Accra Region only.

4.4.3 Manual and paper-based system inefficiencies

A significant barrier identified is the absence of a complete or comprehensive data, occasioned by manual data management inefficiencies. The ongoing digitization efforts of the Commission has been stifled by missing or illegible documents. The condition of some of the sheets or maps due to wear and tear has made them unusable. Crucial information including land area, boundaries, ownership details and security features are difficult to see or interpret. These inefficiencies will derail any digitization efforts, BCT included.

4.5 Socio-cultural Barriers

4.5.1 Preference of physical transactions

The interviewees revealed that most of their clients, educated and uneducated alike, are often not comfortable with signing of digital contracts for real estate transactions. Transacting parties are used to the presence of witnesses and the signing of physical documentation, and as such any technology that reduces this step be regarded as unsafe. Safety is of particular concern because of the huge funds usually involved in property transactions. The following quotes demonstrates thus barrier.

> *They may be okay with verifying stages of the transaction digitally but with signing property documents, it would have to be in-person (Land Professional).*

Personal contact between clients or their agents and the Commission is extremely important. Before you submit your document, you must be here physically. If we need to make any corrections or enquiries, the client needs to be present. After the completion of the document, the client needs to be present to collect it. It means that physical contact is not cut off. (Officer, Lands Commission).

4.5.2 Information hoarding

Another potential barrier to the adoption of BCT, and other technologies, in Ghana is the socio-cultural barrier of information hoarding. Generally, Ghanaians are very private with their information and avoid sharing information about property transactions. People simply do not want others to know about their ownership. The risk, perceived or real, of technology making public transactional data may dissuade Ghanaians from adopting the technology. This information "hoarding" persists despite the benefits of data transparency. This high level of sensitivity and anonymity that users in Ghana attach to real estate transactions has been captured in previous studies including Baako (2019).

4.5.3 Registration misconceptions

There are also several misconceptions associated with land registration in general in Ghana which will translate to BCT. Many Ghanaians, per our interviews, do not use title registration because they think it is reserved for the elite. The analysis shows that many middle-class real estate transacting parties do not see the usefulness of land registration, except as a way in which highly educated and "bookish" individuals flaunt their property ownership status. Not wanting to associate with this kind of perception, the former group desists from land registration, affecting land registration uptake. BCT when used to digitize the land administration process will not solve this misconception, but only inherit it, affecting its implementation. The following quote captures this barrier.

The new Digital Addressing System, for example, is a good idea but it has not been wholly accepted across the country. Some banks do not accept it for transactions. The Digital Addressing System can be likened to a technology that has emerged in Ghana and one barrier, I think, is a mindset issue. The human component within the process (Land Professional).

4.6 Organisational Barriers

4.6.1 Institutional friction

Institutional issues were identified as potential barriers to the adoption of BCT in Ghana. The analysis revealed that the existing miscommunication within the Commission will likely lead to BCT being unsuccessful in Ghana. The merger of the 4 divisions under the Lands Commission Act in 2008 under one umbrella has not fully led to the Commission running smoothly. Processes vary across the division, and some duplications of efforts were mentioned particularly by the private practitioners interviewed. These challenges are exacerbated by the collaboration needed with other state and parastatal institutions to accelerate the adoption of BCT. The following quote capture this barrier.

As at now we are experiencing collaboration challenges. I foresee collaboration challenges with different institutions not wanting to yield their territories (Officer, Lands Commission)

One can run a survey within the sector, the Commission and even in divisions (such as Survey, Title, etc.) and will realize that they are all not in sync… The level of coordination between the four divisions is not smooth even after the merger. The merger was aimed at making things easy but as it stands now, things do not seem so (Land Administration Officer)

4.6.2 Human factors

Another key barrier to the adoption of BCT is human factors. Although BCT is a disruptive technology, it relies on people to populate it with the existing database, register the transactions and manage the entire process. The interview analyses revealed that human factors can limit the success of the adoption of BCT in

Ghana. First, as noted above in the literature review, land sector professionals will avoid adopting technology that threatens to replace them and render them redundant. The interviewees revealed that similar digitization efforts have been met with significant opposition by land sector professionals, hampering their effectiveness. Second, since land administration in Ghana is managed by the public sector, delays and negligence often attributed to civil servants are likely to lower the benefits to be yielded from any intervention, including BCT. The following quote highlights this barrier.

> *Blockchain has the tendency to disrupt services provided by most of these units hence the threat of this could lead to resistance or lack of cooperation from these bodies (Private Land Professional)*

4.6.3 Low levels of digital literacy

Finally, the analysis yielded low levels of digital literacy as a potential barrier to the adoption of BCT in Ghana. This is consistent with findings by Ehwi and Asante (2016) that land sector professionals need to upgrade their digital literacy if any digitisation efforts will see significant success. The following interview quote captures it perfectly.

> *I do not have an issue with Blockchain technology or any other technology, but I am not conversant with it. I have never seen it in use. Most people have worked here for ages, and it is difficult to now tell them to go and learn a new IT skill. It may be a challenge (Lands Officer, Lands Commission)*

5.0 Conclusion

While several studies have examined the impact of technology and property transactions and sectors, very few have investigated the barriers to the adoption of new technologies. In the developing, these studies are even rarer. Drawing on primary data collected from interviews with 15 purposively sampled land sector experts, we explore the potential barriers to the adoption of Blockchain technology in Ghana. We find that six sets of factors can inhibit the successful implementation of BCT within the land administration of Ghana.

The implications of this study are straightforward and very useful. Any endeavors to implement new technologies in real estate should be made cognizant of the fact that multiple barriers exist. For BCT in Ghana specifically, we identify six sets of barriers that must be mitigated to aid smooth adoption of the technology. In light of the barriers identified, we proffer the following recommendations.

First, efforts to implement BCT in land administration in Ghana should be a multi-stakeholder effort. Since there will be multiple parties involved, the efforts to digitize should be supported and implemented by public and private parties concertedly. Next, significant technology infrastructure investment must be made by the government to enable the successful adoption of BCT, any such technology. Again, the land governance institutions must be granted some independence from external influence to enable them focus on policies without fear of political influence. Lastly, the policy to digitize land administration in Ghana must be agreed to by both political parties in a medium- or long-term plan that is not dictated by ruling party sentiment.

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